Business Analytics and its Impact on Business Competitive Advantage: A Comprehensive Systematic Review

Javier Gamboa-Cruzado[1], Renatto Oyague Guerra[2], Enrique Condor Tinoco[3], Guillermo Paucar-Carlos[4], Juan Gamarra Moreno[5]

[1]Universidad Nacional Federico Villareal, Lima, Perú
jgamboa65@hotmail.com
https://orcid.org/0000-0002-0461-4152
[2]Universidad Nacional Federico Villareal, Lima, Perú
2017022116@unfv.edu.pe
https://orcid.org/0000-0002-8500-1437
[3]Universidad Nacional José María Arguedas, Andahuaylas, Perú
enricoti@unajma.edu.pe
https://orcid.org/0000-0002-2711-9517
[4]Universidad Nacional de San Antonio Abad del Cusco, Cuzco, Perú
guillermo.paucar@unsaac.edu.pe
https://orcid.org/0000-0001-5476-1188
[5]Universidad Nacional Mayor de San Marcos, Lima, Perú
juan.gamarra@unmsm.edu.pe
https://orcid.org/0000-0002-3774-1457

Summary

With the rapid growth of the importance of business analytics in recent years, academics and experts have been thinking about ways in which they can incorporate the changes these technologies bring to their competitive strategy. The framework builds on previous empirical work on Business Analytics for competitive advantage in companies from 2017 to 2021. The information-gathering strategy identified 177,678 articles from digital libraries such as IEEE Xplore, ARDI, Taylor & Francis Online, ScienceDirect, Microsoft Academic, IOPscience, Google Scholar, ACM Digital Library, Scopus and ProQuest, of which 71 articles based on exclusion criteria were considered. Therefore, this article aims to provide a systematic review of the literature that can determine the state of the art about experimental research carried out on Business Analytics (BA) and its effectiveness in the Competitive Advantage of Organizations. To this end, 71 articles of great relevance were identified and reviewed; This allowed us to answer each of the questions planned in the investigation.

Keywords: Business Analytics; Business analytics; Competitive advantage; Systematic literature review

I.   INTRODUCTION

Business analytics is a growing phenomenon that reflects the growing importance of data in terms of increasing volume, variety, and velocity. Interest in data science and analytics is growing as companies use their growing data warehouse to create value for their businesses, and governments and communities seek to create value of a broader nature (Zameer *et al.*, 2022) . Analytical methods are used in many and varied ways, for example, to predict consumer behavior, predict the likelihood of diseases, analyze social networks, better manage network traffic, etc. Big data analytics

Javier Gamboa-Cruzado[1], Renatto Oyague Guerra[2], Enrique Condor Tinoco[3], Guillermo Paucar-Carlos[4], Juan Gamarra Moreno[5]

have been reported to increase the effectiveness and efficiency of companies by enabling them to formulate appropriate strategies through the lens of data (Gunasekaran *et al.* , 2018; Kache & Seuring, 2017). Big data analytics has become an essential part of the decision-making process in agile organizations (Vidgen *et al.* , 2020) , and business analytics is expected to produce impressive results across various industries.

Big data analytics is considered an important capability that can improve business performance (Humphrey *et al.* , 2017) . An organization that improves its business analytics capabilities will be able to maximize its performance. This can be done by developing a business analytics capability and identifying factors that can positively influence its creation.

This work aims to make the following contributions: First, determine the number of articles available on several pages to obtain articles focused on the use of business analytics; secondly, to identify the factors identified by the articles published in the successful use of business analytics to improve business performance (Sestino & De Mauro, 2022; Aydiner *et al.* , 2019) . In this sense, this document provides an extensive review of business analytics and corporate performance studies.

Key issues related to the areas of business analytics to be examined can be interpreted, such as mismatched training patterns, non-permanent learning environments and machine learning, human-based and hybrid solutions. This systematic review aims to include the most valuable articles and considers all relevant publications from 2017 onwards, but it is essential to clearly outline the scope of the review and clearly present the procedures. To this end, an iterative process was applied to identify the relevant items.

This study focuses on identifying the state of the art on business analytics and its impact on the competitive advantage of companies. The structure of the work is organized as follows. The Theoretical Background is presented in section II. Section III details the Review Methodology. Section IV presents Results and their discussion.

Finally, section V presents Conclusions and future research.

II. BACKGROUND AND RELATED WORKS

Organizations need to think about how analytics can be used to capture, organize, and leverage HR data for value. To do this, BA must move from existing descriptive models to predictive models to understand the strategic impact of human capital (Kristoffersen *et al.* , 2020) . Today's HR applications and platforms are primarily designed to support data presentation; They are rarely able to understand the contribution of human resources to the success of an organization (Nalchigar & Yu, 2020). Several studies have also debated whether the expansion of human resource management should be part of the role of human resources (Yiu *et al.* , 2021) . It is suggested that it is better to have a centralized analytical cell within an organization because data from other departments, such as marketing, is also required to solve larger business challenges (Ashaari *et al.* , 2021) . It needs to be remembered that data analysis alone is useless unless it is used to extract information, which is then used to weave a compelling story to guide decision-making. (Amyrotos *et al.* , 2021; Kristoffersen *et al.* , 2020; Speier-Pero & Schoenherr, 2020), questioned whether Human Resources (HR) professionals can effectively extract various trends and insights from Business Analytics to promote organizational benefits in competitive advantage. Even when HR professionals need to perform relevant analysis, collecting data from sources remains a daunting task (Vidgen *et al.* , 2020) .

III. REVIEW METHODOLOGY

The present research has been developed rigorously following the main recommendations established in the proposal of (Keele, 2007). The detail of each of the stages of the proposal is shown in Figure 1.
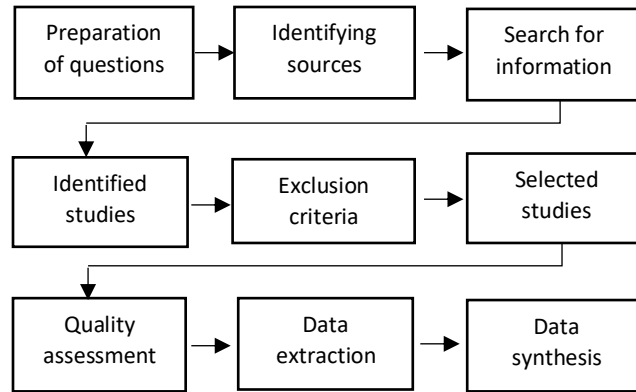
Figure 1. Stages of RSL

A. Questions and Research Objectives

When starting with the systematic review, it is very important to define the research questions well, since they influence the next steps to follow as it is the starting point of the research. Table I presents the defined research questions (RQ).

