Proceedings of the First Australian International Conference on Industrial Engineering and Operations Management, Sydney, Australia, December 20-21, 2022

Implementation of Advanced Technologies: A Meta-synthesis of the Manufacturing Industry

Save Akilimalissiga
Department of Quality and Operations Management
University of Johannesburg
Johannesburg, South Africa
savea@uj.ac.za

Nita Sukdeo
Department of Quality and Operations Management
University of Johannesburg
Johannesburg, South Africa
nsukdeo@uj.ac.za

Sambil Mukwakungu
Department of Quality and Operations Management
University of Johannesburg
Johannesburg, South Africa
sambilm@uj.ac.za

Abstract

Advanced Manufacturing Technology (AMT) encircles the deployment of innovative technologically-based practices to improve processes and products across various manufacturing industries. Advanced manufacturing technology covers process technologies that are used to produce cutting-edge technologies and process technologies associated with computer-integrated manufacturing, robotics and automation technology. Organisations that adopt AMT are characterised by the pace at which the deployment of innovative technologically-based practices is selected and implemented in order to improve the organisations' activities and end-products. Hence, some organisations are still struggling to implement AMT practices for improvement. Therefore, the following question needs to be researched: How well is the workforce equipped to embrace the implementation of AMT, and what are the critical factors and benefits of AMT? To answer this question, a conceptual framework was developed to mainly consider manufacturing organisations concerned with deploying the AMT in some of their activities, hoping to significantly improve processes and products, ultimately enhancing customer satisfaction.

Keywords

Advanced Manufacturing Technologies (AMTs), Computer-Aided Design, Critical Factor, Computer Integrated Manufacturing, Flexible Manufacturing Systems.

1. Introduction

The 21st century has seen the birth of various innovative technologies in multiple industries worldwide. Advanced manufacturing technology is one of them, and it concerns using innovative, creative and cutting edge technologically-based practices to improve the quality of products and processes in any given organisation (Brocal et al. 2018). These practices are becoming the norm today as they give an edge to organisations to influence competition. Any manufacturing organisation committed to bringing innovative change, improving the quality of its activities, and remaining competitive in the global market has no option but to embrace the practices of advanced manufacturing technology (Qian et al. 2017).

Advanced manufacturing depends on the latest revolutionised technology practices that warrant agility, flexibility, as well as the propensity to configure. For instance, semiconductors, biomanufacturing, advanced materials,

nanomanufacturing and additive manufacturing rely all on technology-based practices to improve the results or outcomes of their processes. Hence, advanced manufacturing technologies can become an impacting game-changer not only on manufacturing models but on concepts, approaches and businesses as a whole (Esmaeilian et al. 2016; Zhong et al. 2017). Several organisations have therefore embarked on this emerging technology-driven journey. However, not all have seamless experiences due to various reasons. This paper is going to look into the critical factors and evaluate them in order to come up with a roadmap for the implementation of advanced manufacturing technology.

1.1 Problem statement

Organisations adopt advanced manufacturing technologically based practices to produce products that are of high quality and to ensure continuous improvement in processes in order to have leverage on the competition. Hence, to fully adopt the AMT, organisations have to bear the costs that come along with its implementation (Percival et al. 2013; Demeter and Szász 2016). The use of technologies such as Computer Integrated Manufacturing, computer-aided design (CAD), Flexible Manufacturing (FM), Computer Numerical Control (CNC), etc. in the manufacturing activities requires some level of expertise in order to smooth business operations (Percival et al. 2013), mainly, most of these tools operate on cutting edge-improved versions. Various business entities are still lagging in terms of providing employees with appropriate training so they can master the new technologies. Hence, software and hardware not under employees' control represent a great danger for organisations to improve processes and provide high-quality products to customers.

1.2 Aims of the study

The aim of this paper is to cross-synthesise the manner in which manufacturing organisations need to emphasise the importance of critical factors to adopt AMT in order to reap the full benefits or advantages that come along. Also, to acknowledge the need for training progammes in implementing AMT to improve employees' performance, thus quality products/services.

