IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

Exploring the Relationship between Big Data Analytics and Economic Development

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Abstract

The research paper explored the relationship between big data analytics and economic development. The discourse concerns the notion of Big Data, its progression, import, and association with economic progress. The text delves into the multifaceted aspects of Big Data, its potential benefits, and its emergence as a subject of intense scholarly and professional discourse. The text elaborates on the initial phases of the meta-analysis and systematic review process, followed by the results and potential directions for future research.

1. Introduction

The proliferation of technology and subsequent rise in societal and organisational reliance on the internet has resulted in a significant surge in data quantity and diversity in recent times. According to Desjardins (2019), Facebook generates approximately 4 petabytes of data on a daily basis, while each networked car produces 4 terabytes of data. Additionally, WhatsApp generates 65 billion messages and almost 294 billion email messages are sent daily. The World Economic Forum predicts that a total of 463 gigabytes of data will be produced daily by the conclusion of 2025. The expansion of the Internet of Things (IoT) and the proliferation of social media platforms and cloud computing have been identified as the primary drivers of growth, resulting in a surge in the number of connected users and devices (Dai et al., 2020).

The aforementioned estimates may be deemed overly cautious, given the potential for the COVID-19 outbreak to significantly augment the telecommuting populace and expedite corporate digitisation, as posited by Berger (2020). Implementing these modifications will inevitably necessitate a fundamental shift in organisational paradigms, as the market's competitive nature demands the accumulation of substantial amounts of data from diverse origins. The concept of Big Data has emerged in this particular context and has been employed to denote data's rapid and substantial expansion (Yaqoob et al. 2016). The aforementioned notion pertains to a collection of methodologies, procedures, and technologies that facilitate enterprises acquiring valuable insights and enhancing their decision-making procedures by analysing vast amounts of data (Almeida, 2018).

The notion of Big Data has undergone a progressive evolution, encompassing a range of novel viewpoints. Laney (2001) introduced a perspective on data exploration that encompasses three dimensions: volume, velocity, and variety. Notwithstanding, various authors have incorporated alternative viewpoints, including the significance of knowledge exploration from data, the importance of integrating Big Data in decision-making procedures, the veracity of data to mitigate the perils of uncertainty, and the indispensability of data dissemination via the cloud to facilitate distributed data processing (Wang et al., 2013). The development of the Big Data concept has resulted in the recognition that Big Data is presently comprised of ten dimensions, namely volume, velocity, variety, variability, value, visualisation, veracity, validity, volatility, and vulnerability, as posited by Khan et al. (2018). Companies aim to investigate and capitalise on the potential advantages Big Data Analytics may provide to enhance their organisational performance.

The significance of data in the information society is noteworthy. However, its potential for generating business value depends on its appropriate treatment and analysis. The present investigation is structured as follows; the present discourse outlines the preliminary stages of the meta-analysis and systematic review procedure. Subsequently, the outcomes are exhibited. The initial stage of this study involves the presentation of the PRISMA diagram for the systematic review, followed by evaluating the quality of the studies that have been incorporated into the review. Subsequently, a meta-analysis examines the correlation between big data and economic advancement. Subsequently, the obtained findings are analysed in light of the current body of literature within the respective field. Ultimately, the study's findings are summarised, the research constraints are deliberated upon, and potential avenues for further investigation are proposed.

2. Literature review

According to Mazumdar et al. (2019), using Big Data technologies presents notable cost benefits because they provide distributed storage of vast amounts of data. This facilitates corporations in identifying novel business prospects with greater efficiency and expediency. Hajli et al. (2020) assert that the utilisation of Big Data Analytics facilitates the examination of a wide range of data, encompassing unstructured as well as structured information, due to its rapidity and nimbleness. Moreover, a diverse range of sources can be utilised to gather data, including but not limited to ERP (Enterprise Resource Planning), SCM (Supply Chain Management), Customer Relationship Management (CRM), social networks, and web pages (Holmlund et al. 2020).

