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Big data analytics and key success factor in achieving competitive advantage and performance of small medium enterprises: literature review

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ABSTRACT

Along with the rapid changes in technology, many small and medium-sized enterprises (SMEs) have leveraged Big Data Analytics and other factors to drive digital transformation to gain a competitive advantage and improve performance. Making smart decisions based on data will help small and medium-sized companies get through the wave toward larger investment targets.. Identifying critical success factors (CSFs) in driving Big Data innovation is critical to addressing the challenges surrounding Big Data Analytics and its application. This study aims to examine a systematic literature review that explains the concept of Big Data Analytics and the key success factors in achieving competitive advantage and performance of small and medium-sized companies. By conducting a systematic literature review analysis for studies related to key success factors and Big Data Analytics during the research period on data needs, there were 50 sources of articles analyzed to identify the concept based on its classification. Referring to the descriptive qualitative analysis method for the selected literature section, the findings of this study succeeded in identifying 48 critical success factors from the implementation section of Big Data Analytics by proposing schemes and frameworks in 4 categories, namely: Organization, Technology, Human Resources (People) and Management Data Governance. These findings can be used as a reference for successful strategies and implementation of Big Data Analytics by formulating them into a more effective database form to improve the performance of small and medium-sized companies in achieving competitive advantage.

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INTRODUCTION

In recent years, Big Data has become a hot topic for academics and practitioners in the digital competitive era. BD is an important asset that attracts the attention of many CEOs in various organizations to gain faster insights as well as high revenues (Al-Sai, 2019). The BD journey began

when many organizations realized that their BD volume exceeded the organization's capabilities, processes, capacities, structure, technology infrastructure, and organizational governance. They struggled to meet the requirements for analyzing large amounts of various data (Ibrahim, 2020). The Industrial Development Corporation reports that the amount of data created in 2020 will exceed 40 zettabytes (ZB) greater than the amount of data in the previous few years (Al-Sai, 2019). The researchers identified various elements of BD-related capabilities and resources as a solid potential base for improving organizational performance. Most of the research discusses the role of the Big Data Analytics (BDA) domain covering the dimensions of technology, talent, and management that affect organizational performance (Ajah&Nweke, 2019). The ability of organizations to benefit from various forms of massive data is critical and readiness for investment within the scope of BD takes center stage (Eybers&Hattingh, 2017). Despite the benefits of BD and BDA, these projects are often risky and expensive investments that require serious planning (Zaher Ali, 2020). The BD project is different from other technology projects, where its implementation requires more preparation (Zaher Al-sai, 2022). BD implementation is a complex commitment that requires a new technological approach and organizational readiness. Small and medium-sized enterprises are now at a crossroads where they can tackle challenges related to BD implementation and become winners to reap the benefits of BDA with various characteristics in it (Eybers&Hattingh, 2017). Beside that, small & medium-sized companies need to increase their ability on challenges & risks associated with BD investments, if they are to survive along with high level of competitive advantage (Zaher Al-Sai, 2019).

Several approaches to critical success factors (CSFs) have been adopted by many other researchers (Zaher Ali, 2020). CSFs are considered a reinforcing factor as well as a workable method to address challenges related to the application of information technology across multiple domains in various companies. Reference with Kaur & Singh introduces CSFs as elements or characteristics that exist in a particular context and if satisfactory, will lead to a competitive advantage in organizational performance. CSFs are considered a key area where everything will be done the right way through business processes to achieve organizational goals (Kikwasi, 2018). CSFs analysis guides organizations in identifying potential critical factors that can be used to successfully obtain BD investment value. The identification of CSFs is considered a business management approach used to support strategic planning and information system readiness assessments on various enterprise applications (Eybers&Hattingh, 2017).

The CSFs method is used to identify critical elements of success that were originally developed to align technology planning with the strategic planning of an organization. CSFs as best practices are often identified after the achievement of a particular activity. As a result, this success factor is close to real-life experience (Al-Rousan&Al-Shargabi, 2017). On the other hand, the use of CSFs can have a major impact on the readiness, maturity, design, development, and implementation of information systems in the enterprise (Huang, 2019). In the context of developing a comprehensive information system success model for the BD domain, there is a need to investigate the factors influencing the successful implementation of BD (Adrian, 2017). Activities regarding the determination of critical factors can transform the organization towards the successful implementation of BD's new technologies (Vrchota, 2020). Most categories of CSFs are aligned with BD implementations adopted with requirements against BD challenges (Onofre&Teixeira, 2022). CSFs related to the readiness phase, availability of adequate resources, and the right people have a positive effect on project outcomes (Agha, 2019). The key to the successful implementation of BD in an organization is not only based on sufficient technical capabilities for analyzing data. Data management also plays the most important role in the implementation phase (Muniz Felix, 2018). In addition, the availability of effective assessment tools with clarity of layout can be used as a basis for managers in making informed decisions toward successful implementation (Agha, 2019).