Table I. Questions and Research Motivation

Research Question	Motivation
RQ1: What are the most used methodologies for Business Analytics development?	Identify the most used methodologies for the development of Business Analytics.
RQ2: Who are the most productive authors for the number of citations in the development of Business Analytics and its impact on the competitive advantage of companies?	Recognize the most productive authors for the number of citations in the development of Business Analytics and its impact on the competitive advantage of companies.
RQ3: Which are the countries that present Co-occurrence in research on Business Analytics and its impact on the competitive advantage of companies?	Identify the Countries that frequently present Co-occurrence in Business Analytics research and its impact on the competitive advantage of companies
RQ4: What are the Article Clusters whose Discussions and Conclusions are characterized by their high Objectivity and low Polarity by Source in Business Analytics research and their impact on competitive advantage?	Determine the articles whose Discussions and Conclusions are characterized by their high Objectivity and low Polarity by Source on Business Analytics and their impact on competitive advantage.
RQ5: What are the named entities (NERs): people, organizations, places, expressions of time and quantities that are presented in the Summaries by source of research on Business Analytics and its impact on the competitive advantage of	Register named entities (NERs): people, organizations, places, time expressions and quantities presented in the Summaries by source of research on Business Analytics and its impact on the

Javier Gamboa-Cruzado[1], Renatto Oyague Guerra[2], Enrique Condor Tinoco[3], Guillermo Paucar-Carlos[4], Juan Gamarra Moreno[5]

companies?	competitive advantage of companies

B. Search Sources and Search Strategies

The sources of information used to search and collect the articles were the following: IEEE Xplore, ARDI, Taylor & Francis Online, ScienceDirect, Microsoft Academic, IOPscience, Google Scholar, ACM Digital Library, Scopus and ProQuest.

The key terms used in the search strategy used are shown in Table II.

Table II. Search descriptors and their synonyms

Descriptor		Description
Spanish	English	
Business Analytics / Business Analytics	business analytics / business analysis	Independent variable
Competitive advantage	competitive advantage / competitive edge	Dependent variable

The search has been carried out using the rigorous search equations, which are shown in Table III.

**Table III**. Information Sources and Search Equations

Fountain	Search Equation
IEEE Xplore	("All Metadata":"competitive advantage" OR "All Metadata":"competitive edge") AND ("All Metadata":"business analytics" OR "All Metadata":"business analysis" OR "All Metadata":"ba")
ARDI	("business analytics" OR "business analysis" OR "ba") AND ("competitive advantage" OR "competitive edge")
Taylor & Francis Online	[[[All: "business analytics"] OR [All: "business analysis"] OR [All: "ba"]] AND [[All: "competitive advantage"] OR [All: "competitive edge"]]
Science Direct	("business analytics" OR "business analysis" OR "ba") AND ("competitive advantage" OR "competitive edge") AND (methodology OR method OR model)
Microsoft Academic	("business analytics" OR "business analysis" OR "ba") AND ("competitive advantage" OR "competitive edge")

IOPscience	("business analytics" OR "business analysis" OR "ba") AND ("competitive advantage" OR "competitive edge")
Google Scholar	("business analytics" OR "business analysis" OR "ba") AND ("competitive advantage" OR "competitive edge")
ACM Digital Library	[[All: "business analytics"] OR [All: "business analysis"] OR [All: "ba"]] AND [[All: "competitive advantage"] OR [All: "competitive edge"]]
Scopus	(ALL ("business analytics" OR "business analysis" OR "ba") AND ALL ("competitive advantage" OR "competitive edge"))
ProQuest	("business analytics" OR "business analysis" OR "ba") AND ("competitive advantage" OR "competitive edge")

C. Identified Studies

At the end of the search for the articles using the equations, Figure 2 shows the number of articles obtained by source and the total number of articles found.
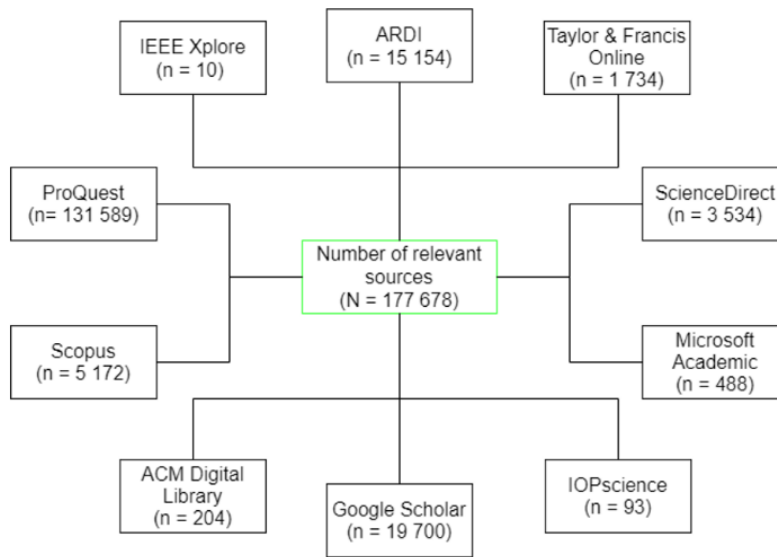
Figure 2. Number of Relevant Sources

D. Exclusion Criteria

For the selection of the articles, 8 exclusion criteria (EC) were established for the evaluation and filtering of the investigations found. The ECs established were as follows:

CE1: The articles are older than 5 years

CE2: Articles are not written in English

CE3: Articles were not published in Conferences or peer-reviewed journals

CE4: The keywords and titles of the articles are not very suitable

CE5: The abstract of the articles is not very relevant

CE6: The articles do not mention a methodology,

Javier Gamboa-Cruzado[1], Renatto Oyague Guerra[2], Enrique Condor Tinoco[3], Guillermo Paucar-Carlos[4], Juan Gamarra Moreno[5]

model or method

CE7: Articles are not unique

CE8: The full text of the article is not available

E. Selection of studies

After the application of the filters and subsequent selection of articles, a PRISMA graph was developed to show the number of discarded articles with each filter applied, and in turn the number of articles with which it remains, this process is shown in Figure 3, which is the consolidated matrix of the articles finally selected, which were 71.
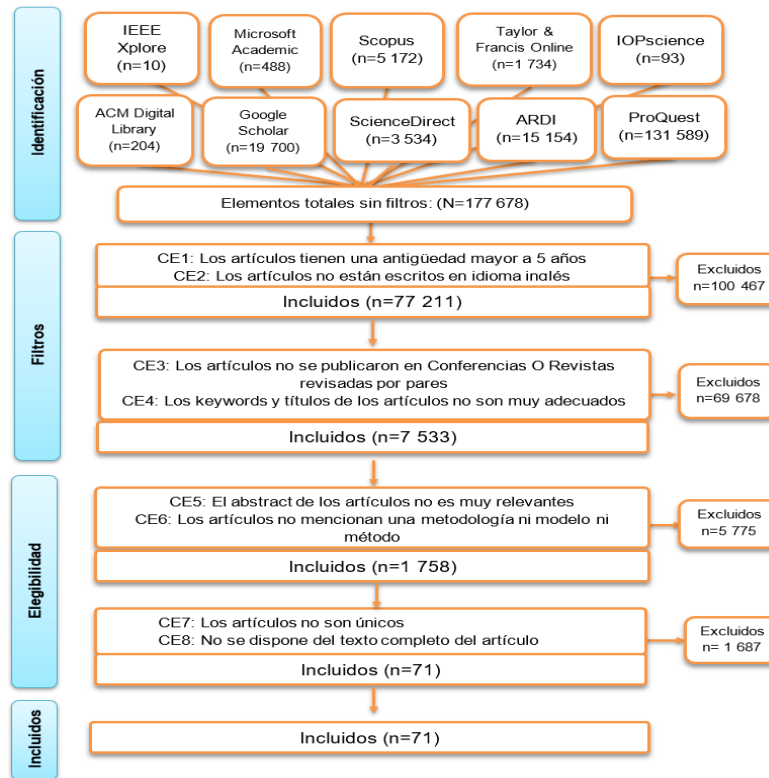

Figure 3. PRISMA Flowchart

F. Quality Assessment

During this stage, the quality of the articles that had met the exclusion criteria was evaluated. To analyze the rigor, credibility and relevance of the studies, 7 quality criteria (QA) were established for their evaluation. The selected QAs are mentioned below:

QA1: Does the article have the information well distributed?