The utilisation of big data has emerged as an indisputable advantage for various entities. Due to this rationale, big data has emerged as a highly debated topic among scholars and professionals in the respective domain. The initial inquiry phase in this domain has centred on scrutinising data distribution models, followed by examining large-scale statistical algorithms and their potential advantages for enhancing organisational efficacy (Hajli et al. 2020). The study's findings validate the existing evidence, indicating that a significant proportion of research (81.25%) examining the correlation between big data and economic development was published in 2019. The study's findings led to the conclusion that this phenomenon's significance is relevant worldwide, encompassing both major corporations and small to medium-sized enterprises.

The present study reports a quantitative estimate of the association between big data and firm performance. Despite the relatively narrow estimation interval, certain studies have reported a significant impact exceeding 0.50, as

evidenced by Ferraris et al. (2019). Conversely, other studies, such as Chierici et al. (2019), have observed a comparatively lower impact of less than 0.25. Harris (2019) has reported that adopting the MA has a significant potential to identify divergent phenomena from studies with varying origins. Chierici et al. (2019) and Shan et al. (2019) have conducted research studies that highlight the mediating and limiting effects of organisations' creative and dynamic capabilities on their performance in the context of big data adoption.

Shan et al. (2019) have demonstrated that the strategic adaptability of organisations, and has a more than the twofold impact on organisational performance. This finding is supported by previous studies, including Ferreira et al. (2020), which have also highlighted the significance of these competencies over IT technology capabilities. Contrarily, the enhancement of organisational performance in businesses via the adoption of big data is facilitated by elements such as information quality, as reported by Wamba et al. (2019), and the management knowledge, as emphasised by Ferraris et al. (2019).

The concept of big data encompasses multiple facets, such as technology, data science, and an understanding of finance, making it an all-encompassing phenomenon. The field of technology encompasses the gathering, examination, correlation, and juxtaposition of extensive data sets by disseminating data processing and optimising computational capability (Avci et al., 2020). The data analysis process involves the establishment of criteria that can enhance the quality of decision-making, as noted by Jeble et al. (2016) and Sivarajah et al. (2017). The acquisition of extensive data sets is crucial in obtaining comprehensive knowledge that can produce precise value, which would otherwise be unattainable, as evidenced by the works of Müller et al. (2018).

The primary feature immediately apparent when delineating big data is its substantial data volume. In recent times, scholars have introduced additional components such as velocity, diversity, accuracy, and significance to the existing ones. This has been documented by Ramasamy and Chowdhury (2020). The significance of value as a crucial component cannot be overstated in the process of transforming big data into a valuable asset for organisations. As per the research conducted by Günther et al. (2017), the concept of "value" plays a crucial role in determining the potential of data to generate value for a particular process or activity. This implies that the ability to derive economic benefits from the collected data is of utmost significance. The practice of analysing data has become an essential requirement for organisations seeking to derive meaningful insights from their operations.

Thus, a big data solution must be able to effectively handle all the information generated and acquired by the entity. Ajah and Nweke (2019) have highlighted that a significant data solution would decrease technical costs, time savings, and new services and goods creation. The discrete facets of big data exhibit interdependence and mutual reinforcement in pursuing organisational goals. To fully leverage the possibilities of big data, organisations must possess a diverse range of multidisciplinary skills. One of the dimensions under consideration is the capability of big data technology, which pertains to the technological capability of big data analytics platforms to perform cross-analysis of information originating from multiple sources and encompassing structured, semi-structured data, unstructured (Mishra & Misra, 2017).

The capacity to manage big data is a crucial factor in ensuring that the big data platform yields organisational benefits. According to Akter et al. (2016), the successful implementation of a project requires careful consideration of various elements, including investments, planning, coordination, and control. The emergence of talent capable of handling big data has finally come to fruition. According to Persaud (2020), this dimension pertains to the capacity of an organisation to avail the services of experts who possess the requisite knowledge and analytical abilities to execute tasks in an environment characterised by a large volume of data.

3. Methodology

Systematic Literature Review (SLR) is a scientific research methodology that involves synthesising multiple original studies while employing strategies to minimise bias and accidental mistakes. The present study, RLS, is a secondary retrospective investigation that seeks to collect comparable published research, focusing on critically evaluating its quality. Booth et al. (2016) posit that Systematic Literature Review (SLR) has significantly contributed to study planning in the field and facilitates informed decision-making.

