Journal of Innovation and Business Management
Volume 2 (1) 2021

Strategic Synergy: Leveraging Big Data and Information Systems for Competitive Advantage in the Digital Age

Ana-Maria-Bianca Comanoiu [1,] Muhammd Umar Farooq [2*]

[1&2] York St John University*

ABSTRACT

In the digital era, organizations have increasingly realized that linking big data and information systems is essential for achieving competitive advantage. This paper also highlights shared dependency of the two elements, on how it affects decision-making processes, organizational functionality, and the customer interface. There are numerous benefits from analysing large datasets as it would help the organization to better understand the world around it and make better decisions as well as improve the efficiency of certain processes and, finally, improve its clients' experience. The paper also presents the different characteristics of information systems and also analyses the applicability of these systems at various organizational tiers, with regard to the ways they facilitate data solutions. it also fits with the problem of data handling, storage, and protection that arises when implementing big data. In conclusion, the study reveals the need to use information systems and big data to sustain competitiveness in the current ever-changing digital business environment.

Keywords: Big Data; Information Systems; Strategic Decision-Making; Data-Driven Strategies; Competitive Advantage

Introduction

Today, people from all over the world create immense amounts of data, and it is often challenging even to perceive all the existing ones as big data due to the constant flow of information and the availability of telemetry featuring every social media post, cash payment, and much more. The rapidly expanding information adds up new possibilities and problems in different fields of operation (Ivanov et al., 2020; Benbya et al., 2020; Tseng et al., 2021; Choi et al., 2020). On one hand, the quantum of data generated is staggering, but at the same time, it provides us with micro and macro insights into the business which are very useful in case of formulation and implementation of strategies. In order for corporations to manage themselves in this environment and extract relevant information from the somewhat chaotic sea of data, the business needs to embrace the concept of data mining.

The opportunity for proper evaluation and analysing the outcomes of BIG data is significant for management decision-making and beneficial strategies in order to achieve a competitive advantage (Zhang et al., 2020; Niu et al., 2021; Nisar et al., 2021). The use of analysis tools and methods helps the enterprises to convert the collected and accumulated volumes of data into usable knowledge that will let the companies foresee the trends and make relevant decisions concerning their further operations as well as bring more value for their customers. In this regard, the incorporation of big data with information systems plays the crucial role. Information systems comprise data acquisition, communication, and decision-making channels at different organizational hierarchies that facilitate the provision of the right information to the right people at the right time (Joseph and Gaba, 2020; Ardito et al., 2020; Yoshikuni and Dwivedi, 2021).

This paper briefly examines the integration between big data and information systems to show how big data influences the insights that organizations use to strategize. It also looks into how various information systems work within various levels of organization structures focusing on the effects of such systems on productivity, decision making and competitiveness of today's organizations as the world shifts towards information-based economy. Therefore, if it is fully understood and utilized, it becomes possible for the problems presented by the big data environment to be dealt with and the opportunities to be explored.

Literature Review

Definition of Big Data

Big data encompasses vast and varied datasets that expand at an accelerating pace. The concept of big data referred to as the "five v's", includes the dimensions of information volume, veracity, velocity, value and variety. Big data frequently originates from the process of data mining and is received in many formats (Saeed and Husamaldin, 2021).

According to Jean Paul and Zikopoulos (2018), three categories can be used to group big data. Information that has already been arranged and kept by the business in spreadsheets and databases is referred to as *structured data*. Information that is disorganised and does not follow a predetermined pattern or organisation is referred to as *unstructured data.* Information that is somewhat organised and has components of unstructured as well as structured form is referred to as *semi-structured data.*

Richardson (2017) states that big data can be gathered through product acquisitions, electronic check-ins, publicly distributed remarks on social media, and freely obtained from personal gadgets and apps. Smart equipment that have built in sensors allow data to be collected under a variety of scenarios and settings.

Data analysts examine the correlation between various forms of data, such as demographic information and purchase history, in order to ascertain if a relationship exists. These evaluations can be conducted internally or externally by a specialised third-party that specialises in transforming large amounts of data into easily understandable formats. Businesses frequently rely on the evaluation of large

datasets by specialised professionals to transform it into practical and implementable insights (Sedkaoui, 2018).