QA2: Are the research objectives clearly described in the article?

QA3: Is the context in which I run the research explained?

QA4: Is the experimentation carried out reasonable?

QA5: Was the experimentation done in a timely manner?

QA6: Are the methods used to analyze the results adequate?

QA7: In general, is the document considered useful?

After reading each article and verifying that it meets each quality criterion mentioned, the authors of the present research jointly determined that the 71 selected articles met the established criteria, so they are ensuring that they meet the criteria.

G. Data Extraction Strategies

At this stage, we proceeded to extract the most relevant information from each article, which would allow us to answer the proposed research questions.

The information taken into account for the extraction was as follows:

Article ID, article title, URL, source, year, country, number of pages, language, publication type, publication name, authors, affiliation, number of citations, abstract, keywords and sample size.

It is worth mentioning that not all the selected articles answered all the research questions, for the classification of the articles the Mendeley tool was used as shown in Figure 4.
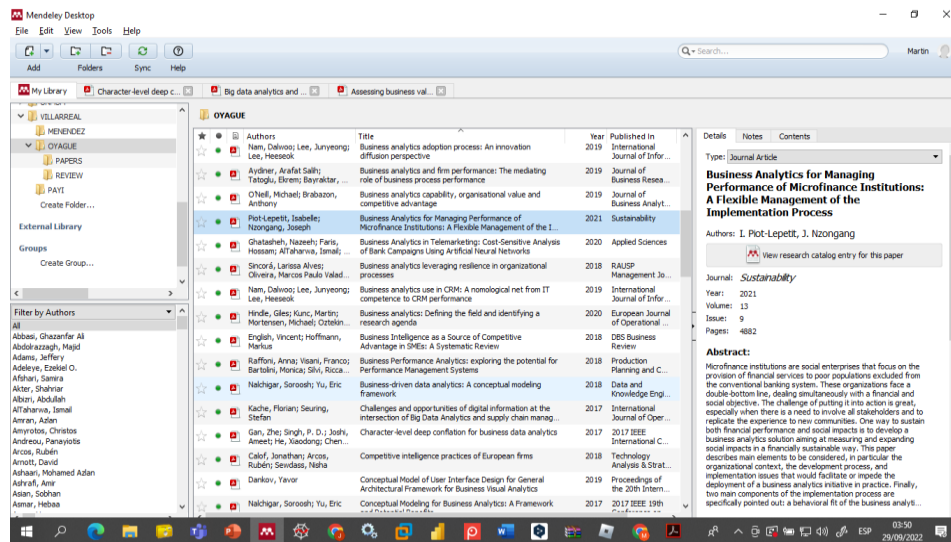

Figure 4. Mendeley Reports
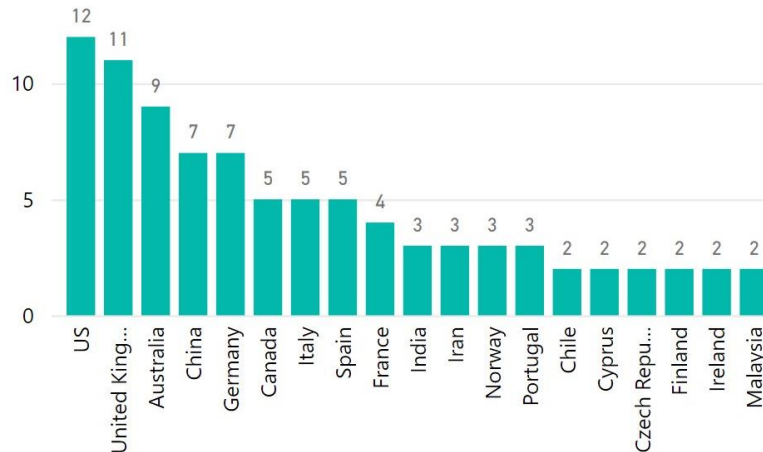
H. Data Synthesis

The data synthesis process includes assembling the data and crafting the answers to the research questions. The synthesis of data has been carried out by analyzing the literature through various statistics.

The information extracted for the RQ1–RQ5 research questions was extensively reviewed and analyzed using descriptive statistics, inference statistics, and natural language processing (NLP) techniques. These statistics allowed us to discover certain patterns of behavior that were followed during the investigations during the last 5 years.

IV. RESULTS AND DISCUSSION

A. Study overview

The study selection process resulted in 71 studies selected for review and data analysis. Figure 5 shows the distribution of published studies by country. This indicates that Business Analytics has been recognized from various parts of the world, but recent research has focused on applying new technological tools to obtain better and accurate results within companies, mostly this is largely seen in areas of Europe, as well as in North America.

Javier Gamboa-Cruzado[1], Renatto Oyague Guerra[2], Enrique Condor Tinoco[3], Guillermo Paucar-Carlos[4], Juan Gamarra Moreno[5]

Figure 5. Distribution of published articles by country

It can be seen that the US leads this graph with 10 articles, followed by Australia and Canada, but to a lesser extent. Confirming the impact generated by the topic of Business Analytics for the competitive advantage of companies, it lets us know how relevant their development is in the US and what is related to their economic growth.

On the other hand, the authors Lim & Heinrichs (2021), ensure that these countries have a greater research support to achieve a greater foundation in their results. In addition, Mikalef *et al.* (2018) mention how it is understood that the field in which they are measured competitive advantage

and they find themselves with greater economy. In another, more dynamic approach, Shet *et al.* (2021), indicate that articles have this great impact in their most developed countries for Business Analytics to have more impact in their locality than to capture them in another environment.

Table IV shows the distribution of the ranges of number of citations and the number of articles by applied research methodology. In the development of the study, 71 studies were obtained, which accumulate a total of 2118 citations. It is observed that the research methodologies applied in the articles were experimental and non-experimental.

Table IV. Articles by Research Methodology and Number of Citations Range

Citation Range	<5		>=15		>=5 and <15		Total	
Research Methodology	Until Art	No. Dating	Until Art	No. Dating	Until Art	No. Dating	**Until Art**	**No. Dating**
Experimental	24	18	23	1750	5	34	**52**	**1802**
No Experimental	13	22	1	274	2	20	**19**	**316**
Total	**37**	**40**	**27**	**2024**	**7**	**54**	**71**	**2118**

According to authors Phillips-Wren *et al.* (2021),

this is reflected in a large number for those

companies that are involved in the boom in technological development where a greater reach is created by promoting the greater use of data to generate value in search of competitive advantage. On the other hand, authors Ogbuke *et al.* (2022), make clear how this holistic vision of seeking to generate data can leave very exposed to the moment of security, both the internal competitive advantage that is given can cause long-term problems, this must be controlled as it progresses.

Finally, authors Shet *et al.* (2021), deal with a much more given approach to the field of how this learning of generating data should be carried out to achieve this perspective that they present with Business Analytics, given that they lead to recreate the fact of how they seek to increase the

impact of competitive advantage in companies.

B. Answers to Research Questions

RQ1: What are the most used methodologies for Business Analytics development?

According to the results of the literature review, there are five methodologies for Business Analytics for competitive advantage and Data collection (27%) and Dirichlet latent allocation (25%) were considered as the most used methodologies as shown in Table V. These have been bringing a high degree of sustenance to be used in the competitive environment to achieve optimal development.