1.3 Objectives

The study was developed based on the following objectives:

- To examine the extent to which manufacturing organisations focus on training prgrammes for optimal use of AMTs.
- To review the impact of the AMT training programmes on the employees' performance and consequently on the quality of products manufactured.
- To synthesise the literature review on the critical factors driving AMT's successful deployment and evaluate the potential benefits.

1.4 Scope of the study

This research paper investigates the effects of using advanced technologies to improve not only product quality but also prominent manufacturing organizations' operations. Various organisations use advanced technologies to optimise their employees' work while increasing the average production. This study focuses on the aspects that allow organisations to use AMT to become competitive and resilient in the world market. Since continuous improvement is immensely important to assure long-term results, given the outcome of the study, final remarks need to be provided to underline the elements that should be capable of contributing to enhanced quality and continuous improvement.

2. Literature review

One of the core aspects of advanced manufacturing technology is to leverage the development of new products, markets, new technologies and new techniques to manufacture existing or new products (Sodeyfi, 2016; Yakovlev et al. 2019).

Hence, Manufacturing organisations are acquiring innovative skills to master the implementation of AMT in order to remain competitive in the global market. These technologies, if well implemented, improve the efficiency of the operations of organisations. The implementation of these technologies may be time-consuming and costly for various organisations to produce on a large scale. However, if the implementation is to be inappropriate, including lack of skills, negligence and lack of innovative personnel, the danger would not be far off.

2.1 Conceptual research framework

A conceptual framework was therefore developed to describe the relationship between the variables that drive the adoption of advanced manufacturing technologies in the manufacturing industry globally. The framework relates the integrating importance of AMTs, the critical factors, training programmes and the resulting overall uptakes.

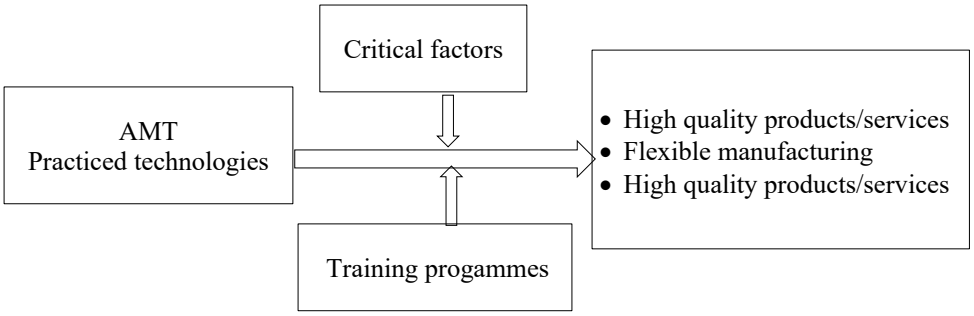

Figure 1. Conceptual framework

2.2 Advanced manufacturing technology (AMT) and quality improvement

A few decades ago, organisations relied on manual or labor-intensive operations to produce goods and services. However, as time passed, organisations started being creative and innovative to improve operations and speed up production processes, especially in manufacturing organisations (Hu et al. 2017). AMT is one of the technologically based practices in which organisations have provided more attention to drastically bring change in the operating systems. AMT philosophy is characterised by being computerised, automated and flexible, and can count, print and stick barcodes on products. Advanced manufacturing technology enables employees to use automated retrieval and storage machines to speed up the execution of activities. As organisations focus on these technology practices, providing improved quality products and providing business operations are becoming the absolute norm (Ghobakhloo and Azar 2018).

Organisations have been influenced by global competition, trade liberalisation, technological innovation, market fragmentation, and ultra-modern customers' demands. To respond to these pressures, organisations, especially manufacturing organisations, strive to incorporate more technology-based practices and flexibility across different production processes. These characteristics are now becoming a trademark for excellent corporations worldwide. Advanced Manufacturing technology is par excellence the facilitator for organisations having the desire to achieve world-class performance, objectives and targets (Kumar and Gurtu 2021).