Based on the systematic literature review (SLR) method by Halaweh & Massry, this study examines matters related to BDA capabilities and success factors for the development of small and medium-sized companies in achieving competitive advantage and organizational performance by answering the following three aspects of the question (Mikalef, 2019):

RQ1: "How many studies have identified key success factors (CSFs) and implemented Big Data Analytics that have implications for the development of small and medium-sized enterprises?
RQ2: "How is the implementation of key success factors (CSFs) associated with the implementation of Big Data Analytics to drive improved performance of small and medium-sized companies?
RQ3: "What are the classifications of key success factors (CSFs) from implementing Big Data Analytics for improving the performance of small and medium-sized companies?

RESEARCH METHOD

This study applies the systematic literature review method (SLR) to identify various existing and relevant literature with the concept of BDA capability and the key success factors accompanied by its classification. The matching of SLR results and reliable and accurate methods can be used to identify and evaluate all research related to multiple question items, topic domains as well as phenomena of interest (Dos Santos, 2018). Meanwhile, individual studies that contribute to systematic reviews are called primary studies. A systematic review is considered a form of secondary study that can be used in the preparation of this research to answer problem formulations on several points of question (Huang, 2019). The SLR strategy in this study was carried out based on guidelines for conducting a systematic literature review of the software (Dos Santos, 2018). The concept of SLR itself consists of three main levels, namely: Planning Review, Briefing Review, and Reporting Review.

Phase I: Planning Review

Activities associated with the planning stage include: the identification of need factors, formulating research questions, identifying search strategies, developing reviews of protocols used, formulating research questions to be discussed as well as reviewing the methodology to be used in the discussion of this article (Dos Santos, 2018). Research strategy is an initial mapping study that helps in determining the accuracy of the strategy. A systematic review of the literature was conducted based on a review of previous research. The search strategy aims to identify relevant literature in SLR research questions. The strategy aims to identify key studies including key search terms and resources used. The approach to identifying the term is by sorting the question items into several parts. Then list synonyms, abbreviations, and alternative spellings. Consider the subject headings used in databases and journal sources. Advanced search strings can use Boolean's AND and OR techniques (Dos Santos, 2018). Resources include electronic search engines, journals, conference proceedings, digital libraries, and literature (Dos Santos, 2018).

Phase II: Briefing Review

Activities related to the briefing review stage include search strategies for data sources, selection of literature studies, assessment of study quality, data extraction & monitoring, and data synthesis (Dos Santos, 2018). In this study, the SLR method was used to evaluate all research related to predetermined research questions in the planning stage. The next sub-section will provide further explanation of this briefing review.

Database source

A total of five database sources were used to identify available literature with consistency on research questions, namely: Google Scholar, Science Direct, Scopus, Springer, and IEEE. This

study selected five databases as the main reference sources with credible repository categories. This primary source is used to search for journals that have been published, both at various conference proceedings, journal newsletters, symposia, and workshops.

Selection criteria (Inclusive & Exclusive Criteria)

The selection of relevant literary literature is organized based on the criteria of inclusion and exclusion in the context of BDA, CSFs, and their categories. Use various forms of searching against previously identified research questions. This study identified several keywords namely: 'Big Data', 'Big Data Analytics, 'Key Success Factors (CSFs)', 'Challenges', and Big Data Implementation'.

Assessment Quality

The quality of the assessment is considered an important step in assessing the quality of the selected literature. Quality assessment includes question items aimed at assessing the scope of biased articles as well as internal & external factors of validity (Dos Santos, 2018).

Phase III: Reporting Review

The 'Reporting' phase is a phase in which there are findings of research constructs that are reported systematically, as the results of the reporting study.

RESULTS AND DISCUSSIONS

The findings in this study aim to answer the formulation of specific question items based on the criteria that have been set in this SLR model. The selection of studies for the application of SLR consists of 3 stages, starting from extracting a total of 29 relevant papers based on initial sources. Then it is scanned by title, abstract and conclusion. Furthermore, it is sorted based on abstracts and reading conclusions for 40 papers resulting in related studies, then re-selected through an assessment assessment of the paper's selection criteria. Followed by an abstract detail view and full text of the returned article with 29 final results received and identified as the final source for data synthesis.