Table V. Methodologies for developing Business Analytics

Methodology	Reference	Cant. (%)
Statistical technique	(Palacios-Marqués *et al.* , 2021) ; (Zameer *et al.* , 2022) ; (Eldor, 2020); (Bergmann *et al.* , 2020) ; (O'Neill & Brabazon, 2019); (Côrte-Real *et al.* , 2020) ; (Côrte-Real *et al.* , 2019) ; (Le & Lei, 2018); (Mitchell *et al.* , 2021)	9 (17)
Deep feature extractors	(Ciano *et al.* , 2021) ; (Lomakin *et al.* , 2019) ; (Nalchigar & Yu, 2018); (Nalchigar & Yu, 2017); (Gan *et al.* , 2017)	5 (9)
Operationaliz-ation and measurement of variables	(Humphrey *et al.* , 2017) ; (Abdolrazzagh *et al.* , 2020) ; (Viswanadham, 2018); (Parks *et al.* , 2018) ; (Torres *et al.* , 2018) ; (S. Wang *et al.* , 2019) ; (Oesterreich & Teuteberg, 2019); (Mikalef *et al.* , 2020) ; (Chung *et al.* , 2020)	9 (17)
Data collection	(Ashrafi & Zare Ravasan, 2018) ; (Ashrafi *et al.* , 2019) ; (Najdawi & karan Patkuri, 2021); (Raffoni *et al.* , 2018) ; (Aydiner *et al.* , 2019) ; (Vitari & Raguseo, 2020); (Ciampi *et al.* , 2021) ; (Carillo *et al.* , 2019) ; (Rana *et al.* , 2022) ; (Gu *et al.* , 2021) ; (Le & Lei, 2018); (Vidgen *et al.* , 2017) ; (Wamba *et al.* , 2017) ; (Tim *et al.* , 2020) ; (Z. Wang *et al.* , 2020)	15 (28)

Javier Gamboa-Cruzado[1], Renatto Oyague Guerra[2], Enrique Condor Tinoco[3], Guillermo Paucar-Carlos[4], Juan Gamarra Moreno[5]

Latent Dirichlet Allocation	(Sestino & De Mauro, 2022) ; (Speier-Pero & Schoenherr, 2020); (Amyrotos *et al.* , 2021) ; (Nam *et al.* , 2019a) ; (Kache & Seuring, 2017); (Calof *et al.* , 2018) ; (Ghatasheh *et al.* , 2020) ; (Nam *et al.* , 2019b) ; (Mitchell *et al.* , 2021) ; (S. Wang *et al.* , 2019) ; (Raghupathi & Raghupathi, 2021)	13 (25)
Structural equation modeling	(Arnott *et al.* , 2019) ; (Côrte-Real *et al.* , 2017)	2 (4)

The use of the methodology of data collection as part of Business Analytics is significantly greater in terms of the degree of reliability that gives it at the time of being so useful because to achieve more accurate metrics in the business can be given through this methodology, on the other hand the extraction of deep features as a methodology is not so present in the current articles possibly to the degree of difficulty of the learning from it and that data that is more detailed is required.

The authors Sun & Scanlon (2019), ratify the use of this methodology to provide a better result for the company to make different advances competitively. According to authors Hindle *et al.* (2020), the best advances in terms of the management of the methodology from the data lie in how the latent allocation has been supporting on a large scale which generates greater support in the extrapolation of data that help improve competitive advantage. As mentioned by the authors Maroufkhani *et al.* (2019), the smallest case of variables that are supportive to manage how they are creating better technological advances to acquire an exponential value in competitive advantage through Business Analytics helps this measurement.

RQ2: Who are the most productive authors for the number of citations in the development of Business Analytics and its impact on the competitive advantage of companies?

Table VI shows the distribution of the most productive authors according to the number of citations of the articles published on Business Analytics and their impact on Business Competitive Advantage. It is noted that the most productive authors are Samuel Fosso Wamba, Angappa Gunasekaran, ShahriarAkter, Steven Ji-fan Ren, Rameshwar Dubey, Stephen J. Childe and Nadine Côrte-Real, Tiago Oliveira, Pedro who obtained a greater number of citations, with a total of 582 and 245 citations respectively.

Table VI. Most productive authors according to the number of citations of their publications

Authors	2017	2018	2019	2020	2021	Total
Samuel Fosso Wamba, Angappa Gunasekaran, ShahriarAkter, Steve...	582					**582**
Nadine Cérte-Real, Pedro Ruivo, Tiago Oliveira	158		43	44		**245**
Richard Vidgen, Sarah Shaw, David B. Grant	180					**180**
Anas Najdawi, Sree Karan Patkuri					116	**116**

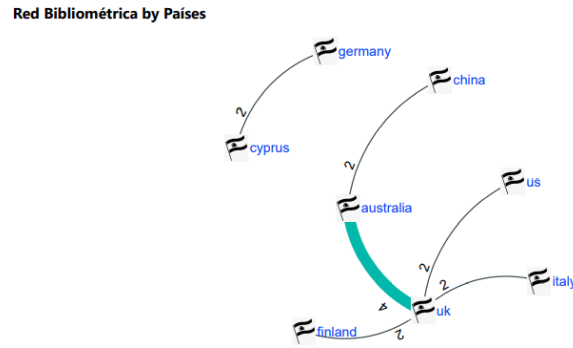|						
Paul Schneider		86				**86**
Patrick Mikalef, John Krogstie, Ilias O. Pappas, Paul Pavlou				85		**85**
Christopher Humphrey, Brendan O'Dwyer, Jeffrey Unerman	73					**73**
Peter B. Seddon, Dora Constantinidis, Toomas ...	72					**72**
Amir Ashrafia, Ahad Zare Ravasanb, Peter Trkm..			71			**71**
Arafat Salih Aydiner, Ekrem Tatoglu, Erkan Erkan Bayraktarc, ...			65			**65**
Dalwoo Nam, Junyeong Lee, Heeseok Lee			55			**55**
Russell Torres, Anna Sidorova, Mary C. Jones		50				**50**
Kieran Conboy, Patrick Mikalef, Denis Dennehy				44		**44**
Artem Polyvyanyy, Chun Ouyang, Alistair Barr	42					**42**
Eivind Kristoffersen, Fenna Blomsma, Patrick				41		**41**
Yanging Duan, Guangming Cao, John S. Edwards				40		**40**
Maiid Abdolrazzaah, shokooh for Mahyaba				37		**37**

The number of quotations from the most productive authors Samuel Fosso Wamba and Nadine Côrte-Real are significantly higher. The other authors are also productive applying Business Analytics, but in a smaller percentage.

The authors Salijeni *et al.* (2019), validate that the most productive authors with higher citations, allow to have greater scope of the application of Business Analytics for competitive advantage, through the studies found. Likewise, Ertek *et al.* (2017) see how these authors who obtain higher citations manage to give a richer contribution to Business Analytics for competitive advantage. On the other hand, authors Mikalef *et al.* (2018), believe that these authors who were more productive, generate a greater impact so that future research is carried out appropriately within a clear methodology.

RQ3: Which are the countries that present Co-occurrence in research on Business Analytics and its impact on the competitive advantage of companies?

Based on the review of the 71 articles, Figure 6 shows the cooperation of the research between the countries of the various authors of the reviewed publications as a Co-occurrence diagram.

