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Digitalization in the blood supply chain : A systematic literature review

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Abstract

This study aims to investigate how the blood supply chain (BSC) has embraced digitalization. This study identifies the factors that influence and pose obstacles to the adoption of digital technologies in the BSC. In order to identify the articles available, this study uses a methodical literature review. PRISMA techniques were used in this study. Only thirteen articles are discovered to be pertinent to digitalization in the field of BSC after the article has been properly screened. In the BSC, this study covered the factors that influence digitalization adoption. The study is suggested along with a theoretical framework and some propositions. Additionally, this study identified barriers to the BSC adoption of digitalization. Due to the discussion of adoption drivers and challenges, this article will be beneficial to managers and service providers.

Subject Classification: *90B10, I11.*

Keywords: *Digitalization, Blood supply chain, Systematic literature review, Digital technologies, Adoption factors, Challenges.*

1. Introduction

Digital technologies have changed how humans communicate with each other and their surroundings [11]. Everyone is surrounded by technical devices like mobiles, wearable devices, drones, self-driving cars, smart watches etc. The industry and service sectors are affected by these technologies. Digitalization is a decade that has touched almost every industry [5]. The Digital revolution has a tremendous impact across sectors, generating value and network effects. With a quick electronic glance, it might be possible to determine the contents of a cargo container.

A short shelf life applies to human blood. Since blood must be transferred from one person to another and cannot be synthesised, it is frequently in short supply but in high demand [4]. In an equitable and innovative healthcare system, WHO advised a seamless BSC at the national and international levels to prevent infections, lower child mortality, and enhance citizens' general health and wellbeing [1], [2], [12]. According to WHO, a nation's blood ecosystems should ensure that blood transfusions are safe throughout the lifecycle in order to provide patients with blood products on demand; as a result, BSC management is an essential component of any society's social well-being [3]. Blood shortages and, in some cases, diseases linked to transfusions can occur as a result of a lack of coordination among all the stakeholders [7]. Because of numerous issues, managing the BSC in India is frequently difficult. By balancing supply and demand volumes, blood banks in particular play a crucial role

in the overall BSC [10]. To fill the gap in the literature, we proposed three research questions:

RQ1: How are the drivers for digitalization adoption in the BSC?

RQ2: How are the challenges/barriers to adopting digitalization in the BSC?

RQ3: What is the future agenda of digitalization in the BSC?

This research used a systematic literature review (SLR) to fill the gap in the literature on the BSC. There is a need for digital technology adoption in the BSC.

2. Methodology

This chapter presents the facets of SLR and emphasizes the research gaps. The highlighted research gaps help in elucidating the anticipated research problems. A literature review allows uncovering the historical perspective of a research area and is considered a significant contribution to a research venture. The SLR technique is adopted to find articles related to digitalization and BSC. The systematic literature review technique is adopted for this study so as to reduce biasness and enhance the validity of the results. Data is taken from Scopus and Web of Science. This was the planning stage of the review, and scope of study was provided. It is one of the most important phases of limiting the subject delimitation and the range of the literature review. The Stage II review is conducted by identifying the studies using relevant search strings. To cut off bias errors, articles were then assessed regarding internal validity, including peer-review journals and impact factors.

Preferred Reporting Items for Systematic Reviews and Meta-Analyses is a minimal set of items for reporting in systematic reviews and meta-analyses based on evidence-based approach. The steps are summarised in figure I. PRISMA emphasizes how researchers ensure the transparency and completeness of systematic reviews and meta-analyses. For the Scopus database, we found 187 articles, while for the web of science database, we found 161 articles. Now, for both the databases, the articles identified were 348. Articles considered after the elimination of duplicability were 266. Thus, 86 articles were removed, as they were duplicate. Just 76 of the 266