Previous studies have demonstrated and concluded that advanced manufacturing technology has prompted one of the core value-added concepts that yield high performance in manufacturing organisations that are implementing AMT (Goetsch and Davis 2014). That is why this paper is concerned with investigating the potential work-class performance that can be facilitated by the use of the performance-driven practices making up the advanced manufacturing technology. The table below highlights the types of technologies enabling AMT.

Table 1. Advanced manufacturing technology practices

Typical function	Practiced technology
Assembly, Processing, and Fabrication	Flexible manufacturing systems (FMS). Lasers used in materials processing. Computer numerically controlled (CNC). Robots with or without sensing capacities. Rapid Prototyping systems. High precision and velocity machining.
Automation of Material Handling	Automated Guided Vehicle System (AGVS). Identification of parts for automated manufacturing (part barcoding). Automated storage and retrieval system (ASRS).

Engineering and designing	Technologies used for simulation or modeling. Computer-Aided Design known as CAD. Computer-Aided Manufacturing (CAM)– an extension of CAD. Digital/Electronic handling of CAD-related files. Electronic portray of output generated by CAD.
Communications and coordinated inspections	Testing or inspection of final products/outputs based on the automated visual systems. Outputs/final products are automatedly tested and inspected using other sensor-based systems .
Integration and Control	Integration of functional systems using Computer-Integrated Manufacturing (CIM). Use of expert systems or Artificial Intelligence (AI). Supervisory Control & Data Acquisition (SCADA).

Source: Adapted from Gunawardana (2010).

Some of the practiced technologies may not be original to the recent era. However, AMT uses them as the baseline to incorporate revolutionised features of the 21st century, such as the use of 3D printing machines to improve Computer-aided manufacturing (CAM) or Computer-aided design (CAD) (Shahrubudin et al. 2019). These types of innovation happen across the existing technologies to basically conform to the emerging 'industry 4.0'. Hence, the use of automated manufacturing systems potentially permits organisations to integrate and automate processes, which results, in some cases, in smart manufacturing systems (Zhong et al. 2017). For example, among the practiced technologies highlighted in Table1, automated guided vehicles (AGV) have the capacity and capability of autonomously identifying parts during production processes (Hrušecká et al. 2019).

Moreover, the connection between the functional types of AMT, the possession structure, and the organisation size brings about performance in the manner in which an organisation executes its activities. For instance, a manufacturer of vehicle engines makes use of the practiced technologies mentioned in table 1 to produce world-class engines, which can improve the company's reputation over its competitors and bring along financial benefits (Cheng et al. 2018). Based on research undertaken by Kumar and Gurtu (2021), the implementation of AMTs by organisations is capable of yielding leverage in the manufacturing systems in terms of quality improvement. Hence, that study revealed that an "Increase in the quality of the product(s)" was ranked first as a motivating factor, which most encourages organisations to adopt the implementation of advanced manufacturing technology.

2.3 Critical factors for the implementation of AMT

AMT is considered as a concept for organisational differentiation. It leads to customer satisfaction and inspires confidence in the eyes of customers. Hence, executive management or top management is seen as one of the critical factors because they have a huge responsibility to commit to the well-guided implementation of AMT (Sukathong et al. 2021; Kumar et al. 2018). Executive management's commitment to the implementation of AMT is considered to be critical because the implementation takes part at various and different levels of any given organisation. Therefore, sound planning and careful financial context are indispensable. There are various aspects related to the implementation of AMT, such as organizational culture, competitive advantage, supplier or distributor development, integration of departments, and, most importantly, training provided to the workforce. Employee training is considered to be critical because it allows employees to get upskilled to effectively and efficiently make use of the new technologies in order to improve the organisation's operating system driven by advanced technologically-based practices (Sukathong et al. 2021). Additionally, from a study conducted by (Kumar and Gurtu 2021), "Top management commitment" and training of employees were amongst the highest-ranked factors when it comes to the successful implementation of AMTs.