Javier Gamboa-Cruzado[1], Renatto Oyague Guerra[2], Enrique Condor Tinoco[3], Guillermo Paucar-Carlos[4], Juan Gamarra Moreno[5]

Red Bibliométrica by Países

Figure 6. Bibliometric Network of Business Analytics Research Countries
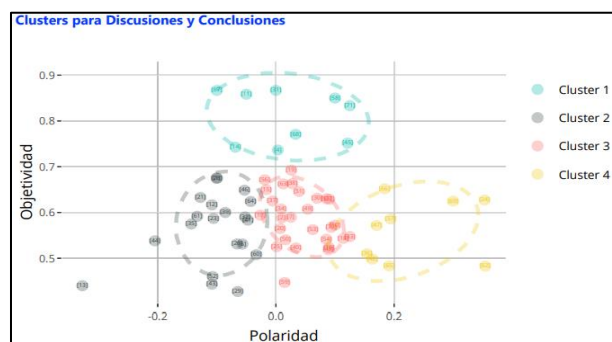
This indicates that Business Analytics has been more applied in countries that have a fairly high degree for the subject, in this Bibliometric Network shows that the relationship that is most visualized is Australia and UK with 4 related articles this is given largely by the affiliation they have, the agreements between the universities strengthen this possibility of diversifying collaborative work with other countries thus giving greater sustenance It is forming with these research works.

This indicates that Business Analytics has been recognized in greater numbers, as presented by the authors, Sun & Scanlon (2019), it can be seen that countries such as the UK have a greater interest in research for Business Analytics with Australia this is because the methodologies they put into practice are more used in their business styles. On the other hand, what is supported by the authors Salijeni *et al.* (2019) show that being able to communicate in English was supportive in conducting these investigations so that countries can have that relationship. In any case, Phillips-Wren *et al.* (2021), mention that the affiliation of the authors in relation to where they come from by agreement achieved this collaborative research work.

RQ4: What are the Clusters of Articles whose Discussions and Conclusions are characterized by their high Objectivity and low Polarity in Business Analytics research and their impact on Competitive Advantage?

Figure 7 shows the Objectivity and Polarity of the Discussions and Conclusions of the research in Business Analytics and its impact on Competitive Advantage. This is visualized by grouping articles into 4 clusters where each one shows a certain level of objectivity and polarity.

Figure 7. Cluster of Discussions and Conclusions on Business Analytics research and its impact on Competitive Advantage

This indicates that the publications reviewed and analyzed about Business Analytics present 9 articles with high objectivity and moderate polarity, but there were also articles that have a fairly high polarity of which 2 of them are the most extreme, but at the same time have low objectivity.

Reviewing several systematic review articles we could not find similar research to make comparisons in this regard.

RQ5: What are the named entities (NERs): people,

organizations, places, expressions of time and quantities presented in the Abstracts by Source of research on Business Analytics and its impact on the Competitive Advantage of companies?

Based on the review of the 71 articles that were used for the extraction and analysis of data in Figure 8, it can be seen how the named entities are shown, such as people, organizations, places, expressions of time and quantities that they present most frequently in the Summaries of the investigations by Source.
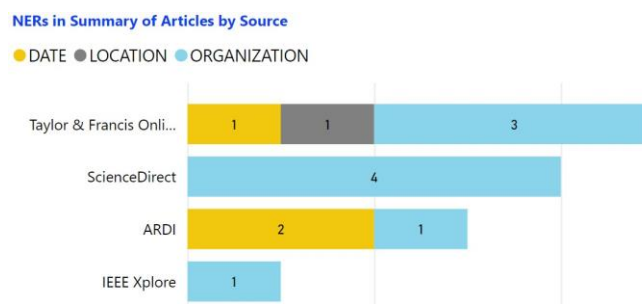
Figure 8. Number of NERs in Summaries of Conclusions

Figure 8 shows the presence of 5 NERs in the Taylor & Francis Online Fountain with 1 DATE type, 1 LOCATION type and 3 ORGANIZATION type. ScienceDirect only presents 4 NERs type ORGANIZATION. Finally, IEEE Xplore only presents 1 NER of the ORGANIZATION type.

We found no similar research on the subject with whom to make comparisons.

V. CONCLUSIONS AND FUTURE RESEARCH

This study presents an in-depth review of the publications on Business Analytics and Competitive Advantage in Companies of the best rated articles between the years 2017 and 2021. To extract the articles, they were selected and classified by title, abstract, objective, results and conclusion. During the selection stage, those who do not meet the criteria withdrew from the process.

This article generates knowledge through its systematic review in the area of big data analytics and provides directions for future research. The results show that the term Business Analytics capabilities/assets is the most used by researchers, in addition to Competitive Advantage. The latter term is used in almost all reviewed articles. In addition, the study attempted to identify terms that are used as synonyms for Business Analytics analysis. This study provides a benchmark for academics and practitioners identifying Business Analytics challenges. Potential researchers can identify journals that match their research approach to facilitate the publication of a wide variety of experimental and conceptual articles with different methodologies.

With the rise of Business Analytics in the digital world, businesses and entrepreneurs can be inspired to learn how to adopt and apply BA and Competitive Advantage instead of simply using devices that generate Business Analytics. Companies, especially new and incubator-backed ones, need to continuously improve their

Javier Gamboa-Cruzado[1], Renatto Oyague Guerra[2], Enrique Condor Tinoco[3], Guillermo Paucar-Carlos[4], Juan Gamarra Moreno[5]

performance. Therefore, studying the factors that contribute to BA adoption will help them use it appropriately in their context.

Based on the results obtained from the present research, it is recommended that future researchers conduct more systematic and empirical studies on the use of Business Analytics in different types and sizes of organizations to discover what other factors can help an organization expand its adoption of data analytics to improve performance.

In addition, it will be possible to carry out more complete studies from an integrated perspective from the social, behavioral and management sciences. BA's growing popularity in various fields such as business, science, engineering and social sciences means that its multidisciplinary nature is favoured in the competitive advantage of companies.

REFERENCE

[1] Abdolrazzagh, M., Pour Mahyabadi, S., Jalali-Poor, S., & Budhiarti Nababan, E. (2020). Multi-Objective Feature Selection based on Clustering and Principal Component Analysis by Enhanced Electromagnetic-likes Algorithm. *2020 International Conference on Data Science, Artificial Intelligence, and Business Analytics (DATABIA)*, 45–54. https://doi.org/10.1109/DATABIA50434.20 20.9190226

[2] Amyrotos, C., Andreou, P., & Germanakos, P. (2021). Human-centred Persona Driven Personalization in Business Data Analytics. *UMAP 2021 - Adjunct Publication of the 29th ACM Conference on User Modeling, Adaptation and Personalization*, 175–180. https://doi.org/10.1145/3450614.3462241

[3] Arnott, D., Gao, S., Lizama, F., Meredith, R., & Song, Y. (2019). Are business intelligence systems different to decision support systems and other business information systems? *Australasian Conference on Information Systems 2019*, 624–634. https://aisel.aisnet.org/acis2019?utm_source =aisel.aisnet.org%2Facis2019%2F66&utm_ medium=PDF&utm_campaign=PDFCoverP ages

[4] Ashaari, M. A., Singh, K. S. D., Abbasi, G. A., Amran, A., & Liebana-Cabanillas, F. J. (2021). Big data analytics capability for improved performance of higher education institutions in the Era of IR 4.0: A multi-analytical SEM & ANN perspective. *Technological Forecasting and Social Change*, *173*(January), 121119. https://doi.org/10.1016/j.techfore.2021.1211 19

