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Title: Artificial Intelligence and Knowledge Management in South African Automotive Industries.

Automotive industries in the developed world have strived to improve performance and productivity by incorporating Knowledge Management (KM) practices in their manufacturing processes. This has been attributed to the use of upgraded technological capabilities in the acquisition, sharing, and retention of organisational knowledge. Literature has unpacked that as much as automotive industries need Information Communication Technologies (ICTs) in their KM strategy, they should also include aspects of Artificial Intelligence (AI) to facilitate and share knowledge (Wisskirchen *et al.*, 2017; Calitz, Poisat & Cullen, 2017; Cronin, Conway & Walsh, 2019). More so, they recognised the limitations of ICTs concerning the management of tacit knowledge, which is intangible and difficult to share, as it plays a crucial role in the KM process. Despite the interest of many authors towards KM in automotive industries, there is a lack of studies aimed at investigating AI as a KM enabler in the South African automotive industry. This is a relevant issue as knowledge in the automotive industries tends to manifest itself tacitly. This realisation has spawned a growing interest in incorporating advanced technologies like artificial intelligence into KM practices to overcome knowledge loss and bringing in innovation in automotive industries. It is against this backdrop; the study seeks to investigate AI as a KM enabler in automotive industries of South Africa.

Aim of the study

The main aim of the study is to investigate the use of AI as a KM enabler in selected automotive industries of South Africa.

Research objectives

The study will be guided by the following research objectives:

- What is the perceived use of AI in KM practices in the South African automotive industries?

- What are the hurdles confronting the South African automotive industries in integrating AI into KM practices?
- What is the extent of AI as a KM enabler in South African automotive industries?

Theoretical Framework

The theoretical underpinnings of this study are shaped by the Knowledge Management Solutions framework by Becerra-Fernandez and Sabherwal (2010), the Social Exchange Theory and the Leavitt's Diamond Organisational Model (1965). Based on the highlighted theories, automotive industries considering KM in their strategic plan should incorporate AI technologies that enable the storage of huge amounts of data and knowledge, enabling access to both tacit and explicit knowledge. Besides the frameworks and models of KM, a solid advanced technological platform is necessary for KM practices in any organisation (Piezunka and Dahlander, 2015). Drawing from this model, AI as a KM enabler is necessary for successful knowledge exchange with the help of the other variables which are people, organisational structure, and tasks in automotive industries.

Preliminary findings from the literature

The South African automotive industry is widely viewed as the second-largest employer behind mining. Hence, the South African government has made the automotive industry a priority through a series of policy adjustments (Ansara and Davids, 2018). However, in South Africa, like in any other automotive industry in other countries, knowledge loss has been attributed to the phenomenon of 'brain drain', which refers to the result of the retirement of experienced professionals, the changing work behaviours among the younger generations and the lack of new talent infusion into the South African automotive industry over the past decade (Abdi *et al.*, 2018). Calitz and Cullen (2017) assert that organisations have found that the investment in employees through training, by formal and informal knowledge transfer, is lost when these individuals resign. This leads to the loss of organizational knowledge and contributes to errors, duplication of work and additional investment needed for the training and development of replacement employees.

Artificial Intelligence (AI) has become a buzzword and is a technology that simulates human intelligence processes through machines especially computer systems (Liu *et al.*, 2018). These processes include learning (the acquisition of information and rules

for using information and knowledge), reasoning (using rules to reach approximate or definite conclusions), and self-correction (Walch, 2018). In addition, it is a technology where knowledge is acquired, captured, shared, carefully developed, and transformed into the right format in organisations (Rachinger *et al.*, 2018; Liu *et al.*, 2018). In essence, KM practices allow an understanding of knowledge to occur, while AI as a KM enabler provides the capabilities to expand, share, use, and create knowledge (Mageswari, Sivasubramanian and Dath, 2015; Cooper, 2018). In the Industry 4.0, the ability to mine large amounts of data, information, and knowledge to gain competitive advantage is gaining momentum. Particular technologies used in AI include business intelligent systems, knowledge intelligent systems, expert systems, cloud computing, natural language processing, virtual reality, and neural networks (Wisskirchen *et al.*, 2017).