In the current era where the world is on the brink of the artificial intelligence dominance, AMT is considered to be a crucial asset for organisations. The advanced manufacturing technologies can drastically change an organisation's landscape and culture, especially with the use of lean and agile manufacturing, which leads to lean organisations (Ghobakhloo and Azar 2018). The implementation of AMT has a significant impact on the organisation culture. This is made possible by combining organizational structure and human behaviour to potentially increase overall productivity.

Advanced manufacturing technology has the capability and potential to interpret information from tactical and strategical levels more explicitly and accurately, not only to understand but to create integrations across different organisational functions. It lessens the unnecessary collaborative work in order to provide communication across time and space (Ghobakhloo and Hong 2014). Having rich information and communication flow helps organizations produce innovative products and services and enhance customer experience. The AMT allows employees to share ideas and execute certain activities remotely from various locations of the organisation. This has the potential to permit employees to get timely feedback for continual improvement at different stages. For instance, computer-aided design (CAD) helps engineers visualize the design of a project structure from different locations and timely inputs are provided. This involves collaborating with cross-functional teams to have adequate project visibility (Ghobakhloo and Azar 2018).

An organisational structure is dependent on an organisation's philosophy and mission. Therefore, different organisations have different structural forms, which come along with different investment costs. It has been demonstrated that the most advisable organisation structure is one with less complexity and a decentralised system. This structure can bring about improvement in production processes and facilitate the implementation of advanced technologically-based practices (Saberi and Yusuff 2011; Fatorachian and Kazemi 2018).

Employees' participation is also essential for any given manufacturing organisations. And when it is combined with training and advanced manufacturing technologies, organisations become capable of achieving world-class performance levels and targets. Lack of or limited knowledge about the implementation of the latest technologically-based practices among employees leaves an important negative impact. That is the reason the training and participation of employees to master the latest AMTs is considered to be a major and critical factor (Sukathong et al. 2021).

2.4 AMT Training and employee performance.

When examining training aspects put forward by various scholars such as Marri et al. (2007) and Kumar et al. (2018), concerning the implementation of advanced manufacturing technologies framework, it is clear that employee skills, the active presence of an in-house training facility, including access to an external facility, are put forward as the areas that need to be addressed to assist in the implementation of AMT. As long as manufacturers continue to move towards creating automated systems to produce high-quality products and services, the workforce performance has also to be re-assessed to keep up with what is commonly known as the emerging 'Industry 4.0'. Therefore, carrying out effective education and training of the relevant workforce on the new AMT can improve the receptiveness of workers to it. Training requirements depend on the type of AMTs being introduced and the skills level prevalent in the organisations. The critical advantage and value of the training /skill development are that they act as a domino effect. This means top management feels competent and has the potential to significantly impact employee performance. Engaged, committed and upskilled employees lead to high job satisfaction and retention while enabling organisation benefits due also to high-quality products (Guan and Frenkel 2018). Similarly, The Advanced manufacturing technology process requires linking and recognising advanced knowledge, which in turn requires the internal advancement of human capabilities and knowledge. Advanced manufacturing technology practices, through training programmes, are appraised to positively impact the performance of the employees and the performance of the organisation as a whole (Dauda 2009).

2.5 Benefits from the implementation of AMTs

The implementation of advanced manufacturing technologies in an organisation improves its production system by making it more agile and reliable and similarly lowers the waste of production, which decreases the rate of non-conforming products. AMT has the capability to position organisations where they can access the latest information through strategic and linked market research (Niaki et al. 2019). This is advantageous because organisations enter new markets much faster than their competitors and can have a consistent stance on the changes related to customers' requirements or preferences (Lu and Ramamurthy 2011). In this case, there is a great reduction in the manufacturing lead time also due to manufacturing flexibility and quick response to changes in customers' preferences.