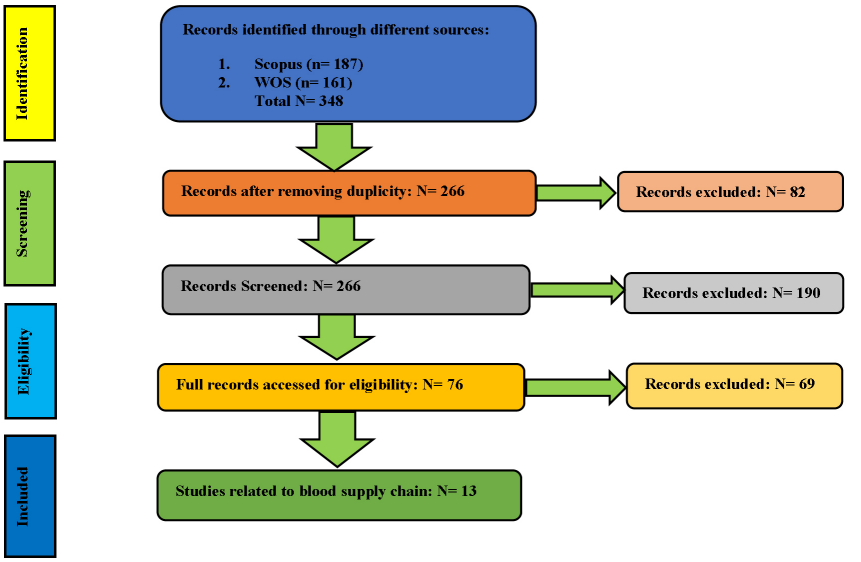

Figure I

The review process according to the PRISMA guidelines [8]

papers that were evaluated were determined to be suitable for a final screening. Lastly, thirteen articles were taken into consideration for the final review.

3. Findings

3.1 *The Breakdown of Publication by year*

Research on digitalization and the Balanced Scorecard (BSC) from 2012 to 2022 shows limited findings. Four papers were found in both 2022 and 2021, three in 2020, and one each in 2019 and 2018, with no articles from 2012 to 2017. This indicates increased focus on the topic only in recent years.

3.2 *Papers published by Journals*

Four papers were published in IEEE Access, followed by two articles in Industrial Management and Data Systems. IEEE Access has an impact factor of 3.244. Industrial Management and Data Systems have an impact factor of 7.3.

3.3 *Digitalization in BSC categorization*

Articles were categorized in respect of technology used in the BSC and blood management. Seven articles used blockchain technology in the area of BSC and blood management. ML techniques have been used in two articles. Big data technology has been used in two articles. One article used AI for BSC. Table I shows the digital technology used in BSC and blood management. Table I shows the details of the literature on digitalization in BSC.

4. Discussion

This research aims to study digitalization in the BSC using SLR techniques. Managing the BSC is one of the most challenging research problems in the SC literature. Blood service operations include collecting, processing, keeping the inventory, blood distribution, management of the blood bank, and transfusion [6], [9], [13]. The primary goal is to optimise blood utilisation in the system and to reduce supply shortages and outdated rates. This section discusses the three research questions proposed to fill the gap highlighted by the research gap.

4.1 *RQ1: What are the drivers for digitalization adoption in the BSC?*

The drivers act as an adoption factor leading to technology adoption in BSC. This article highlights the adoption barriers to digitalization in the BSC. The first adoption driver is technological factors, consisting of six sub-adoption drivers: complexity, compatibility, security, privacy, technological infrastructure, and cost. The characteristics or factors of technology acceptance research that are manifested in an organization's internal and external technologies, operations, and equipment include innovation characteristics. Organizational factors consist of six sub-adoption drivers namely top management support, cost, firm size, organizational culture, human resource capability, change resistance, and decision-making culture that is the second adoption driver. The third adoption driver is organizational factors comprising six sub-adoption drivers like competitive pressure, partner support, government support, regulatory support, competitive advantage, and service expertise. The fourth adoption driver is human factors, comprising three sub-adoption drivers: innovativeness, internal excellence, and prior experience. Figure II shows the conceptual model for the adoption of digitalization in BSC.