Therefore, this work has defined AI as an enabler of KM practices in which these advanced technologies are used to capture, retain, share, and transform knowledge into the right format in automotive industries (Sharifirad, 2010). KM is a strategic process where organisations create value from intangible assets like tacit knowledge (Gold, Malhotra and Segars, 2001; Nair, Ramalingam and Ravi, 2015; Sanzogni, Guzman and Busch, 2017). The only challenge with intangible assets would be the process of grasping, addressing, and transforming them into tangible ones. Nonetheless, these assets must be made accessible to everyone in the organisation through AI technologies.

A review of literature on the technologies used in KM in automotive industries has confirmed the availability of ICTs in most of the automotive industries of South Africa. However, extant literature also points out that the need to analyse large data sets will require greater investment in mathematics and quantitative reasoning skills in the workforce (Athirah *et al.*, 2015; Asrar-ul-Haq and Anwar, 2016; Zhong *et al.*, 2017; Sutherland, 2020). In so doing, WEF (2018) proposed the use of mobile internet and cloud technology as a way to enhance efficiency and productivity in the workplace, meaning the workforce has to be more adaptable to new technology. These technologies will aide in the KM process which will further enhance productivity and efficiency. According to a research project that investigated the relevance of occupations and skills for the South African motor industry, stated that it would be

crucial for employees to adapt to new technology to fit in the global market, of which these may only occur in the long-term (Ansara and Davids, 2018).

As the proliferation of structured and unstructured data continues to grow, there is a constant need to uncover the knowledge contained within these big data sources (Cerchione, Esposito and Spadaro, 2016). Big Data describes large amounts of data that can originate from a wide range of sources and are evaluated using modern computer technology (Buyya, Calheiros and Dastjerdi, 2016). For example, a study done in Romania found that cognitive computing has been key in extracting knowledge from big data in automotive industries (Paschek *et al.*, 2017). This extracted knowledge is shared across the organisation to increase organisational performance and innovation. In addition, the use of these AI technologies allows KM practices to be viable in the automotive industry to be able to crowdsource, share, and sift the required knowledge within and out of the organisation to extract knowledge on their markets and customer base.

It is evident in the review of literature that, in the South African automotive industry, KM is prevalent in the large extra-large multinational companies where the necessary resources are available. These include BMW, Mercedes-Benz, Ford, General Motors, Toyota and Volkswagen, and most of these multinational automotive industries have developed a Knowledge Management System which complements the organisational culture (Dube, 2017). In addition, these extra-large multinational companies in South Africa have resorted to the use of cobots (collaborative robots) as a solution to ramp-up production volume while maintaining social distancing (Malik, 2020). According to Wang *et al.*, (2020), when robots get into action in close proximity to humans, they are referred to as collaborative robots (cobots). Cobots are more affordable and easily trainable and programmable than existing industrial robots, and they are flexible to handle short runs, repetitive and boring jobs and ergonomically challenging tasks (Sadik and Urban, 2017; Liu *et al.*, 2018). However, the whole cooperative manufacturing system needs to communicate and share their knowledge, to reason and process the shared knowledge, which eventually gives the control solution the capability of obtaining collective manufacturing decisions (Wisskirchen *et al.*, 2017; Mușat and Mihu, 2018; Malik, 2020; Wang *et al.*, 2020). It also has to be considered that the control solution should provide a natural language which is human-readable

and can be understood by the machine, that is, the cobot (Calitz and Cullen, 2017; Mușat and Mihu, 2018).

Literature studies regarding KM in the automotive industry have focused on the connection between KM practices and organizational performance (Sawant, Teli and Gaikwad, 2015). In a study in the automotive sector, Sawant, Teli and Gaikwad, (2015) found that suppliers who are involved in the manufacturing process improve product performance and the use of KM tools improves the financial performance of an organization. A supplier-oriented KM model is proposed by Sawant, Teli and Gaikwad, (2015). This alludes to the possibility that many of the automotive industries may not be applying KM due to a lack of resources available to manage complex information technology (IT) infrastructures.