Advanced manufacturing technology is well-known for integrating various organisational functions to optimize the product development process time. AMT generates a range of benefits that can be both tangible and intangible. Similarly, it helps an organisation reduce costs related to the process of manufacturing products, including the cost of managing the entire supply chain of an organisation–consequently, procurement and delivery lead times are subject to be reduced (Azemi et al. 2019).

According to the results of joint research undertaken by (Kumar and Gurtu 2021), the highest-ranked benefit generated by the adoption of advanced manufacturing technology is "Manufacturing flexibility", which means, in an undetermined business situation or condition, organisations need to develop and rely on flexible manufacturing processes in order to become resilient and sustainable. This allows manufacturing organisations to consistently improve performance and attract new opportunities from the business market.

Moreover, among the most significant benefits of ATMs is their integration. The ability for computers to electronically and digitally connect to different workstations and machines within a manufacturing organisation is critical when it comes to implementing AMTs. A single integrated system is set up to control and monitor an organization's operations, from the processing of raw materials to when the finished goods are ready for delivery to the customers (Boyer 1994). The integration of AMTs can concern electronically integrating transactions, functions, or processes from various departments within the same organisation, for example, between marketing, production/manufacturing (Through CNC) and product design (like CAD) (Jonsson 2000; Diaz et al. 2003).

3. Final remarks

In this era, organisations use technologically-based innovations to compete in the global market. Organisations leverage the advantages and benefits that come with adopting advanced manufacturing technologies to improve their operating systems and manufacturing processes and ultimately improve products and services to constantly attract current and new customers. It's important to highlight that for the implementation of advanced manufacturing technologies to be regarded as a success, organisations have to make sure employees are provided with appropriate training programmes so they can master the use of AMT practices. Because the practices of AMT are becoming incredibly complex, therefore, well-elaborated training programmes have to be put in place in order to improve employee performance so they can effectively contribute to the production of high-quality products. The knowledge of the critical factors such as top management commitment, organisational structure, integration of processes and employee participation are essential for a successful implementation of AMTs. Lack of expertise or skills regarding the use of the practiced technologies mentioned in table 1 has the potential to turn an organisation into a cost-generating entity which can lead to bankruptcy. Hence, organisations have to take appropriate standing, including evaluating financial conditions to reap the full benefits that come along with the implementation of the advanced technologies.

References

Azemi, F., Šimunović, G., Lujić, R., Tokody, D. and Rajnai, Z., The Use of Advanced Manufacturing Technology to Reduce Product Cost, *Journal of Acta Polytechnica Hungarica*, vol. 16 no. 7, pp. 115-131, 2019.

Boyer, K.K., Patterns of advanced manufacturing technology implementation: Technology and infrastructure. Ph.D. *Thesis*, The Ohio State University, p: 262, 1994.

Brocal, F., Sebastián, M. A. and González, C., Chapter 2 - Advanced Manufacturing Processes and Technologies," *Management of Emerging Public Health Issues and Risks*, Academic Press, pp. 31-64, 2018.

Cheng, Y., Matthiesen, R., Farooq, S., Johansen, J., Hu, H. and Ma, L. The evolution of investment patterns on advanced manufacturing technology (AMT) in manufacturing operations: A longitudinal analysis, *International Journal of Production Economics*, vol. 203 no. 1, pp.239-253, 2018.

Demeter, K. and Szász, L., The diversity of European manufacturing plant roles in international manufacturing networks, *Journal of East European Management Studies*, Vol. 21 no. 2, pp.184-208, 2016, https://www.jstor.org/stable/44112762.

Dıaz, M.S., Machucaa, J.A.D. and Alvarez-Gil, M.I.J., A view of developing patterns of investment in AMT through empirical taxonomies: New evidence. *J. Operat. Manage*., 21, 577-606, 2003.

Esmaeilian, B., Behdad, S. and Wang, B., The evolution and future of manufacturing: a review, *Journal of Manufacturing Systems*, Vol. 39, 2016, pp. 79-100, 2016, https://doi.org/10.1016/j.jmsy.2016.03.001.