The Simple Linear Regression (SLR) technique can be integrated with statistical approaches to examine and condense the outcomes of the incorporated research studies. Due to the systematic nature of an SLR, it must be carefully planned. Booth et al. (2016) assert that to achieve this objective, and it is imperative to clearly specify the proof that needs to be incorporated, define and limit the scope of the search area, identify the search terms utilised, refrain from subjective assessments of observed phenomena, and specify the temporal and disciplinary parameters of the review. Additionally, the systematic literature review (SLR) must be capable of being replicated. The systematic literature

review (SLR) is distinguished from the narrative or conventional book review by its focus on particular research issues and its methodological rigour, which includes comprehensiveness, transparency, and replicability.

The scientific articles were researched using two databases, namely Web of Science (ISI) and Scopus. Such databases were selected based on their established credibility and widespread acceptance within the global scientific community. The ACM (Academy for Computing Machinery) and the Institute of IEEE (Electrical and Electronic Engineers) Explore Digital Library were initially taken into account owing to their significant recognition in the domain of computer science, in addition to the two databases mentioned earlier. Nevertheless, it has been determined that this particular measure would be superfluous given that all previously catalogued articles in ISI and the Scopus database have already been incorporated into these databases.

The study searched for relevant articles using various search terms. These terms included combinations of "Big Data," "Structural Equation Modelling," and "Regression" with "firm performance," "business performance," and organisational performance. The search terms were used to query every paper's title, abstract, and phrase. Meta-analysis is a statistical method employed to integrate data from various studies pertaining to a particular subject. Various independent research studies are utilised to amalgamate, merge, and synthesise their findings. As per the findings of Borenstein et al. (2011), the utilisation of this methodology leads to a decrease in the standard departure and trust interval, thereby enhancing the dependability of the outcome. To implement this approach, the data must be standardised and capable of being grouped. Using SLR in conjunction with meta-analysis allows for examining the compiled data on the subject matter while mitigating the potential for prejudicial inclinations (Ahn & Kang, 2018). Moreover, pursuing a Master of Arts degree enables investigating and resolving inquiries that may not have been initially presented in singular research endeavours. This degree programme also affords the chance to reconcile conflicting assertions made by said research endeavours (Harris, 2019). The systematic reviews were maintained, and meta-analysis was performed using the Review Manager (RevMan) software. In order to estimate the connection between Big Data and firm performance, a confidence interval was computed using both fixed-effect and random-effect estimates scenarios. A forest chart of the risk proportion was executed in both instances.

4. Discussion

A systematic review is a comprehensive evaluation of a well-defined set of one or more research inquiries that employs explicit and systematic techniques to identify, choose, and assess pertinent research and gather and analyse

data from the studies incorporated in the review. The PRISMA protocol was implemented during the analysis and systematisation of findings, as Oláh et al. (2020) suggested. The PRISMA framework depicts the sequential progression of data acquisition and examination across the various stages of a systematic review. The first figure illustrates the identified records and the rationale behind their inclusion or exclusion. Considering the pre-established search parameters, the Scopus and ISI records were utilised during the initial stage to locate pertinent articles published in the field.

In total, 167 materials were identified, with 40 items duplicated due to their indexing in both databases. After removing duplicates, a total of 127 records were obtained. Subsequently, the records underwent a two-tier model analysis. Firstly, the abstracts of the publications were scrutinised, leading to a list of 90 pertinent publications. Secondly, the full-text articles were examined, resulting in 26 publications. The exclusion of the pieces was attributed to various reasons, including the fact that the publication did not prioritise the topic of big data, the technical aspect of big data was explored, and the focus was not on the organisation's performance but rather on the social and organisational impact of big data. Subsequently, the aforementioned studies were incorporated into the quantitative synthesis during the third phase. During the aforementioned procedure, 8 records were eliminated from consideration due to insufficient quantitative data on the utilisation of Structural Equation Modeling (SEM).