[5] Ashrafi, A., & Zare Ravasan, A. (2018). How market orientation contributes to innovation and market performance: the roles of business analytics and flexible IT infrastructure. *Journal of Business and Industrial Marketing*, *33*(7), 970–983. https://doi.org/10.1108/JBIM-05-2017-0109

[6] Ashrafi, A., Zare Ravasan, A., Trkman, P., & Afshari, S. (2019). The role of business analytics capabilities in bolstering firms' agility and performance. *International Journal of Information Management*, *47*(July 2018), 1–15. https://doi.org/10.1016/j.ijinfomgt.2018.12. 005

[7] Awan, U., Shamim, S., Khan, Z., Zia, N. U., Shariq, S. M., & Khan, M. N. (2021). Big data analytics capability and decision-making: The role of data-driven insight on circular economy performance. *Technological Forecasting and Social Change*, *168*(March), 120766. https://doi.org/10.1016/j.techfore.2021.1207 66

[8] Aydiner, A. S., Tatoglu, E., Bayraktar, E., Zaim, S., & Delen, D. (2019). Business analytics and firm performance: The mediating role of business process performance. *Journal of Business Research*, *96*(November 2018), 228–237. https://doi.org/10.1016/j.jbusres.2018.11.02 8

[9] Bergmann, M., Brück, C., Knauer, T., & Schwering, A. (2020). Digitization of the budgeting process: determinants of the use of business analytics and its effect on satisfaction with the budgeting process. *Journal of Management Control*, *31*(1–2), 25–54. https://doi.org/10.1007/s00187-019-00291-y

[10] Calof, J., Arcos, R., & Sewdass, N. (2018). Competitive intelligence practices of European firms. *Technology Analysis & Strategic Management*, *30*(6), 658–671. https://doi.org/10.1080/09537325.2017.1337890

[11] Carillo, K. D. A., Galy, N., Guthrie, C., & Vanhems, A. (2019). How to turn managers into data-driven decision makers: Measuring attitudes towards business analytics. *Business Process Management Journal*, *25*(3), 553–578. https://doi.org/10.1108/BPMJ-11-2017-0331

[12] Chen, Y. T., Sun, E. W., & Lin, Y. B. (2020). Merging anomalous data usage in wireless mobile telecommunications: Business analytics with a strategy-focused data-driven approach for sustainability. *European Journal of Operational Research*, *281*(3), 687–705. https://doi.org/10.1016/j.ejor.2019.02.046

[13] Chung, Y., Kraska, T., Polyzotis, N., Tae, K. H., & Whang, S. E. (2020). Automated Data Slicing for Model Validation: A Big Data - AI Integration Approach. *IEEE Transactions on Knowledge and Data Engineering*, *32*(12), 2284–2296. https://doi.org/10.1109/TKDE.2019.2916074

[14] Ciampi, F., Demi, S., Magrini, A., Marzi, G., & Papa, A. (2021). Exploring the impact of big data analytics capabilities on business model innovation: The mediating role of entrepreneurial orientation. *Journal of Business Research*, *123*(June 2020), 1–13. https://doi.org/10.1016/j.jbusres.2020.09.023

[15] Ciano, M. P., Dallasega, P., Orzes, G., & Rossi, T. (2021). One-to-one relationships between Industry 4.0 technologies and Lean Production techniques: a multiple case study. *International Journal of Production Research*, *59*(5), 1386–1410. https://doi.org/10.1080/00207543.2020.1821119

[16] Côrte-Real, N., Oliveira, T., & Ruivo, P. (2017). Assessing business value of Big Data Analytics in European firms. *Journal of Business Research*, *70*, 379–390. https://doi.org/10.1016/j.jbusres.2016.08.01

1

[17] Côrte-Real, N., Ruivo, P., & Oliveira, T. (2020). Leveraging internet of things and big data analytics initiatives in European and American firms: Is data quality a way to extract business value? *Information and Management*, *57*(1), 103141. https://doi.org/10.1016/j.im.2019.01.003

[18] Côrte-Real, N., Ruivo, P., Oliveira, T., & Popovič, A. (2019). Unlocking the drivers of big data analytics value in firms. *Journal of Business Research*, *97*(June 2018), 160–173. https://doi.org/10.1016/j.jbusres.2018.12.072

[19] Dankov, Y. (2019). Conceptual Model of User Interface Design for General Architectural Framework for Business Visual Analytics. *Proceedings of the 20th International Conference on Computer Systems and Technologies*, 251–254. https://doi.org/10.1145/3345252.3345274

[20] Duan, Y., Cao, G., & Edwards, J. S. (2020). Understanding the impact of business analytics on innovation. *European Journal of Operational Research*, *281*(3), 673–686. https://doi.org/10.1016/j.ejor.2018.06.021

[21] Eldor, L. (2020). How Collective Engagement Creates Competitive Advantage for Organizations: A Business-Level Model of Shared Vision, Competitive Intensity, and Service Performance. *Journal of Management Studies*, *57*(2), 177–209. https://doi.org/10.1111/joms.12438

[22] English, V., & Hoffmann, M. (2018). Business Intelligence as a Source of Competitive Advantage in SMEs: A Systematic Review. *DBS Business Review*, *2*, 10–32. https://doi.org/10.22375/dbr.v2i0.23

[23] Ertek, G., Tunc, M. M., Zhang, A. N., Tanrikulu, O., & Asian, S. (2017). Data Mining of Project Management Data. *Proceedings of the 2017 International Conference on Information Technology - ICIT 2017*, 35–41. https://doi.org/10.1145/3176653.3176714

[24] Espino-Rodríguez, T. F., & Ramírez-Fierro, J. C. (2017). Factors determining hotel activity outsourcing. An approach based on competitive advantage. *International Journal of Contemporary Hospitality Management*, *29*(8), 2006–2026.

Javier Gamboa-Cruzado[1], Renatto Oyague Guerra[2], Enrique Condor Tinoco[3], Guillermo Paucar-Carlos[4], Juan Gamarra Moreno[5]

https://doi.org/10.1108/IJCHM-05-2016-0291

[25] Gan, Z., Singh, P. D., Joshi, A., He, X., Chen, J., Gao, J., & Deng, L. (2017). Character-level deep conflation for business data analytics. *2017 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, *4*, 2222–2226. https://doi.org/10.1109/ICASSP.2017.7952551

[26] García, D. L., Nebot, À., & Vellido, A. (2017). Intelligent data analysis approaches to churn as a business problem: a survey. *Knowledge and Information Systems*, *51*(3), 719–774. https://doi.org/10.1007/s10115-016-0995-z

[27] Germanakos, P., Lekkas, Z., Amyrotos, C., & Andreou, P. (2021). Proposing a Perceived Expertise Tool in Business Data Analytics. *Adjunct Proceedings of the 29th ACM Conference on User Modeling, Adaptation and Personalization*, 142–149. https://doi.org/10.1145/3450614.3462236

[28] Ghatasheh, N., Faris, H., AlTaharwa, I., Harb, Y., & Harb, A. (2020). Business Analytics in Telemarketing: Cost-Sensitive Analysis of Bank Campaigns Using Artificial Neural Networks. *Applied Sciences*, *10*(7), 2581. https://doi.org/10.3390/app10072581

[29] Gu, V. C., Zhou, B., Cao, Q., & Adams, J. (2021). Exploring the relationship between supplier development, big data analytics capability, and firm performance. *Annals of Operations Research*, *302*(1), 151–172. https://doi.org/10.1007/s10479-021-03976-7