Corporations like Meta (formerly known as Facebook), employ big data to generate advertising revenue by strategically putting personalised advertisements on social media platforms and websites visited by users (Meta, 2021).

The objective of big data is to enhance the velocity of product launch, minimise the time and resources needed for market acceptance, target specific audiences, and maintain customer satisfaction. Many software-as-a-service (SaaS) providers are experienced in managing complex data of this nature (Chen et al., 2014).

The value of Big Data

Through the analysis of extensive data sets, organisations can get useful insights that can facilitate informed decision-making, optimise operational efficiency, and elevate consumer experiences. There are four types of data analytics that function on a continuum. *Descriptive*-which focuses on understanding past events, *Diagnostic*-which aims to uncover the reasons behind those events, *Predictive*-which involves forecasting future events and *prescriptive*-which recommends the most effective actions to achieve desired future outcomes. Collectively, they enable organisations to derive significant insights, make well-informed choices, and enhance different facets of their operations (Marr, 2019).

The proliferation of data offers both prospects and challenges, possessing a greater amount of client data enables organisations to more effectively customise products and marketing endeavours, hence maximising satisfaction levels and fostering repeat business. Companies that accumulate a substantial volume of data are afforded the chance to perform more extensive and comprehensive analysis for the advantage of all stakeholder (Caslin, 2021).

Although improved analysis is advantageous, big data can also lead to information overload and diminishing its use. Companies must effectively manage and analyse increasing amounts of data to identify meaningful information amidst irrelevant or unimportant data because determining the criteria for data relevance is a crucial issue (Jean Paul and Zikopoulos, 2018).

Presently, businesses are employing Big Data in various ways, such as:

• ***Personalised Marketing***: Companies such as Amazon and Netflix utilise Big Data to examine customer preferences, purchase history, and browsing patterns. This allows them to offer customised suggestions and focused marketing, resulting in heightened client involvement and revenue growth (Behera et al., 2020).

• Retail behemoths like Walmart employ Big Data analytics to optimise their ***supply chain operations.*** Through the analysis of data pertaining to inventory levels, client demand, and transportation routes, it is possible to optimise logistics operations, minimise expenses, and guarantee punctual delivery of goods (Walmart, n.d.).

• ***Fraud Detection***: Financial institutions utilise Big Data analytics to identify and thwart fraudulent operations. Through the

examination of extensive volumes of transactional data in real-time, they are able to detect suspicious patterns and implement preventive actions to reduce risks (Sunder, 2015).

• ***Healthcare Analytics***: Healthcare organisations employ Big Data to enhance patient outcomes and optimise resource allocation. Through the examination of patient data, medical research, and clinical trials, experts can detect patterns, create customised treatment strategies, and forecast the occurrence of disease epidemics (Reddy and Aggarwal, 2015).

Discussion

Types of Information Systems

• ***Transaction Processing Systems (TPS)*** are crucial for the operational level of an organisation. They collect and handle routine transactions, including as sales, inventories, and payroll. TPS offer up-to-the-minute data that enables managers to oversee operations, make prompt choices, and guarantee seamless business processes (Gupta, 2011).

• ***Management Information Systems (MIS)*** assist middle-level managers by offering concise reports and data analysis. These systems integrate data from multiple sources and present it in a format that facilitates decision making. For instance, a Management Information System (MIS) can provide sales reports, conduct budget analysis, and provide performance indicators to assist managers in monitoring progress and identifying opportunities for enhancement (Gupta, 2011).

• ***Decision Support Systems (DSS)*** aid senior executives in formulating strategic decisions. These systems employ sophisticated analytics and modelling approaches to examine intricate data and offer insights for strategic planning. For example, DSS has the capability to replicate various situations, assess prospective results, and assist executives in making well-informed decisions (Gupta, 2011).

• ***Executive Information Systems (EIS)*** are designed to meet the requirements of top-level executives by delivering concise and comprehensive information derived from both internal and external sources. These systems provide executives with the ability to personalise dashboards and access key performance indicators (KPIs) in order to effectively monitor organisational performance, detect patterns, and make informed strategic decisions (Bocij, Greasley and Hickie, 2018).

