Abstract: Adopting intelligent decision-making systems within the manufacturing sector of Wales: a thematic analysis approach.

[1]Shahzad, F., [1]Bennette, S., [1]Remoundou, K.

[1]Aberystwyth Business School, Aberystwyth University, UK, Wales.

Background: The purpose of this study is to discover the future leadership role in the presence of Artificial Intelligence and how these smart technologies will change, assist and transform the leadership decision-making within the Welsh manufacturing sector. Exponential growth in miniature technology and ubiquitous computing is revolutionising the industrial sector ranging from raw materials to manufacturing the products and distributing them in the market for end-users. However, along with opportunities, there are barriers in transitioning from current to a smart and advanced manufacturing system (Industry 4.0) due to uncoordinated policies, lack of awareness, and cultural aspects in underdeveloped regions. Technological advancement influences the manufacturing industry by automating manufacturing practices and processes using innovative and artificial intelligence-based systems.

Method: This study uses a qualitative research approach to investigate the current technological advancement adopted in the Welsh manufacturing industry through detailed interviews with the senior management. These were conducted in order to gain insight and understanding of the leadership decision-making system. The research strategy involved Semi-structured interviews with the industry leaders in identifying gaps to enable smart technology in the decision-making process of leaders, followed by semi-structured with the policy makers to overcome the lack of coordination with the industry.

In the first stage, 16 senior management from the Welsh manufacturing sector were interviewed online. Our semi-structured approach provided an in-depth understanding of the agenda of industry leaders. We analysed manually transcribed data using thematic analysis to develop a

framework to identify the gaps and barriers in the current leadership decision-making compared with intelligent decision-making system.

Results: Findings showed a significant gap and great margin of improvement in adopting intelligent decision-making systems within the Welsh manufacturing sector. Additionally, research outcomes indicated significant progression is required to compete and meet the modern world manufacturing sector's trends and standards, such as Industry 4.0. Most interviewees are unaware of the contemporary approaches, which brings another challenge of the lack of information propagation of well-managed and organised industry by the government.

The study's results indicate the technology's role will be to assist leaders as an intermediary in the decision-making process. Findings point out that intelligent technologies will be inclined towards the lower-level management decisions putting the top-level management in control. The higher position in the managerial hierarchy will have higher control in the decision-making process and less role of smart technology, such as (AI), whilst the lower-level management may have lower control and are highly influenced by AI.

Consequently, AI and smart technologies may have a downward effect on the managerial hierarchy. This will change both the style and type of leadership within the manufacturing sector of Wales. It changed from egocentric to altrocentric, from autocratic to participative, and now digital leader. Therefore, middle layer management, which is considered a backbone between the top and lower management, is hesitant to adopt advanced technology. The reasons identified through the study include a fear of losing jobs, unreliability, and the requirement of a qualified individual to operate the system.

Findings support the literature that suggests that organisations are reluctant to use AI in decision-making because they believe it is not entirely reliable for all types of decisions

(Guszcza et al., 2017; Dejoux & Léon, 2018; Jarrahi, 2018; Parry et al., 2016). Similarly, findings are also considered within the context of COVID-19, which has highlighted the deficiency in the present system and a reluctance to engage with AI at the decision-making level. Therefore, by overcoming these fears, AI could be a key component of competitive advantage for the Welsh manufacturing sector and could empower decision-making.

Discussions: Industrialisation and the recent pandemic necessitate adopting smart processes through technological development, which have previously lacked attention. The study identified that the Welsh manufacturing industry is still practising the traditional approach and struggling to adopt industry 3.0 technologies. The current environment needs digital leaders who can adjust their skills according to the digital world's today.

There is a discrepancy between literature and industry perspective, however, which is highlighted in this research as while literature indicates that the industrial revolution will considerably increase living standard, innovative technologies will maintain this change, transform job patterns, and open more job opportunities allowing more industry to be installed where more people will be employed, (Makridakis, 2017).

This research is intended to help manufacturing sector leaders in Wales to focus and invest the time and resources effectively. It will allow the optimal utilisation of the resources and skills required to achieve organisational goals. Further, it will help improve the manufacturing processes, capacity, intelligent decision-making system, and utilisation of advanced technologies within the manufacturing sector of Wales. This work may have implications for Governmental funding for technological advancement in rural areas.

Limitation: This work focuses on the manufacturing sectors of Wales, following a primarily qualitative approach and therefore may be considered lacking in scope. In order to reduce this, we plan to organise interviews with the policy makers to identify the key reasons behind the

lack of coordination between national policy makers and industry leaders. It will enrich analysis with more real facts allowing us to find root causes. Current

Keywords: intelligent decision-making systems, manufacturing industry of Wales, digital leaders, thematic analysis, semi-structured interviews.

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