[30] Gunasekaran, A., Yusuf, Y. Y., Adeleye, E. O., & Papadopoulos, T. (2018). Agile manufacturing practices: the role of big data and business analytics with multiple case studies. *International Journal of Production Research*, *56*(1–2), 385–397. https://doi.org/10.1080/00207543.2017.1395488

[31] Hindle, G., Kunc, M., Mortensen, M., Oztekin, A., & Vidgen, R. (2020). Business analytics: Defining the field and identifying a research agenda. *European Journal of Operational Research*, *281*(3), 483–490. https://doi.org/10.1016/j.ejor.2019.10.001

[32] Humphrey, C., O'Dwyer, B., & Unerman, J. (2017). Re-theorizing the configuration of organizational fields: the IIRC and the pursuit of 'Enlightened' corporate reporting. *Accounting and Business Research*, *47*(1), 30–63. https://doi.org/10.1080/00014788.2016.1198683

[33] Johnson, M. E., Albizri, A., & Jain, R. (2020). Exploratory Analysis to Identify Concepts, Skills, Knowledge, and Tools to Educate Business Analytics Practitioners. *Decision Sciences Journal of Innovative Education*, *18*(1), 90–118. https://doi.org/10.1111/dsji.12195

[34] Kache, F., & Seuring, S. (2017). Challenges and opportunities of digital information at the intersection of Big Data Analytics and supply chain management. *International Journal of Operations & Production Management*, *37*(1), 10–36. https://doi.org/10.1108/IJOPM-02-2015-0078

[35] Keele, S. (2007). Guidelines for performing systematic literature reviews in software engineering. *Technical Report, Ver. 2.3 EBSE Technical Report. EBSE.*

[36] Kristoffersen, E., Blomsma, F., Mikalef, P., & Li, J. (2020). The smart circular economy: A digital-enabled circular strategies framework for manufacturing companies. *Journal of Business Research*, *120*(July), 241–261. https://doi.org/10.1016/j.jbusres.2020.07.044

[37] Le, P. B., & Lei, H. (2018). The effects of innovation speed and quality on differentiation and low-cost competitive advantage. *Chinese Management Studies*, *12*(2), 305–322. https://doi.org/10.1108/CMS-10-2016-0195

[38] Lim, J., & Heinrichs, J. H. (2021). Developing context-relevant project experiences for marketing analytics students. *Decision Sciences Journal of Innovative Education*, *19*(2), 150–156. https://doi.org/10.1111/dsji.12234

[39] Lomakin, N., Shokhnekh, A., Sazonov, S., Polianskaia, A., Lukyanov, G., & Gorbunova, A. (2019). Hadoop and Deductor Based Digital Ai System for Predicting Cost of Innovative Products in Conditions of

Digitalization of Economy. *Proceedings of the 2019 International SPBPU Scientific Conference on Innovations in Digital Economy*, 1–8. https://doi.org/10.1145/3372177.3373810

[40] Maroufkhani, P., Wagner, R., Wan Ismail, W. K., Baroto, M. B., & Nourani, M. (2019). Big Data Analytics and Firm Performance: A Systematic Review. *Information*, *10*(7), 226. https://doi.org/10.3390/info10070226

[41] Mikalef, P., Krogstie, J., Pappas, I. O., & Pavlou, P. (2020). Exploring the relationship between big data analytics capability and competitive performance: The mediating roles of dynamic and operational capabilities. *Information and Management*, *57*(2), 103169. https://doi.org/10.1016/j.im.2019.05.004

[42] Mikalef, P., Pappas, I. O., Krogstie, J., & Giannakos, M. (2018). Big data analytics capabilities: a systematic literature review and research agenda. *Information Systems and E-Business Management*, *16*(3), 547–578. https://doi.org/10.1007/s10257-017-0362-y

[43] Mitchell, R. B., Woolridge, R. W., & Johnson, V. (2021). The role of nontechnical skills in providing value in analytics-based decision culture. *Journal of Education for Business*, *96*(1), 1–9. https://doi.org/10.1080/08832323.2020.1719961

[44] Najdawi, A., & karan Patkuri, S. (2021). Modeling Business Intelligence Process: Toward Smart Data-Driven Strategies. *2021 International Conference on Computational Intelligence and Knowledge Economy (ICCIKE)*, 198–202. https://doi.org/10.1109/ICCIKE51210.2021.9410804

[45] Nalchigar, S., & Yu, E. (2018). Business-driven data analytics: A conceptual modeling framework. *Data and Knowledge Engineering*, *117*(April), 359–372. https://doi.org/10.1016/j.datak.2018.04.006

[46] Nalchigar, S., & Yu, E. (2020). Designing Business Analytics Solutions: A Model-Driven Approach. *Business and Information Systems Engineering*, *62*(1), 61–75. https://doi.org/10.1007/s12599-018-0555-z

[47] Nalchigar, S., & Yu, E. (2017). Conceptual Modeling for Business Analytics: A Framework and Potential Benefits. *2017 IEEE 19th Conference on Business Informatics (CBI)*, *1*(1), 369–378. https://doi.org/10.1109/CBI.2017.63

[48] Nam, D., Lee, J., & Lee, H. (2019a). Business analytics use in CRM: A nomological net from IT competence to CRM performance. *International Journal of Information Management*, *45*(96), 233–245. https://doi.org/10.1016/j.ijinfomgt.2018.01.005

[49] Nam, D., Lee, J., & Lee, H. (2019b). Business analytics adoption process: An innovation diffusion perspective. *International Journal of Information Management*, *49*(July), 411–423. https://doi.org/10.1016/j.ijinfomgt.2019.07.017

[50] O'Neill, M., & Brabazon, A. (2019). Business analytics capability, organisational value and competitive advantage. *Journal of Business Analytics*, *2*(2), 160–173. https://doi.org/10.1080/2573234X.2019.1649991

[51] Oesterreich, T. D., & Teuteberg, F. (2019). The role of business analytics in the controllers and management accountants' competence profiles. *Journal of Accounting & Organizational Change*, *15*(2), 330–356. https://doi.org/10.1108/JAOC-10-2018-0097

[52] Ogbuke, N. J., Yusuf, Y. Y., Dharma, K., & Mercangoz, B. A. (2022). Big data supply chain analytics: ethical, privacy and security challenges posed to business, industries and society. *Production Planning and Control*, *33*(2–3), 123–137. https://doi.org/10.1080/09537287.2020.1810764

[53] Palacios-Marqués, D., Gallego-Nicholls, J. F., & Guijarro-García, M. (2021). A recipe for success: Crowdsourcing, online social networks, and their impact on organizational performance. *Technological Forecasting and Social Change*, *165*(June 2020), 120566. https://doi.org/10.1016/j.techfore.2020.120566

[54] Parks, R., Ceccucci, W., & McCarthy, R. . (2018). Harnessing Business Analytics: Analyzing Data Analytics Programs in U.S.

Javier Gamboa-Cruzado[1], Renatto Oyague Guerra[2], Enrique Condor Tinoco[3], Guillermo Paucar-Carlos[4], Juan Gamarra Moreno[5]

Business Schools. *Information Systems Education Journal*, *16*(3), 15–25.