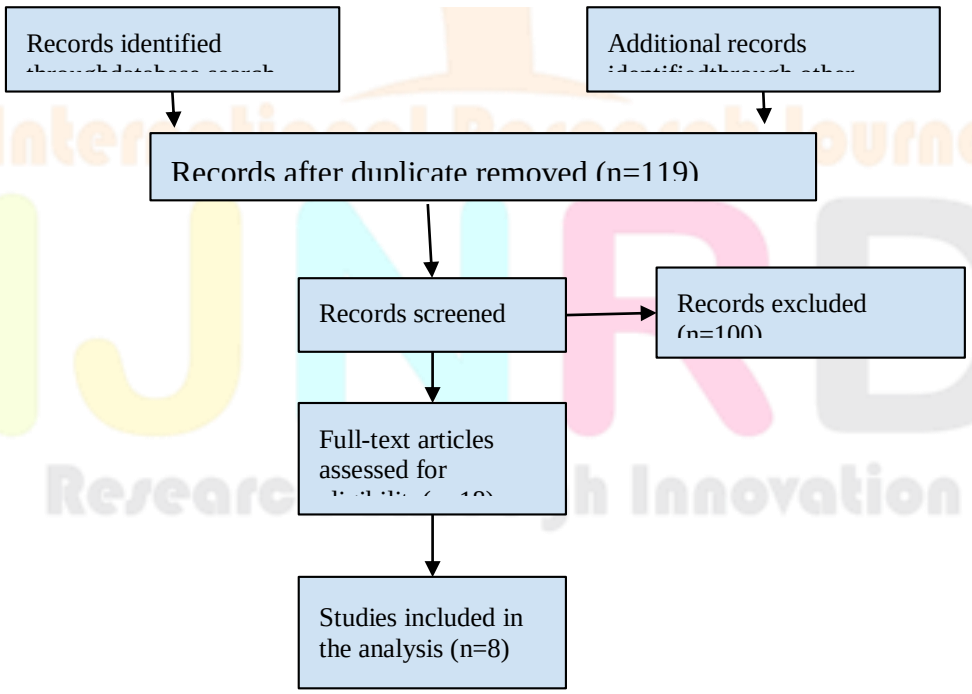

Figure 1: PRISMA Table

Source: Author

The study's findings demonstrate the concurrent influence of all three perspectives and show a moderately positive correlation between big data and economic development or firm performance. This conclusion is derived from various studies investigating big data's impact on enterprises. According to Faroukhi et al. (2020), using big data is causing a significant transformation in both value chains and company structures. According to Prescott's (2016) assertion, organisations' utilisation of big data has emerged as a crucial strategy to sustain a competitive edge and enhance their operational efficiency. Ramadan et al. (2020) also confirm this sight and add that big data allows the creation of a new organisational paradigm, altering the value of expertise, leadership practices, and the capabilities of managers to use and analyse a large weight of data at their disposal.

The results indicate that utilising big data impacts organisational performance, but various factors influence this impact. This understanding sheds light on the limited effects of big data on firm performance. Organisations face numerous challenges. According to Braganza et al. (2017), the process of analysing data presents not only technical difficulties but also organisational challenges. The perspective put forth by Gupta and George is corroborated by their research, which indicates that an organisation's ability to leverage big data is contingent upon a combination of intangible, material, and human-related factors. Gupta and George (2016) posit that additional factors come to light, including an organisational culture driven by data and a tendency towards organisational learning. The responsibilities of a data scientist extend beyond addressing the technical complexities associated with big data. Rather, they involve devising strategic remedies for disruptive changes that arise as organisations integrate big data into their decision-making and management processes.

5. Conclusion

The utilisation of meta-analysis and systematic literature review has facilitated an examination of the phenomenon pertaining to the connection between big data and economic development, as well as the quantification of this relationship. The suitability of this method has been demonstrated in light of the multitude of current research that has been conducted in the field, which aim to explicate this phenomenon across diverse contexts, including but not limited to different countries, sizes of companies, and sectors of activity. The study estimated the correlation coefficient between big data and company performance. The potential benefits of big data to organisations include developing new businesses, making new products and services, and making improvements in business operations.

This leads to the conclusion that big data holds significant promise for organisations. The systematic review findings have revealed that firm performance evaluation encompasses various dimensions, including revenue, cost minimisation, and market share. Hence, firms that successfully implement or leverage innovation to provide superior products or services will likely attain enhanced performance. Nevertheless, the study also uncovers the presence of additional variables that influence an organisation's ability to leverage the advantages of big data. The capacity of a corporation to leverage big data is not solely confined to the technical aspect but encompasses additional intangible, tangible, and human factors.