Fatorachian, H. and Kazemi, H.A., Critical investigation of Industry 4.0 in manufacturing: theoretical operationalisation framework, *Journal of Production Planning & Control*, vol. 29 no. 8, pp.633-644, 2018, https://doi.org/10.1080/09537287.2018.1424960.

Ghobakhloo, M. and Azar, A., Business excellence via advanced manufacturing technology and lean-agile manufacturing, *Journal of Manufacturing Technology Management*, vol. 29, no. 1, pp. 2-24, 2018, DOI: 10.1108/JMTM-03-2017-0049.

Ghobakhloo, M. and Hong, T.S. IT investments and business performance improvement: the mediating role of lean manufacturing implementation, *International Journal of Production Research*, vol. 52 no. 18, pp. 5367-5384, 2014, DOI: 10.1080/00207543.2014.906761.

Goetsch, D.L. and Davis, S.B., Quality management for organizational excellence, *Upper Saddle River*, NJ: Pearson, 2014.

Gunawardana, K.D., Introduction of Advanced Manufacturing Technology: a literature review, *Sabaragamuwa University Journal*, vol. 6 no. 1, pp. 116-134, 2010.

Guan, H. and Frenkel, S., How perceptions of training impact employee performance: Evidence from two Chinese manufacturing firms, *Personnel Review*, Vol. 48 no. 1, pp.163-183, 2018, DOI - 10.1108/PR-05-2017-0141.

Hrušecká, D., Lopes, R. and Juřičková, E. Challenges in the introduction of AGVs in production lines: Case Studies In The Automotive Industry, *Serbian Journal of Management*, Vol. 4 no. 1, pp. 233-247, 2019, DOI - 10.5937/sjm14-18064.

Hu, P., Ying, L. and He, B., Hot stamping advanced manufacturing technology of lightweight car body, *Springer Singapore*, 2017.

Jonsson, P., An empirical taxonomy of advanced manufacturing technology. Int. J. Operat. Prod. Manage., 20: 1446-1474, 2000.

Kumar, R. and Gurtu, S.A, Embracing advanced manufacturing technologies for performance improvement: an empirical study, Benchmarking: An International Journal, 2021.

Kumar, R., Singh, H. and R. Chandel, Exploring the key success factors of advanced manufacturing technology implementation in Indian manufacturing industry, *Journal of Manufacturing Technology Management*, vol. 29 no. 1, pp. 25-40, 2018, https://doi.org/10.1108/JMTM-03-2017-0057.

Lu, Y. and Ramamurthy, K., Understanding the link between information technology capability and organizational agility: an empirical examination, *MIS Quarterly*, vol. 35 no. 4, pp. 931-954, 2011, DOI: 10.2307/41409967.

Marri, H.B., Gunasekaran, A. and Sohag, R.A. Implementation of advanced manufacturing technology in Pakistani small and medium enterprises: an empirical analysis, *Journal of Enterprise Information Management*, Vol. 20 no. 6, pp. 726-739, 2007, https://doi.org/10.1108/17410390710830745.

Niaki, M.K., Torabi, S.A. and Nonino, F., Why manufacturers adopt additive manufacturing technologies: The role of sustainability, *Journal of cleaner production*, vol. 222 no. 6, pp.381-392, 2019, https://doi.org/10.1016/j.jclepro.2019.03.019.

Percival, J.C., Cozzarin, B.P. and Formaneck, S.D., Return on investment for workplace training: The Canadian experience, *International Journal of Training and Development*, Vol. 17 no. 1, pp.20-32, 2013, http://dx.doi.org/10.1111/ijtd.12002.

Qian, F., Zhong, W. and Du, W., Fundamental theories and key technologies for smart and optimal manufacturing in the process industry, *Engineering*, Vol. 3 no. 2, pp.154-160, 2017, https://doi.org/10.1016/J.ENG.2017.02.011.