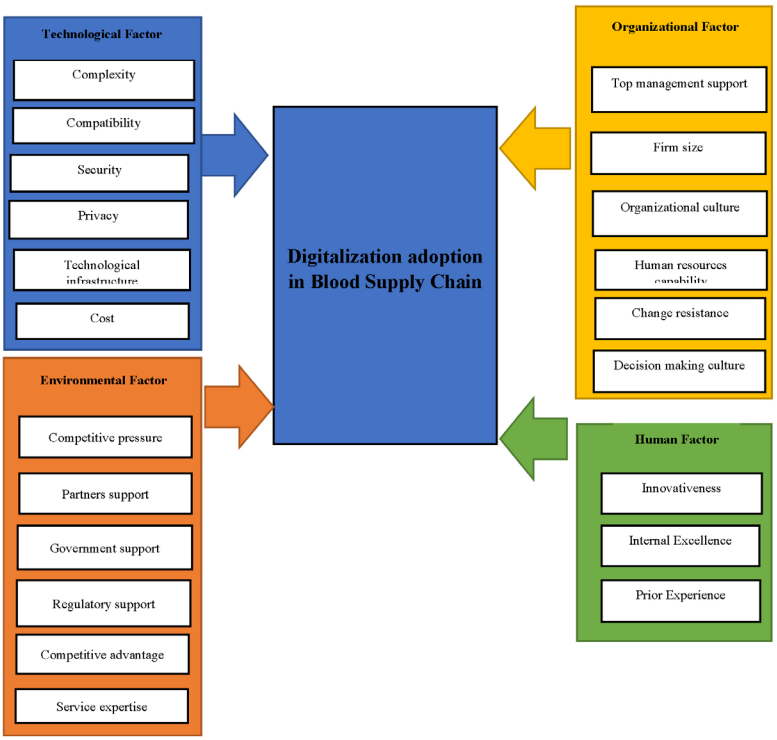

Figure II

Conceptual framework for the adoption of digitalization in BSC

4.2 *RQ2: What are the challenges/barriers to the adoption of digitalization in the BSC?*

This research question explains the barriers or challenges to adopting digitalization in BSC. The literature identified ten barriers that digital technology providers need to address for possible solutions. The first one is "Lack of data storage capability", "No trust", "Scalability problems", "High maintenance cost", "No data standardization", "Lack of understanding among the users", and "Lack of awareness of the adoption of digital technologies", "Security and privacy concerns", "Lack of support from higher authorities", and "Infrastructure problem".

4.3. *RQ3: What is digitalisation's future agenda in the BSC?*

Digitalization can change the face of BSC by tracing and tracking the blood supply. The future plan for the digitalization in BSC can be:

- *AI in BSC:* AI-based technologies can be used to predict the blood demands in a particular hospital. Whenever a specific blood group is required blood bank will come to know before it gets finished in the hospitals. This will save many lives, and there will be no blood shortage.
- *Blockchain in BSC:* Blockchain can be used for tracking and tracing the blood in the BSC. The blood a donor gives to the blood bank can be tracked before reaching the patient body.
- *Big data in BSC:* Big data software can access a large amount of data for predicting blood demand in a particular district. This will help in less death due to blood shortage.
- *Drone technologies in BSC:* Often, a patient dies due to a blood shortage as the blood could not reach the hospital on time. The blood transfer will not be stuck in any traffic, and blood can be transported in the rural sector where there are no proper roads.

5. Conclusion

This article used SLR techniques to adopt digital technologies in the BSC. From the literature, it becomes clear that no such study discussed adopting digital technologies in the BSC. An SLR was performed using the PRISMA technique, and only 13 articles were found relevant in the search area. Due to the low availability of the article in the literature, it has become apparent that there is a gap in the literature fulfilled by this article. This article discussed the adoption factor of digital technologies in the BSC. A conceptual model is also proposed for adopting digital technologies in BSC.

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