In a study by Ďurišová (2011) in Munich, findings revealed that the most important knowledge in automotive industries is the end-user customer knowledge. In addition, AI technologies like consumer data analysis applications were among some of the most mature technologies in Munich automotive industries that can identify target audiences and the expectations of those audiences. In this regard, customer knowledge can be applied to improve component reliability. Ďurišová (2011) study further revealed that Munich automotive industries used Text Mining to analyse free knowledge contained in customer feedback gathered via e-commerce websites and forums. This type of knowledge has been used to revise the design of particular components and avoid the need for recall campaigns.

In another research study by the Access Partnership (2017) in the South African manufacturing industry, AI capabilities influenced the organisation's internal structures by reinforcing interdisciplinary collaborations within and across the organisation. However, the study recommended that even though AI and KM enhanced collaboration in the organisation, more studies are required to ascertain the extent to which AI technologies and KM practices can go in terms of product enhancement, organizational performance, product innovation and increased Return on Investment.

The automotive industry is one of South Africa's most important sectors, with many of the major multinationals using South Africa to source components and assemble vehicles for both the local and international markets. Despite its distance from some of the major markets in Africa, and particularly South Africa, produces high-quality

products at prices competitive with other automotive manufacturing and assembly centres (Economic Development Department, 2017). Hence, this study seeks to investigate the perceived use of AI as a KM enabler in the automotive industries of South Africa.

Methodology

This study proposes the use of the interpretivist research paradigm which posits that reality cannot be separate from our knowledge of it and the values of the researcher are inherent in all phases of the research process (Angen, 2000). Findings or knowledge claims are created during the research process and truth is negotiated through dialogue. Since the incorporation of AI technologies in KM practices is still in its early stages in the South African automotive industries, fostering a dialogue between the researcher and the respondent allows a more sophisticated and informed understanding of the phenomena under study (Creswell, 2014). Hence, this study will be guided by an interpretivist research paradigm to address the research objectives of the study. In addition, the study will make use of a qualitative research design since the researcher wants to explore the use of AI as a KM enabler in South African automotive industries.

This study will be a multiple case enquiry of selected automotive industries of South Africa. The sample will comprise of top management, knowledge officers, Human Resources, and the ICT department. A sample of 20 participants will be used for the study as the individuals were deemed knowledgeable of the subject matter under investigation and will be able to provide the most accurate information or data (Asiamah, Kofi and Oteng-Abayie, 2017). The sample size will also be determined upon saturation of the collected data. In essence, the goal of qualitative research is to have a large enough sample size to uncover a variety of opinions, at the same time, limiting the sample size at the point of saturation (Creswell, 2014).

In-depth interviews will be used to extract information from participants from different organisations and departments. In-depth interviews aim at obtaining meaningful, rich, and subjective information from the experiences and views of the participants themselves (Van Rensburg, 2010). More so, the Delphi method which involves a panel of experts to confirm the qualitative transcriptions will be used.

In some instances, during the data collection process, the researcher will use non-participatory observation, where the researcher will have limited interaction with the people under observation. In non-participatory observation, the identity of the researcher is unknown to the group under observation, even though they acknowledge the researcher's presence (Van Rensburg, Basson and Carrim, 2011). The researcher wants to observe how the employees in the different automotive industries interact with technologies in the KM process. It was also deemed necessary to observe the advanced technologies that are existent in the South African automotive industry.

Conclusion

In summation, it is quite evident in the reviewed literature that automotive industries in South Africa have used ICTs as a KM enabler which has managed to increase innovation and performance. However, drawbacks found in the literature have also revealed that some aspects of AI are required as a KM enabler in the South African automotive industries. In addition, it is crucial to investigate the preparedness of the employees in adopting and adapting to advanced technologies in the KM process. In the same line, it has been unveiled that the South African automotive industry might not have the resources to incorporate advanced technologies within their KM strategy.

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