Table 1. Quality assessment assessment

Quality scale	Very poor (< 1)	Poor (1- < 2)	Good (2- <3)	Very Good (3-4)	Total
Number of Paper	0	0	10	19	29
Percentage (%)	0	0	20	80	100

As shown in Table 1, twenty nine (29) articles were rated (80%) as excellent quality, ten (10) articles were rated (20%) as good, and other poor quality articles were not included in the next stage of the process. Table 1 shows the final results of the quality of the assessment score. In the next sub-section, the discussion of the answers in determining the SLR criteria consists of 3 questions: (a). RQ1: "How many studies have identified key success factors and implemented Big Data Analytics that have implications for the development of small and medium-sized companies?", (b). RQ2: "How is the implementation of key success factors associated with the implementation of BDA to drive improved performance of small and medium-sized companies?", (c). RQ3: "What are the classifications of key success factors from implementing Big Data Analytics for improving the performance of small and medium-sized companies?"

The following is an explanation of the formulation of the questions underlying the review literature review article for in-depth analysis to produce findings for the development of the small and medium enterprises sector:

RQ1: "How Many Studies Have Conducted The Identification Of Key Success Factors (Csfs) And The Implementation Of Big Data Analytics That Have Implications For The Development Of Small And Medium-Sized Enterprises?"

Many researchers have conducted different investigations to understand and identify different categories of CSFs. Content analysis methods and assessment quality for selected literature, few articles were selected as high-quality literature that can be used to answer specific research questions in this SLR study. Studies by (Eybers&Hattingh, 2017); (Zaher Ali, 2020); (Zaher Al-sai, 2022); (Huang, 2019); (Adrian, 2017); (Onofre&Teixeira, 2022); (Muniz Felix, 2018), have investigated factors influencing the successful implementation of BDA. A study by Evers investigated CSFs of BDA and Business Intelligence systems (Zaher Ali, 2020). Reference with Schull followed Technology, Organization, and Environment (TOE) in the category of factors influencing it. Reference Schull extends the TOE framework from a dynamic capability perspective that combines technological, management, and skill factors as a condition for adopting BDA success. Reference Schull focuses on the importance of dynamic capabilities and BD Capabilities for organizational development following the accelerating changes in the environment (Schüll&Maslan, 2018).

Table 2. BD CSFs and CSFs Categories Linked to SMEs

No.	CSFs category	CSFs Big Data Analytics
1.	Organizational SMEs	• Vision and Business Case
		• Top Management
		• Championship and Support
		• Change Management & Talent
		• Project Management and Methodology
		• Team Skills and User Participation
		• Resource Relate Factors.
		• Data Availability and Quality
		• Infrastructure
2.	Technology SMEs	• System
		• Infrastructure and Application
		• Data Source
		• Team Skills Related Facets for Success
		• Analytical tools
		• Technological tools
		• Documentation
		• Infrastructure
		• Integration
		• System Performance
3.	Performance SMEs	• Technology Performance
		• Quality of The System
		• Information Quality
		• Accurate Query Time.
		• Organizational and Process Performance
		• Systems Usages/User Acceptance
		• Operational Costs and Time Effort
4.	SDM SMEs	• Team Skills
		• Aptitude of Team Members

5.	Process SMEs	• Strategy process • Management Support process • Documentation • Data Quality • Project Management Related (For Example Project milestones)
6.	Data Policies Technology and Techniques SMEs	• Policies and Procedures • Ability to Gather, Disseminate, and Handle Data
7.	Access to Data SMEs	• Availability and Accessibility of Data

Source: Journal Reference, author-processed

RQ2: "How Is The Implementation Of The Key Success Factor (Csfs) When Associated With The Implementation Of Big Data Analytics To Encourage Improved Performance Of Small And Medium-Sized Companies?"

The implementation of the BDA includes important factors that small and medium-sized enterprises must identify to guarantee the success of the organization (Mikalef, 2019). Increased investment in BDA projects requested a focused investigation to identify CSFs and understand their effect on the implementation process (Mikalef, 2016). Although various studies focus on understanding CSFs in the application of information systems, limited academic research has been researched to identify important factors influencing BDA success (Zaher Al-sai, 2022). Based on the analysis of the selected study, this SLR identified 7 categories of CSFs for BDA implementation as shown in Table 2.

RQ3: "What Are The Classifications Of Key Success Factors (Csfs) From The Application Of Big Data Analytics To Improve The Performance Of Small And Medium-Sized Companies?"