• ***Enterprise Resource Planning (ERP) Systems*** integrate essential business operations in an effort to maximise organisational efficiency. By offering a single information platform, this integration promotes decision-making by ensuring uniformity and visibility across many departments (Pelphrey, 2015).

• ***Supply Chain Management Systems (SCM)*** facilitate the efficient exchange of goods, services, and data amongst parties involved in the supply chain. Production and distribution decision-making depend heavily on effective supply chain management which allows the intelligent planning of production schedules, distribution tactics, and resource allocation (Giannakis et al., 2019).

• ***Customer Relationship Management (CRM) Systems*** are crucial in today's customer-focused company environment. They oversee consumer relations, offering insightful data on preferences and comments. This data is used by decision-makers at all levels to customise marketing and service plans, which in turn improves client loyalty and happiness (Peelen and Beltman, 2013).

• ***Knowledge Management Systems (KMS)*** facilitates cooperation and creativity by gathering, organising, and disseminating this knowledge. All levels of decision-makers have access to organisational collective knowledge, which facilitates well-informed decision-making, problem-solving, and ongoing development. Any organisation can benefit greatly from knowledge as an asset (Bocij, Greasley and Hickie, 2018).

<u>The significance of information systems in facilitating managerial decision-making at various levels within an organisation</u>

- ***Operational Level:***. Tesco supports its operations using Point of Sale (POS) Systems execute checkout transactions, and Inventory Management Systems track and control stock levels in real time. Supply Chain Management Systems streamline procurement, distribution, and logistics. Employee Management Systems handle payroll and scheduling, while CRM Systems track customer interactions and preferences. Tesco uses ERP systems to link finance, HR, and supply chain functions. For detailed operational data analysis and reporting, data warehousing and Business Intelligence (BI) systems are used. Online Ordering Systems administer e-commerce systems and assist online transactions (Dhyana and Gupta, 2020).

- ***Manufacturing Tactical Level:*** Tactical manufacturers like Rolls-Royce employ information systems to make complex decisions. Rolls-Royce, a major aerospace and industrial company, optimises resource allocation and production schedules with information systems to improve tactical efficiency (ROLLS-ROYCE, n.d).

- ***Financial Institution Strategic Level:*** Barclays (2019) use information technology by navigating their strategic landscapes. Complex systems help this company make risk management, investment, and market analysis decisions. By using advanced analytics and data-driven insights to make well-informed decisions that support long-term financial goals, they can stay

competitive in the fast-paced financial market.

- ***Enterprise Integrated Decision-Making:*** SAP is a leading provider of business solutions, particularly ERP systems. SAP's linked systems help departments make decisions resulting in a consistent and accurate view of the company and enabling seamless data flow and informed strategic decisions. This is done by coordinating finance, HR, and supply chain management (SAP, n.d.).

- ***Supply Chain Management*** (Logistics): DHL uses a variety of information technologies like Warehouse Management Systems to optimise warehouse operations, Transportation Management Systems to plan and execute transportation activities, and Order Processing Systems to manage order fulfilment. DHL uses Global Trade Management Systems to comply with international trade standards and Track and Trace Systems to track shipments in real time. Supplier Relationship Management Systems streamline procurement, while ERP integrate finance, HR, and supply chain management. DHL uses Data Analytics and BI Systems for in-depth analysis to improve supply chain performance (DHL, 2020).

- ***Customer-Centric Decision-Making*** (E-commerce): Amazon use modern CRM technologies to analyse consumer behaviour, preferences, and purchasing trends. They personalise user experiences, product recommendations, and marketing to boost customer satisfaction and loyalty, which helps them succeed in the increasingly competitive online industry (Amazon, n.d.).

- ***Innovation and Knowledge Sharing*** (Technology): According to Kaur and Gill (2019) Google uses multiple information systems to boost innovation and knowledge sharing. Google Workspace (Gmail, Docs, Sheets, and Drive) is a collaborative hub while Google Chat allows real-time communications and collaboration, speeding up information sharing. Google tracks and manages creative activities with MIS to encourage staff participation. KMS organise and simplify internal information access, including websites and libraries. Learning

Management Systems aid staff development, while customised Intranet Portals supply vital company data. Jira and Asana track innovation project progress, and internal search engines optimise information access.