The performance of an organisation is influenced by its culture of utilising data and the ability of the organisation to learn. The present research provides implications in both theory and practice. The study delved into the conceptual dimension by analysing the results of 18 published articles that investigated the relationship between big data and economic developments across various countries and organisations. The conducted synthesis work facilitated an exploration of the methodological quality of the aforementioned studies. A quantitative connection between the two phenomena was established through a meta-analysis. The findings of this study hold significance for organisations that are in the initial stages of implementing big data, particularly in terms of practical implications. The study's findings indicate that big data has a mild positive influence on firm performance. However, other human beings, cultural and organisational capital factors also significantly determine firm performance. The present study highlights certain limitations that are pertinent to the ongoing discourse. The systematic review encompasses a diverse range of studies that are significantly influenced by the particular setting in which they were carried out.

Henceforth, as a prospective undertaking, it would be pertinent to investigate the significance of control variables, such as the firm's magnitude, the industry category, or the orientation of knowledge management in organisations. As a result, we propose a set of research inquiries that could aid in comprehending and delineating this occurrence, specifically: why certain organisations perceive big data analytics ability as not valuable. This inquiry pertains to the potential impact of organisational culture on the outcomes of big data analytics with respect to company performance. The explanations for variations in results across different countries and to what extent to national cultural dimensions impact the relationship between big information analytics and firm effectiveness.

References

Ahn, E., & Kang, H. (2018). Introduction to systematic review and meta-analysis. Korean Journal of Anesthesiology, 71(2), 103-112.

Ajah, I. A., & Nweke, H. F. (2019). Big Data and Business Analytics: Trends, Platforms, Success Factors and Applications. Big Data and Cognitive Computing, 3(2), 1-30

Akter, S., Wamba, S. F., Gunasekaran, A., Dubey, R., & Childe, S. J. (2016). How to improve firm performance using big data analytics capability and business strategy alignment? International Journal of Production Economics, 182, 113-131.

Almeida, F. (2018). Big Data: Concept, Potentialities and Vulnerabilities. Emerging Science Journal, 2(1), 1-10

Berger, R. (2020). How the current crisis will change the culture of our work. Retrieved 12 January 2021, from https://www.rolandberger.com/en/Point-of-View/Digital-workplace-in-the-era-of-Covid-19.html

Booth, A., Sutton, A., & Papaioannou, D. (2016). Systematic Approaches to a Successful Literature Review. Thousand Oaks, California: SAGE Publications.

Borenstein, M., Hedges, L. V., Higgins, J. P., & Rothstein, H. R. (2011). Introduction to Meta-Analysis. Hoboken, New Jersey: Wiley.

Braganza, A., Brooks, L., Nepelski, D., Ali, M., & Moro, R. (2017). Resource management in big data initiatives: Processes and dynamic capabilities. Journal of Business Research, 70. 328-337.

Chierici, R., Mazzucchelli, A., Garcia-Perez, A., & Vrontis, D. (2019). Transforming big data into knowledge: the role of knowledge management practice. Management Decision, 57(8), 1902-1922.

Dai, H. N., Wang, H., Xu, G., Wan, J., & Imran, M. (2020). Big data analytics for manufacturing internet of things: opportunities, challenges and enabling technologies. Enterprise Information Systems, 14(9-10), 1279-1303.

Desjardins, J. (2019). How much data is generated each day?. World Economic Forum. Retrieved 19 Novemeber 2020, from https://www.weforum.org/agenda/2019/04/how-much-data-is-generated-each-day-cf4bddf29f/

Faroukhi, A. Z., Alaoui, I. E., Gahi, Y., & Amine, A. (2020). Big data monetization throughout Big Data Value Chain: a comprehensive review. Journal of Big Data, 7(3), 1-22.

Ferraris, A., Mazzoleni, A., Devalle, A., & Couturier, J. (2019). Big data analytics capabilities and knowledge management: impact on firm performance. Management Decision, 57(8), 1923-1936.