Saberi, S. and Yusuff, R.M., Advanced manufacturing technology implementation performance: towards a strategic framework, *Proceedings of the 2011 International Conference on Industrial Engineering and Operations Management*, Kuala Lumpur, Malaysia, January, 22-24, pp. 145-150, 2011, http://ieomsociety.org/ieom2011/pdfs/IEOM021.pdf

Shahrubudin, N., Te Chuan, L. and Ramlan, R., An Overview on 3D Printing Technology: Technological, Materials, and Applications, *Procedia Manufacturing*, Vol. 35, pp. 1286-1296, 2019, DOI - 10.1016/j.promfg.2019.06.089.

Sodeyfi, S., Review of literature on the nexus of financial leverage, product quality & business conditions, *Journal of Economic & Management Perspectives*, vol. 10, no. 2, pp.146-150, 2016, https://www.proquest.com/scholarly-journals/review-literature-on-nexus-financial-leverage/docview/1964460477/se-2?accountid=13425.

Sukathong, S., Suksawang, P. and Thanakron, N. T., Analyzing the importance of critical success factors for the adoption of advanced manufacturing technologies, *International Journal of Engineering Business Management*, vol. 13 no. 3, pp. 1-16, 2021, DOI: 10.1177/18479790211055057

Yakovlev, A., Chernikova, A., Livintsova, M. and Lebedeva, T. Improving the quality management system of goods and services based on the Blockchain concept implementation and quality assessment in the digital economy, *In E3S Web of Conferences*, 135, EDP Sciences, 2019, http://dx.doi.org/10.1051/e3sconf/201913503082.

Zhong, R.Y., Xu, X., Klotz, E. and Newman, S.T., Intelligent manufacturing in the context of industry 4.0: a review, *Engineering*, Vol. 3, 2017, https://doi.org/10.1016/J.ENG.2017.05.015.

Biographies

Save Akilimalissiga is a lecturer and PhD candidate in the Department of Quality and Operations Management within the School of Mechanical and Industrial Engineering at the University of Johannesburg, South Africa. He is an active member of the Southern African Society for Quality (SASQ) and the Society for Operations management in Africa

(SOMA). His research interests are in Service Delivery Automation (SDA), Manufacturing Technologies, Quality Management Systems and Auditing, Continuous Quality Improvement, Supply Chain and Warehousing Management.

Nita Inderlal Sukdeo is an Associate Professor and Head of Department in the Department of Quality and Operations Management within the School of Mechanical and Industrial Engineering at the University of Johannesburg, South Africa. She is an active researcher in the field of total quality management and operations management. Her field of expertise also includes advanced manufacturing technologies, smart factories, Quality 4.0, quantitative analysis, quality management systems, quality auditing and risk assessment. She is a qualified Lead Auditor, proficient in ISO standards and certification. She is the chairperson and director of the Society for Operations Management in Africa (SOMA) and a professional member of the South African Society for Quality (SASQ). She is an active member and participant, session chair of the IEOM Women in Industry and Academia panel session Africa edition.

Sambil Charles Mukwakungu is an award-winning academic who has been lecturing Operations Management, Food Production, and Quality Management at the University of Johannesburg since 2009. His passion for teaching and learning has allowed him to make a difference in at least one student's life every year. He is a young researcher who is still establishing himself in knowledge creation with a keen interest in Quality Management Systems, Service Operations Management, Lean Operations, Continuous Improvement, as well as business innovation and innovation in Higher Education. He was awarded Best Track Paper Awards at the 2016 IEOM Conference in Rabat, Morocco, also at the 2018 2nd European Conference in Paris, France, and he is together with his team from the IEOM UJ Student Chapter a recipient of the 2018 IEOM Outstanding Student Chapter Gold Award for exceptional chapter activities and contributions to the field of industrial engineering and operations management. He supervises master's students in the field of Operations Management while completing his Doctoral studies at the University of Johannesburg.