After conducting a qualitative descriptive analysis of the various available literature and the key success factors for the development of small and medium-sized enterprises, several CSFs were extracted from the available literature sources. Such factors are categorized using concrete and potential content (Ahmad_Al-tit, 2019). Based on the meaning of the most common categories, in this study the authors identified and categorized the final results of CSFs by listing four (4) main categories of BDA implementation, including: (1) Organization; (2) Human Resources (People); (3) Technology; and (4) Management Data Governance. Table 3 shows the final list of CSFs and BDA implementations as well as the proposed categories based on the literature.

Table 3. Proposed CSFs Classification & BDA Success Key Factors

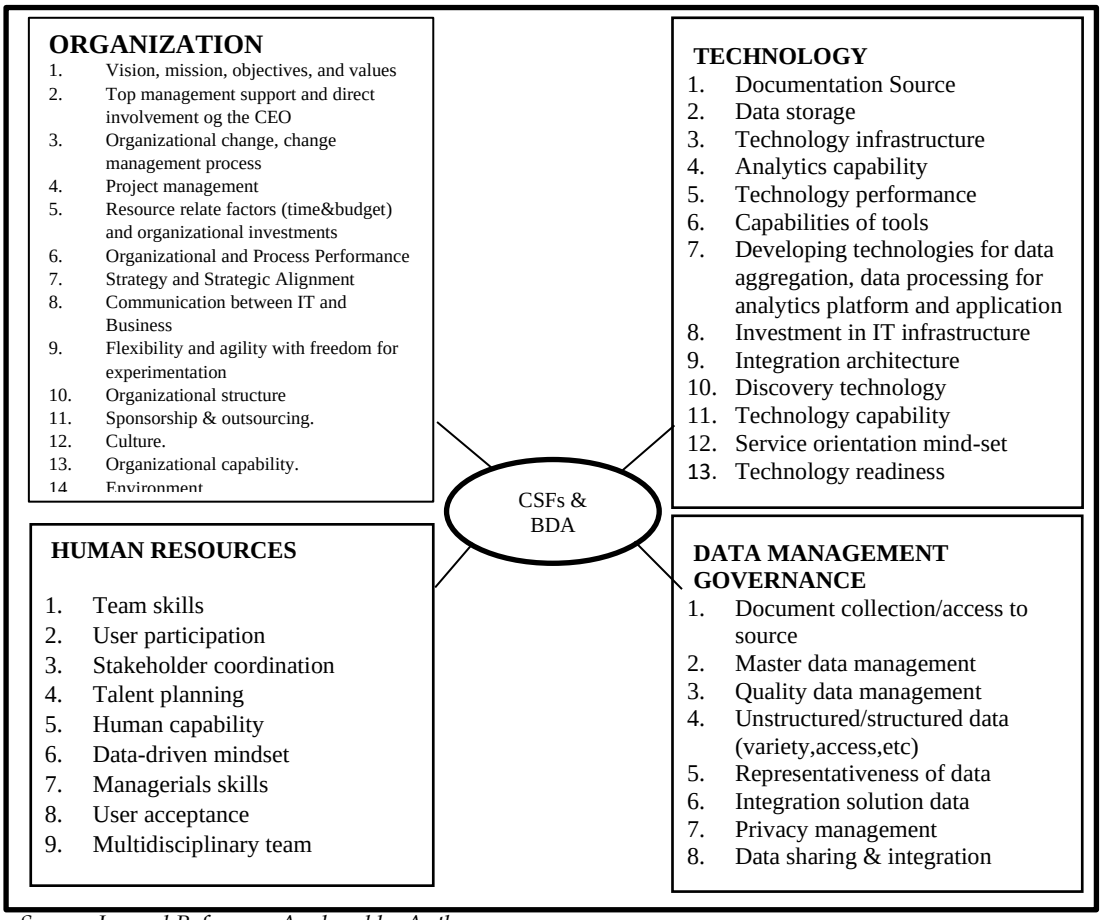
No.	Classification of CSFs	BDA Key Success Factors (CSFs)
1.	Organization	1. Vision, mission, objectives, and values. 2. Top management support and direct involvement of CEO. 3. Organizational change, change management process. 4. Project management 5. Resource relate factors (time&budget) and organizational investments. 6. Organizational and Process Performance. 7. Strategy and Strategic Alignment. 8. Communication between IT and Business. 9. Flexibility and agility with freedom for experimentation.