Günther, W. A., Mehrizi, M. H., Huysman, M., & Feldberg, F. (2017). Debating big data: A literature review on realizing value from big data. The Journal of Strategic Information Systems, 26(3), 191-209.

Gupta, M., & George, J. F. (2016). Toward the development of a big data analytics capability. Information & Management, 53(8), 1049-1064.

Hajli, N., Tajvidi, M., Gbadamosi, A., & Nadeem, W. (2020). Understanding market agility for new product success with big data analytics. Industrial Marketing Management, 86. 135-143.

Harris, C. (2019). The Handbook of Research Synthesis and Meta-Analysis. New York: Russell Sage Foundati.

Holmlund, M., Vaerenbergh, Y. V., Ciuchita, R., Ravald, A., Sarantopoulos, P., Ordenes, F. V., & Zaki, M. (2020). Customer experience management in the age of big data analytics: A strategic framework. Journal of Business Research, 116, 356-365.

Jeble, S., Kumari, S., & Patil, Y. (2016). Role of big data and predictive analytics. International Journal of Automation and Logistics, 2(4), 307-331.

Khan, N., Alsaqer, M., Shah, H., Badsha, G., Abbasi, A., & Salehian, S. (2018). The 10 Vs, Issues and Challenges of Big Data. Proceedings of the 2018 International Conference on Big Data and Education -ICBDE '18, Honolulu, USA, 52-56.

Laney, D. (2001). Deja VVVu: Gartner's Original "Volume-Velocity-Variety" Definition of Big Data. Retrieved 26 November 2020 from https://community.aiim.org/blogs/doug-laney/2012/08/25/deja-vvvu-gartners-original-volume-velocity-variety-definition-of-big-data

Mishra, D., Luo, Z., Hazen, B., Hassini, E., & Foropon, C. (2019). Organizational capabilities that enable big data and predictive analytics diffusion and organizational performance: A resource-based perspective. Management Decision, 57(8), 1734-1755.

Müller, O., Fay, M., & vom Brocke, J. (2018). The Effect of Big Data and Analytics on Firm Performance: An Econometric Analysis Considering Industry Characteristics. Journal of Management Information Systems, 35(2), 488-509.

Oláh, J., Krisán, E., Kiss, A., Lakner, Z., & Popp, J. (2020). PRISMA Statement for Reporting Literature Searches in Systematic Reviews of the Bioethanol Sector. Energies, 13, 1-35.

Persaud, A. (2020). Key competencies for big data analytics professions: a multimethod study. Information Technology & People, 34, 178-203.

Prescott, M. E. (2016). Big Data: Innovation and Competitive Advantage in an Information Media Analytics Company. Journal of Innovation Management, 4(1), 92-113.

Ramadan, M., Shuqqo, H., Qtaishat, L., Asmar, H., & Salah, B. (2020). Sustainable Competitive Advantage Driven by Big Data Analytics and Innovation. Applied Sciences, 10, 1-14.

Ramasamy, A., & Chowdhury, S. (2020). Big Data quality Dimensions: A Systematic Literature Review. JISTEM– Journal of Information Systems and Technology Management, 17, 1-13

Shan, S., Luo, Y., Zhou, Y., & Wei, Y. (2019). Big data analysis adaptation and enterprises' competitive advantages: the perspective of dynamic capability and resource-based theories. Technology Analysis & Strategic Management, 31(4), 406-420.

Sivarajah, U., Kamal, M. M., Irani, Z., & Weerakkody, V. (2017). Critical analysis of Big Data challenges and analytical methods. Journal of Business Research, 70, 263-286.

Wamba, S. F., Gunasekaran, A., Akter, S., Ren, S., Dubey, R., & Childe, S J. (2017). Big data analytics and firm performance: Effects of dynamic capabilities. Journal of Business Research, 70, 356-

Wang, W., Zhou, X., Zhang, B., & Mu, J. (2013). Anomaly detection in big data from UWB radars. Security and Communication Networks, 8, 2469-2475

Yaqoob, I., Hashem, I., Gani, A., Mokhtar, S., Ahmed, E., Anuar, N. B., & Vasilakos, A. V. (2016). Big data: From beginning to future. International Journal of Information Management, 36(6), 1231-1247.