Proceedings of the 6th European Conference on Industrial Engineering and Operations Management
Lisbon, Portugal, July 18-20, 2023

Big Data Analytics for Financial Decision-Making by Small- and Medium-Scale Enterprises in South Africa

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Abstract

The world is rapidly and increasingly becoming digital, with over 90% of the data that exists worldwide created since 2010. This process was exacerbated by the COVID-19 pandemic, which saw people being housebound and forced to engage online and, in this way, increased e-commerce. This led to the massive amounts of data that are being added daily. Governments, institutions and big companies mine, refine, store and analyse data, which they use for decision-making and as the basis for innovation and increased profitability. Unfortunately, many small- and medium-scale enterprises (SMEs) are unable to take advantage of the big data that is available to them. SMEs play a pivotal role in growing the economy of developing and emerging markets. In South Africa, over 98% of businesses fall under the category of SMEs; they account for over 45% of the country's gross domestic product; and they employ over 60% of the total labour force. SMEs face several challenges that hinder them from appreciating and using big data analytics. These include a lack of data-science skills and insufficient finances for purchasing the necessary infrastructure and employing appropriately skilled personnel for conducting data analytics. The purpose of this study was to develop a road map for SMEs to follow in adopting and implementing big data analytics. The study adopted a sequential mixed method and a pragmatic philosophical stance. The study began by conducting a bibliometric analysis to understand the challenges faced by SMEs concerning big data analytics and to understand what had been studied thus far, by whom and where. A total of 494 articles, books and documents were sourced from the Scopus database for the years 2005 to 2022. VOSviewer and Python were used as tools to mine and analyse the data. The presentation of the data led to the identification of the Power BI tool as potentially useful, based on two studies that recommended the use of this tool by SMEs for big data analysis. Power BI was adopted and used to create a dashboard for analysis. Experiments were conducted on data obtained from a small-scale poultry producer that was selected using convenience sampling. Ten people were used to confirm the usability of the artefact (dashboard) in interviews, after they had been trained on how to use the tool. The interviews were analysed using ATLAS.ti and the results of the different data-analysis methods were triangulated. This study followed the Technological Organisational Environmental (TOE) theory framework as the base for adopting and implementing big data analytics using the Power BI tool. The tool was found to be working and user-friendly to SMEs and to respond to the problems faced by SMEs such as the lack of skills and finances as it is freely available. This study recommends that a collaboration be formed between government departments that support SMEs and institutions of higher learning to work together to help SMEs. SMEs need to be

taught about legal factors concerning data management, for example. Future research will focus on the environmental factors concerning big data analytics from the context of SMEs.

Keywords
SMEs, Big Data Analytics, TOE Framework, Innovation, Decision-Making

Biographies
Lawrance Seseni is an Entrepreneurship lecturer who teaches undergraduates and supervises honours and master's students at the University of Johannesburg. As part of his work in disadvantaged communities, he has initiated several developmental projects, such as conducting career exhibitions in those communities. He currently serves as the Primary Faculty Advisor of the Enactus University of Johannesburg, an international student organisation dedicated to solving societal problems through social entrepreneurship. In addition, he launched the Business Clinic at the University, as he believes that teaching students to take part in community service projects will create citizens of value. This initiative aims to help struggling SMEs in and around Johannesburg. Furthermore, he is the editor of the Department's newsletter and a houseparent in a mixed residence on campus. Among his commitments, he is the lab manager for the European Union's and Erasmus+'s Common Good First Digital Storytelling project. Participants in the Digital Storytelling Project are universities from Iceland, Norway, Denmark, Scotland, Spain and South Africa. A major goal of this project is to showcase community-generated innovative content. As a researcher, he has had a number of his articles published in international conference procedures that are indexed by Scopus. His recent experience includes serving as a Session Chair at international conferences, reviewing conference papers, and serving as a Track Chair as well as presenting as a distinguished speaker at conferences. A Golden Key member, Lawrance Seseni is in the process of achieving his PhD in Operations Management.

Professor Charles Mbohwa is the former Pro-Vice Chancellor of the University of Zimbabwe. As an established researcher and professor in the field of sustainability engineering and energy, his specialisations include sustainable engineering, energy systems, life cycle assessment, and bioenergy/fuel feasibility and sustainability. He has general research interests in renewable energies and sustainability issues. Professor Mbohwa has presented at numerous conferences and published more than 150 papers in peer-reviewed journals and conferences, six book chapters and one book. Upon graduating with a BSc Honours in Mechanical Engineering from the University of Zimbabwe in 1986, he was employed as a mechanical engineer by the National Railways of Zimbabwe. He holds a Master's degree in Operations Management and Manufacturing Systems from the University of Nottingham and completed his doctoral studies at the Tokyo Metropolitan Institute of Technology in Japan. Prof. Mbohwa was a Fulbright Scholar visiting the Supply Chain and Logistics Institute at the School of Industrial and Systems Engineering, Georgia Institute of Technology. He is a fellow of the Zimbabwean Institution of Engineers and is a registered mechanical engineer with the Engineering Council of Zimbabwe. He has been a contributor to the United Nations Environment Programme and Visiting Exchange Professor at Universidade Tecnológica Federal do Paraná. He has also visited many countries on research and training engagements, including the United Kingdom, Japan, Germany, France, the United States of America, Brazil, Sweden, Ghana, Nigeria, Kenya, Tanzania, Malawi, Mauritius, Austria, the Netherlands, Uganda, Namibia and Australia.

Dr Nelson Sizwe Madonsela is a business intelligence analyst, senior lecturer and acting head of the Department of Quality and Operations Management at the University of Johannesburg (UJ). He holds a doctoral degree in Engineering Management from UJ, where he also obtained his Master of Technology degree in Operations Management. He received a Bachelor of Technology degree in Quality from the University of South Africa (UNISA) and a National Diploma in Information Technology (Software Development) from Tshwane University of Technology (TUT). His research focuses on business artificial intelligence and operations management, concentrating on operational excellence. He also looks at areas such as quality management systems, digital transformation and project management. He has presented at local and international conferences and authored book chapters. Dr Madonsela has helped provide high-level strategic and technical guidance in quality management and advanced project management to upskill the workforce among industries within South Africa. Additionally, he serves as a national advisor on curriculum development, teaching and learning methods, and best practices in quality and operations management for several South African universities.