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Published version

SAAD, Sameh and ALNUAIMI, Samah (2022). Innovation framework for digital era. In: SHAFIK, Mahmoud and CASE, Keith, (eds.) Advances in Manufacturing Technology XXXV. Advances in Transdisciplinary Engineering, 25 . IOS, 54-59.

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Innovation Framework for Digital Era

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Abstract. Digital innovation-led industries progressively utilise different disciplinary teams to address the multidisciplinary challenges associated with highly integrated technologies. In other words, digital innovation makes businesses act rapidly in a short time frame. Creating key performance indicators to measure digital marketing and personalising and encouraging innovation in digital marketing are facilitated to adopt digital technologies. Digital and innovation go hand and hand and present a positive focus for digital transformation and innovation in line with the aims of the current market and user demand. Companies and industries operating in today's market are experiencing many challenges, such as the globalisation of the market and technologies. From the market point of view, digital technologies permit companies to offer new digital solutions for customers based on services embedded in products. This paper proposes an innovation framework with the consideration of the so-called Industry 4.0 reflecting the current digital era requirements.

Keywords. Innovation, Industry4.0, Digitalization-Push, Demand-Pull.

1. Introduction

Companies and industries operating in today's market are experiencing many challenges, such as the globalisation of the market and technologies [1]. From the market point of view, digital technologies permit companies to offer new digital solutions for customers based on services embedded in products. However, various countries have created local systems to boost the development and adoption of Industry 4.0 technologies. In Germany, where this concept was born, this program was called "High-Tech Strategy 2011", in the United States was established as "Advanced Manufacturing Partnership", in China, it was the "Made in China 2025" and in France, the "La Nouvelle France Industrielle [2, 3]. Hence, the global marketplace needs companies to innovate promptly and flexibly and continue transforming market needs. For effect in the competitive environment, Research & Development conditions indicate the need for further adaptation of best practices; in response to the spike in digital development in the 21st century.

Moreover, Companies need different variables to acquire digital technologies aligned with competition and innovation by emphasising the development of digital manufacturing. Consequently, now industries and companies require a new digital innovation process for Digital Product-Service systems to fulfil user innovation needs, requiring a digital innovation framework for the adequate digital era. Therefore, this research aims to develop a digital innovation framework to provide a dynamic, continuous stream of innovation management from the demand-pull and digitalisation-push perspectives.

2. What is innovation, and why is it imperative for future organisation workstreams?

The word "innovation" can often describe an output; however, it is also used simultaneously as a collective noun for an idea, creation, invention, research and development, and prototyping for a new product, technique, or service. Cunningham [4] mentioned that Joseph Schumpeter's economic theories that position each innovation, and its progression (through intrapreneurship) from the idea, to its zenith (its alpha value) as an innovation, into its beta value, as innovations enter the market that diffuse the original innovation's value. His theory of creative destruction is enduring, and it is relevant to this thesis that Schumpeter is credited with being the first scholar to theorise about entrepreneurship from the perspective of innovation [5]. The essential aspects of building innovation competencies that require not only technological capabilities but also organisational efficiency, which encompass four dimensions of practices (i) leading and organisation innovation, (ii) Innovation strategy design, (iii) Innovation management processes, (iv) Innovation networking [6].

3. Research Method

3.1. Review of the Methodology.

A literature review is an essential part of any research. Pertinent literature is assessed and analysed to find possible research gaps. The research gaps should be such that, if conducted upon, would help strengthen the discipline of the stated study [7]. Innovation management theory is commonly exemplified as a theory that matches one's prerequisites [8]; over 70 years, seven generations of innovation processes models have been presented, see Figure 1. Industrialised countries must change their activities to survive long-term. The futures demand market is a significant innovation resource; strong competencies enable the organisation to match intelligent sources with demand; thus, external and internal sources of innovations are essential [9]. Based on a literature review and the growing complexity and pace of industrial-digital change for future demand. This research aims to *develop a new conceptual dynamic digital innovation framework* to provide an effective and continuous stream of demand-pull and Digitalisation-Push in a dynamic system described below.

3.2. Developing the Conceptual Dynamic Digital Innovation Framework.

It synthesises a perception that balances the digital innovation process's intelligent technologies and market dimensions, and the output is a management framework for the digital innovation era.