[55] Pathak, S., Krishnaswamy, V., & Sharma, M. (2021). Big data analytics capabilities: a novel integrated fitness framework based on a tool-based content analysis. *Enterprise Information Systems*, 1–35. https://doi.org/10.1080/17517575.2021.193 9427

[56] Phillips-Wren, G., Daly, M., & Burstein, F. (2021). Reconciling business intelligence, analytics and decision support systems: More data, deeper insight. *Decision Support Systems*, *146*(March), 113560. https://doi.org/10.1016/j.dss.2021.113560

[57] Piot-Lepetit, I., & Nzongang, J. (2021). Business Analytics for Managing Performance of Microfinance Institutions: A Flexible Management of the Implementation Process. *Sustainability*, *13*(9), 4882. https://doi.org/10.3390/su13094882

[58] Polyvyanyy, A., Ouyang, C., Barros, A., & van der Aalst, W. M. P. (2017). Process querying: Enabling business intelligence through query-based process analytics. *Decision Support Systems*, *100*, 41–56. https://doi.org/10.1016/j.dss.2017.04.011

[59] Pozzi, R., Cannas, V. G., & Ciano, M. P. (2021). Linking data science to lean production: a model to support lean practices. *International Journal of Production Research*, 1–22. https://doi.org/10.1080/00207543.2021.194 6192

[60] Raffoni, A., Visani, F., Bartolini, M., & Silvi, R. (2018). Business Performance Analytics: exploring the potential for Performance Management Systems. *Production Planning and Control*, *29*(1), 51–67. https://doi.org/10.1080/09537287.2017.138 1887

[61] Raghupathi, W., & Raghupathi, V. (2021). Contemporary Business Analytics: An Overview. *Data*, *6*(8), 86. https://doi.org/10.3390/data6080086

[62] Ramadan, M., Shuqqo, H., Qtaishat, L., Asmar, H., & Salah, B. (2020). Sustainable Competitive Advantage Driven by Big Data Analytics and Innovation. *Applied Sciences*, *10*(19), 6784. https://doi.org/10.3390/app10196784

[63] Rana, N. P., Chatterjee, S., Dwivedi, Y. K., & Akter, S. (2022). Understanding dark side of artificial intelligence (AI) integrated business analytics: assessing firm's operational inefficiency and competitiveness. *European Journal of Information Systems*, *31*(3), 364–387. https://doi.org/10.1080/0960085X.2021.195 5628

[64] Rienzo, T., & Chen, K. (2018). Planning for Low End Analytics Disruptions in Business School Curricula. *Decision Sciences Journal of Innovative Education*, *16*(1), 23–41. https://doi.org/10.1111/dsji.12143

[65] Salijeni, G., Samsonova-Taddei, A., & Turley, S. (2019). Big Data and changes in audit technology: contemplating a research agenda. *Accounting and Business Research*, *49*(1), 95–119. https://doi.org/10.1080/00014788.2018.145 9458

[66] Saravia-Matus, S., Saravia Matus, J., Sotomayor, O., & Rodriguez, A. (2018). Investment strategies in the Latin American agri-business sub-sectors of agricultural commodities, biofuels and meat chains. *Journal of Agribusiness in Developing and Emerging Economies*, *8*(2), 320–338. https://doi.org/10.1108/JADEE-09-2014-0036

[67] Schneider, P. (2018). Managerial challenges of Industry 4.0: an empirically backed research agenda for a nascent field. In *Review of Managerial Science* (Vol. 12, Issue 3). Springer Berlin Heidelberg. https://doi.org/10.1007/s11846-018-0283-2

[68] Sestino, A., & De Mauro, A. (2022). Leveraging Artificial Intelligence in Business: Implications, Applications and Methods. *Technology Analysis and Strategic Management*, *34*(1), 16–29. https://doi.org/10.1080/09537325.2021.188 3583

[69] Shet, S. V., Poddar, T., Wamba Samuel, F., & Dwivedi, Y. K. (2021). Examining the determinants of successful adoption of data analytics in human resource management – A framework for implications. *Journal of Business Research*, *131*(March), 311–326. https://doi.org/10.1016/j.jbusres.2021.03.05 4

[70] Sincorá, L. A., Oliveira, M. P. V. de, Zanquetto-Filho, H., & Ladeira, M. B. (2018). Business analytics leveraging resilience in organizational processes. *RAUSP Management Journal*, *53*(3), 385–403. https://doi.org/10.1108/RAUSP-04-2018-002

[71] Speier-Pero, C., & Schoenherr, T. (2020). Creating Impactful Student Learning in a Business Analytics Program through Leveraging Scholar-Practitioner Engagement. *Decision Sciences Journal of Innovative Education*, *18*(1), 59–89. https://doi.org/10.1111/dsji.12198

[72] Sun, A. Y., & Scanlon, B. R. (2019). How can Big Data and machine learning benefit environment and water management: a survey of methods, applications, and future directions. *Environmental Research Letters*, *14*(7), 073001. https://doi.org/10.1088/1748-9326/ab1b7d

[73] Tim, Y., Hallikainen, P., Pan, S. L., & Tamm, T. (2020). Actualizing business analytics for organizational transformation: A case study of Rovio Entertainment. *European Journal of Operational Research*, *281*(3), 642–655. https://doi.org/10.1016/j.ejor.2018.11.074

[74] Torres, R., Sidorova, A., & Jones, M. C. (2018). Enabling firm performance through business intelligence and analytics: A dynamic capabilities perspective. *Information and Management*, *55*(7), 822–839. https://doi.org/10.1016/j.im.2018.03.010

[75] Vidgen, R., Hindle, G., & Randolph, I. (2020). Exploring the ethical implications of business analytics with a business ethics canvas. *European Journal of Operational Research*, *281*(3), 491–501. https://doi.org/10.1016/j.ejor.2019.04.036

[76] Vidgen, R., Shaw, S., & Grant, D. B. (2017). Management challenges in creating value from business analytics. *European Journal of Operational Research*, *261*(2), 626–639. https://doi.org/10.1016/j.ejor.2017.02.023

[77] Viswanadham, N. (2018). Performance analysis and design of competitive business models. *International Journal of Production Research*, *56*(1–2), 983–999. https://doi.org/10.1080/00207543.2017.1406171

[78] Vitari, C., & Raguseo, E. (2020). Big data analytics business value and firm performance: linking with environmental context. *International Journal of Production Research*, *58*(18), 5456–5476. https://doi.org/10.1080/00207543.2019.1660822

[79] Wamba, S. F., Gunasekaran, A., Akter, S., Ren, S. J. fan, Dubey, R., & Childe, S. J. (2017). Big data analytics and firm performance: Effects of dynamic capabilities. *Journal of Business Research*, *70*, 356–365. https://doi.org/10.1016/j.jbusres.2016.08.009

[80] Wang, S., Yeoh, W., Richards, G., Wong, S. F., & Chang, Y. (2019). Harnessing business analytics value through organizational absorptive capacity. *Information and Management*, *56*(7), 103152. https://doi.org/10.1016/j.im.2019.02.007

[81] Wang, Z., Wang, N., Su, X., & Ge, S. (2020). An empirical study on business analytics affordances enhancing the management of cloud computing data security. *International Journal of Information Management*, *50*(March 2018), 387–394. https://doi.org/10.1016/j.ijinfomgt.2019.09.002

[82] Yiu, L. M. D., Yeung, A. C. L., & Cheng, T. C. E. (2021). The impact of business intelligence systems on profitability and risks of firms. *International Journal of Production Research*, *59*(13), 3951–3974. https://doi.org/10.1080/00207543.2020.1756506

[83] Zameer, H., Wang, Y., Yasmeen, H., & Mubarak, S. (2022). Green innovation as a mediator in the impact of business analytics and environmental orientation on green competitive advantage. *Management Decision*, *60*(2), 488–507. https://doi.org/10.1108/MD-01-2020-0065