- ***Regulatory Compliance*** (Healthcare): The NHS (National Health Service) uses information technologies to safely handle massive patient data while adhering to strict legal restrictions. These tools enable doctors to make informed decisions, protect patient privacy, and comply with data protection rules. Healthcare organisations utilise powerful information systems to navigate complex regulatory frameworks and provide high-quality patient care (NHS ENGLAND, n.d.).

Information Systems Importance

Information systems are essential to contemporary corporate operations because they provide a multitude of advantages that have a substantial impact on performance and decision-making.

Data Accuracy and Timeliness is a key component that guarantees organisations can depend on accurate and current information. Modern inventory management systems, like the one used by retail behemoth Walmart, for example, track product sales in real-time, reducing errors and facilitating prompt replenishment. Management is able to make well-informed judgements on inventory levels and client requests thanks to this accuracy and timeliness (Samitsch, 2015).

Equally important is the idea of **Data Integration**, which is the process of combining various data sources within an organisation in an easy-to-use manner. Enterprise Resource Planning (ERP) systems are used by companies to combine data from supply chain, sales, and manufacturing, which facilitates decision-making across a range of corporate tasks and streamlines procedures (Yılmaz and Ozcan, 2011).

Analysis and Visualisation enhance the power of data by providing insights in an understandable way. The streaming service Netflix analyses user behaviour using advanced analytics and recommendation algorithms. Personalised recommendations that are visually appealing not only improve user experience but also show how data analysis and visualisation support strategic decision-making in content distribution (Eklund, 2020).

Enhanced Efficiency is another important concept that pertains to improving operational efficiency. Businesses such as Tesla demonstrate how information systems are applied in the production process using robotics and automation. This increases total efficiency by guaranteeing accuracy

and quality control in addition to streamlining production operations (Marr, 2018).

For organisations, obtaining a **Competitive Advantage** is an ongoing objective. Information systems are used by businesses like Amazon for machine learning, data analytics, and logistical optimisation. This helps firms stand out in the very competitive e-commerce sector by allowing them to provide tailored recommendations, effective delivery services, and an all-around better client experience (Amazon,n.d.).

Lastly, **Informed Strategic Planning** entails making choices for long-term success based on data insights. Best example is again Google, which leverages data analytics to understand consumer behaviour and industry trends. By using data to make strategic choices, the business is able to maintain an advantage in the rapidly changing fields of online services and technology (Kaur and Gill, 2019).

Implications

Big data and information systems stay a prominent part of business strategy agenda which asserts weighty policy implications in such areas as data control, privacy, and security. More and more organizations today leverage big data to come up with important decisions; therefore, dependable policies for data ethics are vital. Authorities and legislatures must set rules that put into consideration the utilization of big data and information systems while protecting the rights of citizens into avoiding exploitation by businesses that may have unlawful intentions.

In fact, the integration of big data and information systems is beneficial to businesses in several ways, such as better decision making, productivity, and capacity to build customer relationship. However, in order to fully integrate these technologies into practice, significant resources need to be invested in structure, trained professionals, state of the art analytical instruments etc. There are also other issues that companies have to face, including data quality issues, integration, and emphasis on the requirement for constant new developments due to the competitiveness of the environment. If these practical issues are well managed, then, big data and information systems can indeed be used as competitive weapons in businesses.

From the perspective of big data and information systems, this disrupts the existing business archetypes and decision-making premises. The tremendous growth of information that is produced today demands the development of new models to explain how information can enhance or hinder the activities of an organization. Theoretical models for the analysis of big data will have to change and develop in the context of the continuous action of new information systems. This evolution will not only add further insights to the understanding of the realistic possibilities of business attaining competitive advantage, but it will also be useful for furthering the depth of future research and development in the sphere of data-oriented decision making.

Conclusion

Thus, big data and information analysis are possibly considered an influential key

player in stimulating organizational advancement and enabling better operations and decisions. Thus, the tools reveal hidden patterns and, therefore, help elevate effectiveness, grow profits, and improve the clients' experience. The field of information systems is divided into numerous areas, which forms important subsystems in the organizational structure when providing the manager with the requisite information for fast and well-considered decisions. The compliance of data accuracy, integration, analysis, and planning improves efficiency as well as enhances competitive aspects that help organizations to be competitive in the markets. By the same token, the selective application of information systems orients today's organizations to make correct choices, to operate efficiently and to sustain competitive advantage.