3.3. Demand-Pull.

In contrast to previous innovation frameworks and attempts to observe innovation as an organisational phenomenon, the new framework will present unique aspects for future demand. Therefore, the proposed framework in this study will seek to create performance indicators for innovation that can be adapted to each sector's characteristics

and indicate a model timeline of future modifications that a given organisation must make to maintain a competitive advantage. According to Rothwell [16], empirical and practical studies of innovation in the last half of the 1960s emphasised innovation as a product of 'pull' or market-led influences in need or require [17]. Numerous studies have been published since the 1960s and emphasise the role of the marketplace in innovation [18] and [19]. Innovation provides powerful leverage to improve and develop company performance and enable a company to remain successful in the marketplace [20]. This makes the business more sustainable for the company [21]; sustaining and high potential innovations have high sources in *strategy and planning, marketing, technology process, quality management, logistics, and human resources* [22]. Due to the limitation of paper size, the most significant seven aspects of *demand-pull*, as shown in Figure 2, Digitalisation-Push.

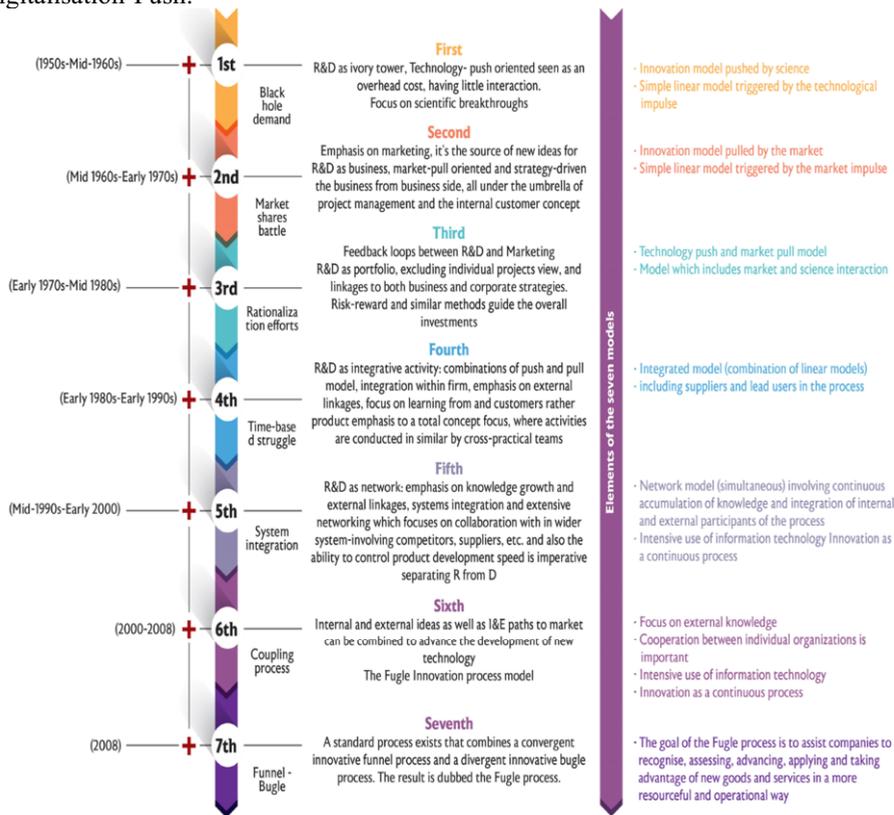


Figure 1. The Journey of Seven Generations of innovation models [10-15]

Digitalisation is the most phenomenon topic in the 21st century; digital technologies have significantly influenced talent management and human resource systems [23]. Moreover, researchers have emphasised that the digital era will overshadow the industrial revolutions of future economic growth [24]. Digitalisation goes further than using computers and the Internet to include ways in which computer services are provided and the impact of artificial intelligence and the Internet of things [25] and [26]. However, Digital technologies are at the forefront of global innovation and disruption in various sectors [27]; Therefore, it must change if this sector aims to transform into intelligent digital to be innovative in line with the industrial revolution [28]. Due to the

limitation of paper size, the Major seven aspects and instruments of digitalisation-push, as demonstrated in Figure 3.