		10. Organizational structure. 11. Sponsorship & outsourcing. 12. Culture. 13. Organizational capability. 14. Environment. 15. Industry structure. 16. Perceived benefit. 17. The maturity and readiness.
2.	Human Resources (People)	1. Team skills. 2. User participation. 3. Stakeholder coordination. 4. Talent planning. 5. Human capability. 6. Data-driven mindset. 7. Managerials skills. 8. User acceptance. 9. Multidisciplinary team.
3.	Technology	1. Documentation Source. 2. Data storage. 3. Technology infrastructure. 4. Analytics capability. 5. Technology performance. 6. Capabilities of tools. 7. Developing technologies for data aggregation, data processing for analytics platform and application. 8. Investment in IT infrastructure. 9. Integration architecture. 10. Discovery technology. 11. Technology capability. 12. Service orientation mind-set. 13. Technology readiness.
4.	Management Data Governance	1. Document collection/access to source. 2. Master data management. 3. Quality data management. 4. Unstructured/structured data (variety,access,etc). 5. Representativeness of data. 6. Integration solution data. 7. Privacy management. 8. Data sharing & integration.

Source: SLR and Compilation by Author

Develop A Csways Classification Framework From Big Data Analytics

Based on the qualitative descriptive analysis approach of various literature, 4 main categories are proposed and identified, namely: Organization, Human Resources (People), Technology, and Management Data Governance. Figure 2 illustrates the CSFs classification of the BDA to develop the CSFs & BDA classification framework. Top-Down Techniques Hattingh can be applied to determine four (4) main categories in the final list of CSFs & BDAs (Eybers&Hattingh, 2017). The following is an explanation of four main classifications in context of BDA implementation and the key success factors for small and medium-sized companies identified in this SLR.



Source: Journal Reference, Analysed by Author

Figure 1. Framework Classification for CSFs of Big Data Analytics

Organization

The 'Organizations' category has the most CSFs in the literature (Eybers&Hattingh, 2017). The category considers the mission, vision, and strategy of the organization. For the successful implementation of BDA projects, small and medium-sized companies must always be aware of what they have, what they want to achieve, and how to align the BDA with the organization's goals (Eybers&Hattingh, 2017).

Technology

Technology includes tools to meet the needs and requirements of BDA. The category 'Technology' is related to data collection, storage, processing, analysis, and application (Vassakis, 2018). This category concentrates on technological data visualization tools such as system performance, time availability, data quality, and integration with existing analysis tools. At the same time, system application and infrastructure refer to several factors including security, scalability, and flexibility of the system.

Human resources

The category 'People' includes the human side of the information system. This category is very important for determining the maturity of BDA projects towards success & achievement targets for implementation. The availability of qualified human resources within the scope of small and medium-sized companies will have a positive impact on the successful implementation of BDA. This category refers to human abilities, analytical skills, and team skills for BDA success (Eybers&Hattingh, 2017).

Data management governance

Management of data by looking at how small and medium-sized companies can manage all problems in BDA sources and analyze data so that it can be used effectively and efficiently. The category 'Data Management' deals with administrative processes that include: capturing, process, validating, storing, and protecting the data necessary to ensure the secure accessibility, reliability, and timeliness of data (Owan&Bassey, 2019). Data management is a broad term that covers the domain of breadth of data applications. This also refers to several BDA management applications as a function of data storage, data security, and data design.

CONCLUSION

Small and medium-sized companies are currently still struggling to achieve competitive advantage and high-performance targets by implementing Big Data Analytics (BDA) through the identification of various categories of key success factors (CSFs). There is a limiting factor in the CSFs domain of BD, most of the literature adopts CSFs from the concepts of Business Intelligent and Data Mining. Based on SLR guidelines in Software Engineering, this study provides an understanding of the existing categories of CSFs for BDA and their implementation by answering the formulation of research questions straightforwardly and comprehensively (RQ1, RQ2, and RQ3). This study identified several lists of CSFs in the BDA implementation domain. This list will be important as a reference list of all BDA CSFs and categories needed by decision-makers to be successful in implementing the BDA concept. Based on the qualitative descriptive analysis method of existing BDA CSFs and their categories and after grouping the extracted CSFs in 48 items with the same meaning, this study resulted in the findings of the classification framework of 4 main categories of CSFs, namely: Organization, Technology, Human Resources, and Management Data Governance. One of the limitations of this study is the limited literature on search results that can be used to answer SLR research questions. In addition to the limitations, related some databases are not accessible. This SLR research can be used as a reference framework for BDA success and implementation strategies by formulating more effective data-based decisions for the development of small and medium-sized companies to improve data-driven performance so that they are expected to be able to achieve competitive advantages. Finally, the application of the BDA concept and key success factors (CSFs) is expected to be implemented by all levels of companies, especially small and medium-sized companies to be able to compete in the era of globalization.

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