References

Amazon (n.d.). *AMS customer relationship management (CRM) - AMS Advanced User Guide*. [online] Available at: https://docs.aws.amazon.com/managedservices/latest/userguide/apx-crm.html

Ardito, L., Cerchione, R., Mazzola, E., & Raguseo, E. (2020). Industry 4.0 transition: a systematic literature review combining the absorptive capacity theory and the data–information–knowledge hierarchy. *Journal of Knowledge Management*, *26*(9), 2222-2254.

Barclays (2019). *Barclays Corporate strategy | Barclays*. [online] Home.barclays. Available at: https://home.barclays/who-we-are/our-strategy/

Behera, R.K., Gunasekaran, A., Gupta, S., Kamboj, S. and Bala, P.K. (2020). Personalized Digital Marketing Recommender Engine. *Journal of Retailing and Consumer Services*, [online] 53, p.101799 doi:https://doi.org/10.1016/j.jretconser.2019.03.026

Benbya, H., Nan, N., Tanriverdi, H., & Yoo, Y. (2020). Complexity and information systems research in the emerging digital world. *MIS quarterly*, *44*(1), 1-17.

Bocij, P., Greasley, A. and Hickie, S. (2018). *Business Information Systems technology, Development and Management for the Modern Business*. Harlow, England Pearson

Caslin, D. (2021). *Big Data Management Revolution*. Independently Published

Chen, W.-J., Bhavani Eshwar, Ramya Rajendiran, Srinivas, S., Subramanian, M.B., Bharathi Venkatasubramanian and IBM Redbooks (2014). *Master Data Management for SaaS Applications*. IBM Redbooks

Choi, T. M., Kumar, S., Yue, X., & Chan, H. L. (2020). Disruptive technologies and operations management in the Industry 4.0 era and beyond. *Production and Operations Management*, *31*(1), 9-31.

DHL. (2020). *Technology | DHL Supply Chain |*. [online] Available at: https://www.dhl.com/global-en/home/our-divisions/supply-chain/sectors-overview/technology.html

Dhyana, B. and Gupta, O. (2020) "Evaluating the management model of information systems and its applicability in enhancing business operations in Tesco", *Central European Management Journal*, 30(3), pp. 353–357. doi: 10.57030/23364890.cemj.30.3.166.336

Eklund, O. (2020). Custom Thumbnails: The Changing Face of Personalisation Strategies on Netflix. *Convergence: The International Journal of Research into New Media Technologies*, 28(3), 737-760. doi:https://doi.org/10.1177/135485652110645 20

Giannakis, M.,Spanaki, K. and Dubey, R. (2019) A cloud based supply chain management system: effects on supply chain responsiveness. *Journal of Enterprise Information Management*, 32 (4), pp.585-607

Gupta A.K (2011). *Management Information System*. S. Chand Publishing

Ivanov, D., Tang, C. S., Dolgui, A., Battini, D., & Das, A. (2021). Researchers' perspectives on Industry 4.0: multi-disciplinary analysis and opportunities for operations management. *International Journal of Production Research*, *59*(7), 2055-2078.

Jean Paul, I. and Zikopoulos, P. (2018). *Unstructured data analytics : how to improve customer acquisition, customer retention, and fraud detection and prevention*. Hoboken: John Wiley & Sons, Cop

Joseph, J., & Gaba, V. (2020). Organizational structure, information processing, and decision-making: A retrospective and road map for research. *Academy of Management Annals*, *14*(1), 267-302.

Kaur, D.J. and Gill, N.S. (2019). *Artificial Intelligence and Deep Learning for Decision Makers: A Growth Hacker's Guide to Cutting Edge Technologies*. [online] *Google Books*. BPB Publications. Available at: https://books.google.co.uk/books?hl=ro&lr=&id=GyTHDwAAQBAJ&oi=fnd&pg=PT19&dq=info:Aq_2f2j0TuUJ:scholar.google.com/&ots=owsLV-kmAq&sig=9BKuW-G012WvBg03lC8kqwZ3IH4&redir_esc=y#v=onepage&q&f=false [Accessed 21 Nov. 2021]