3.4. Research Methodology and Results

The pairwise comparison questionnaire distributed within the U.K. survey data has been used to develop the innovation framework through the analytical hierarchy process (AHP) [29] to obtain the criteria weights in multi-criteria decision-making (MCDM). It calculates the desirable weights associated with criterion map layers with the help of a performance matrix; all identified relevant criteria are compared against each other with preference factors. The consequences can be gathered using criterion maps comparable to weighted combination methods [30]. As well as to compare the importance of (n) criteria, a reciprocity performance relation shown in Figure 4 has been generated automatically using AHP based on the pairwise comparisons.



Figure 2. Demand-Pull

4. Conclusions

This research considers the emerging technologies to improve the innovation process, and after careful research of influential parameters in industry, an innovation framework has been proposed to become a basis for future innovation activities. The contents of this proposed framework and what sets it apart from previous generations is the consideration of Industry 4.0 as one of the drivers of the innovation process nowadays.

The participants who responded to the research questionnaire had a diverse mix of industry experience and worked in various industries; one of the limitations of this research work was the focus on the United Kingdom only. The U.K. is a developed nation, with most companies having access to state-of-the-art facilities and infrastructure.

Therefore, the next stage of this research is to be extended to other countries worldwide to reflect the global trend in the following digital era generation in the area of innovation.

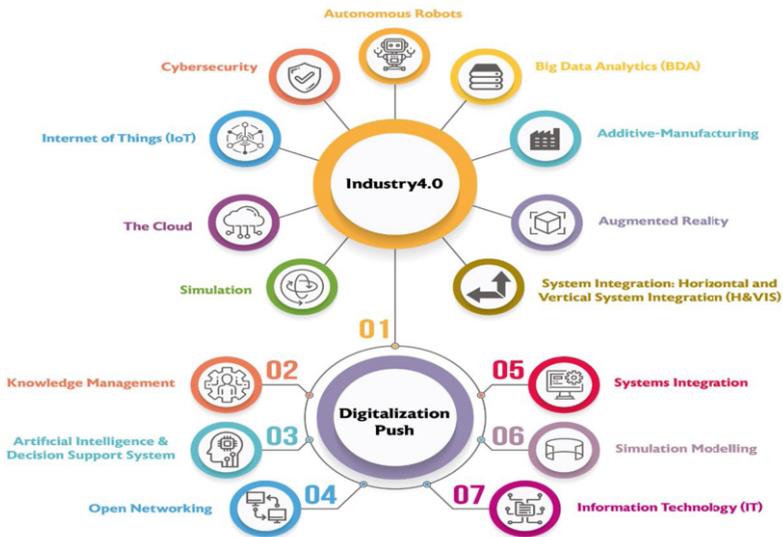


Figure 3. Digitilisation-Push

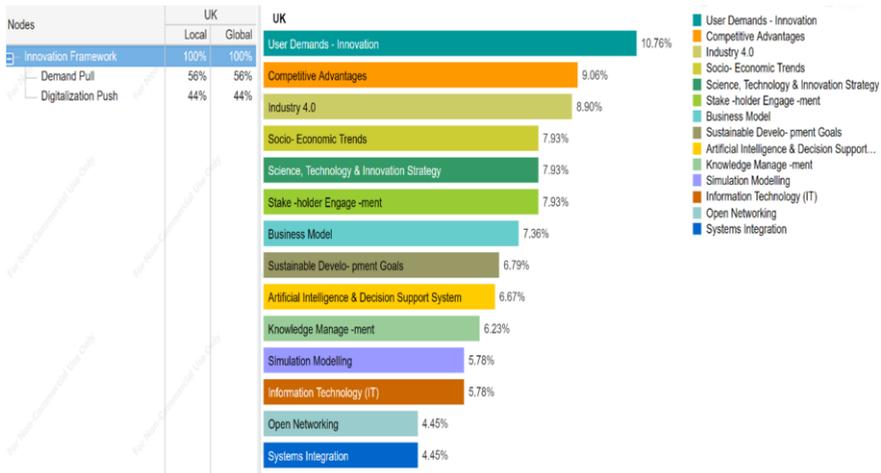


Figure 4. U.K. Main & Sub-Criteria Results

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