Marr, B. (2018). *The Amazing Ways Tesla Is Using Artificial Intelligence And Big Data*. [online] Forbes. Available at: https://www.forbes.com/sites/bernardmarr/2018/01/08/the-amazing-ways-tesla-is-using-artificial-intelligence-and-big-data/amp/

Marr, B. (2019). *Big data in practice : how 45 successful companies used big data analytics to deliver*

extraordinary results. Chichester: J. Wiley

Meta (2021). *Meta*. [online] Available at: https://www.meta.com/facebook [Accessed 16 Nov. 2021]

NHS ENGLAND (n.d.). *NHS England» Protecting and safely using data in the new NHS England*. [online] Available at: https://www.england.nhs.uk/about/protecting-and-safely-using-data-in-the-new-nhs-england/

Nisar, Q. A., Nasir, N., Jamshed, S., Naz, S., Ali, M., & Ali, S. (2021). Big data management and environmental performance: role of big data decision-making capabilities and decision-making quality. *Journal of Enterprise Information Management*, *34*(4), 1061-1096.

Niu, Y., Ying, L., Yang, J., Bao, M., & Sivaparthipan, C. B. (2021). Organizational business intelligence and decision making using big data analytics. *Information Processing & Management*, *58*(6), 102725.

Peelen, E. and Beltman, R. (2013). *Customer relationship management*. Harlow: Pearson Education. Copyright

Pelphrey, M.W. (2015). *Directing the ERP Implementation*. CRC Press

Reddy, C.K. and Aggarwal, C.C. (2015). *Healthcare Data Analytics*. CRC Press

Richardson, S. (2017). *Big Data Diaries*. Createspace Independent Publishing Platform

ROLLS-ROYCE (n.d.). *Digital FIRST*. [online] Available at: https://www.rolls-royce.com/products-and-services/defence/digital-innovation.aspx

Saeed, N. and Husamaldin, L. (2021). Big Data Characteristics (V's) in Industry. *Iraqi Journal of Industrial Research*, 8(1), pp.1–9. doi:https://doi.org/10.53523/ijoirvol8i1id52

Samitsch, C. (2015). *Data Quality and its Impacts on Decision-Making*. [online] Wiesbaden: Springer Fachmedien Wiesbaden. doi:https://doi.org/10.1007/978-3-658-08200-0

SAP. (n.d.). *Human Capital Management (HCM) | Cloud HR Software Systems*. [online] Available at: https://www.sap.com/uk/products/hcm.html

Sedkaoui, S. (2018). *Data analytics and big data*. London: Iste Ltd / John Wiley & Sons, Inc

Sunder, G. (2015). *Fraud and fraud detection : a data analytics approach*. [online] Hoboken, New Jersey: Wiley. Available at: https://www.wiley.com/en-ca/Fraud+and+Fraud+Detection%3A+A+Data+Analytics+Approach%2C+%2B+Website-p-9781118779651 [Accessed 18 Nov. 2021]

Tseng, M. L., Tran, T. P. T., Ha, H. M., Bui, T. D., & Lim, M. K. (2021). Sustainable industrial and operation engineering trends and challenges Toward Industry 4.0: A data driven analysis. *Journal of Industrial and Production Engineering*, *38*(8), 581-598.

Walmart, S. (n.d.). *5 Ways Walmart Uses Big Data to Help Customers*. [online] corporate.walmart.com. Available at: https://corporate.walmart.com/news/2017/08/07/5-ways-walmart-uses-big-data-to-help-customers

Yılmaz, Y. and Ozcan, G. (2011). Implementing ERP-systems with accelerated ERP more efficient and quickly – a best practice. *Journal of Systems Integration*, 2, pp.28–37. doi:https://doi.org/10.20470/jsi.v2i3.97

Yoshikuni, A. C., & Dwivedi, R. (2021). The role of enterprise information systems strategies enabled strategy-making on organizational innovativeness: a resource orchestration perspective. *Journal of Enterprise Information Management*, *36*(1), 172-196.

Zhang, H., Zang, Z., Zhu, H., Uddin, M. I., & Amin, M. A. (2020). Big data-assisted social media analytics for business model for business decision making system competitive analysis. *Information Processing & Management*, *59*(1), 102762.