Revolutionising B2B Innovation: A Novel AI-Integrated Framework for Sustainable Value Creation within Smart PSS

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Introduction and Research Background

A growing number of companies in B2B markets are adding services to their product offerings in order to increase value, as a reaction to highly competitive environment. Therefore, hybrid offerings, which combine traditional goods with additional services or features, have become increasingly important in the evolving business landscape. Manufacturers in the highly competitive and dynamic B2B area are adopting servitization as a strategic way to respond to changing customer expectations (Gaiardelli et al., 2023; Li et al., 2020, Wang et al., 2011; Manzini and Vezzoli, 2003). Vandermerwe and Rada introduced the idea of "servitization," in 1988, as the innovation of an organisation's capabilities and processes for the purpose of transitioning from selling individual products to offering integrated products and services that deliver value in use, which has since propelled Product-Service Systems (PSS) (Goedkoop et al., 1999) into a revolutionary market proposition within the dynamic domains of business and innovation. However, providing basic service strategies of PSS, developed since 1980s, does not ensure organisations' competitiveness in this highly digitalised and competitive market (Kohtamäki et al., 2019).

Digital servitization is the transformational process by which a product company changes its product-centered business model to a service-centered business model with the support of digital technologies, enabling the reconfiguration of its business processes, capabilities, products, and services to improve the value for customers and increase the company's non-financial and financial performance (Kowalkowski et al., 2022; Sjödin et al. 2019). According to Valencia et al. (2015), digital technologies possess the capability to elevate product-service systems (PSS) into intelligent PSS known as Smart PSS. The influence of digital technologies on servitization (and Product Service Systems (PSS) has been the focus of recent research (Chang et al., 2024; Kohtamäki et al., 2022). The manufacturing and services industry are undergoing a fundamental transformation due to the rapid advancement of digital technologies

in the industry 4.0 era, such as Big Data Analytics, Artificial Intelligence, Internet of Things (IoT), and Cloud Computing.

AI is the ability of a system to identify, interpret, draw inferences from, and learn from data to achieve predetermined organisational and societal goals (Mikalef and Gupta, 2021). A significant component is AI's capacity to manage massive amounts of data and identify unique patterns hidden within it, resulting in providing new insights (Cortez & Johnston, 2017), improve operational efficiency (Bag et al., 2021), and facilitate decision-making (Borges et al., 2021). According to the recent study by Gartner, 50% of enterprises will have developed AI orchestration platforms to operationalise AI by 2025. AI as a whole idea consists of different subfields (figure 1). Machine learning, a subset of artificial intelligence techniques, has grown in popularity as data availability and processing power have expanded. Categorised into supervised, semi-supervised, unsupervised, and reinforcement learning, these approaches differ in their use and learning mechanisms.

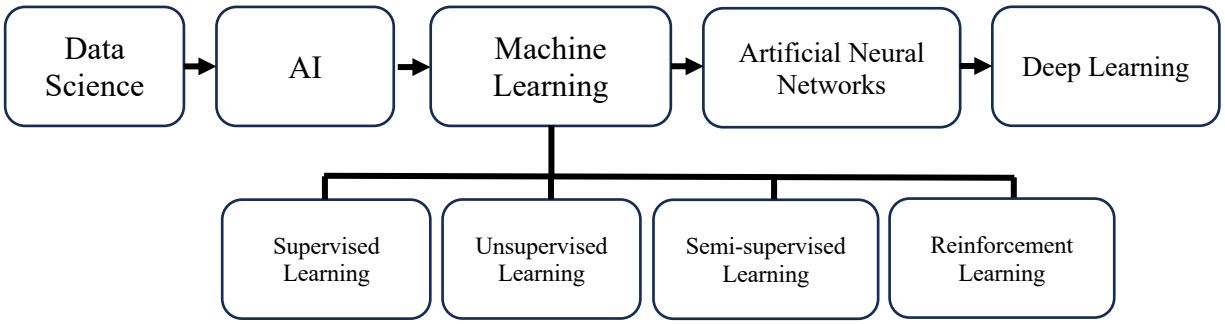

Fig1.AI and subfields

Recommender systems (RS) are tools that help users find services or goods that are likely to be of interest to them. Today, the roles of RS in both academics and enterprises cannot be overstated (Singh et al., 2021). Deep learning has gained prominence for its ability to automatically learn hierarchical representations of data, enabling more effective feature extraction and pattern recognition (Dong et al., 2021). Using Deep Learning and Reinforcement Learning techniques into recommender systems enable optimal decisions based on user and environment interactions. Within this research domain, deep reinforcement learning based recommender systems (figure 2) can revolutionise B2B interactions by providing value-added recommendations while considering sustainable factors that evolve in response to dynamic stakeholders' needs.

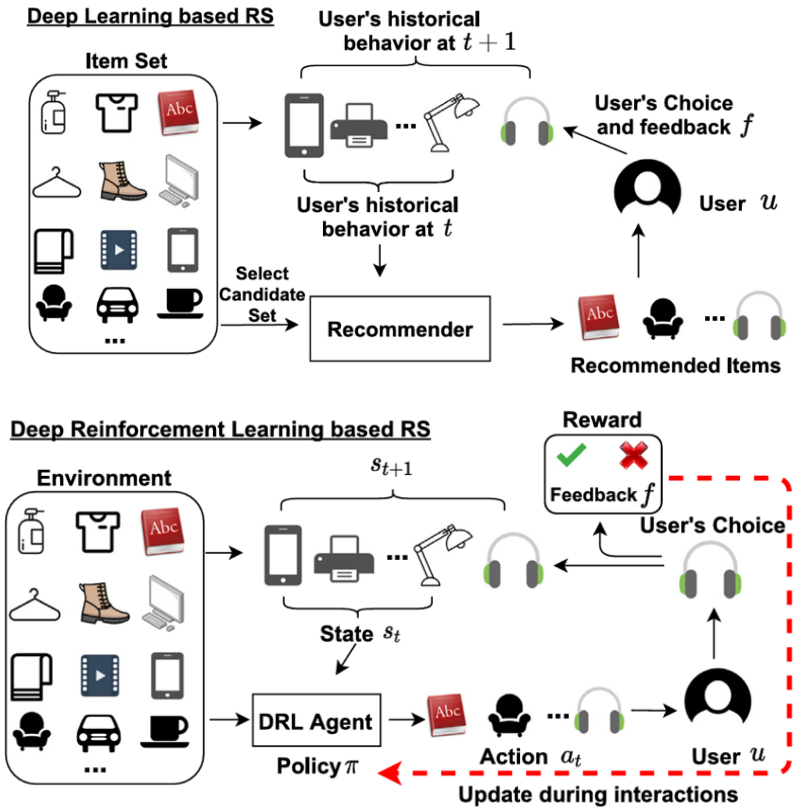

Fig2. Deep Learning Based Recommender System VS Deep Reinforcement Learning Based Recommender System (Chen et al., 2023)

Research Gap

Smart PSS offer great advantages to customers in the highly competitive B2B market. However, their newness in the market may pose challenges related to awareness, understanding, and potential values they can deliver (Rapaccini and Adrodegari et al., 2022). Contemporary research on Smart Product Service Systems focuses on discussing services through the lens of service delivery procedures (Chang et al., 2023; Li et al., 2021) rather than digging into the complexities of big data and the role of AI in enhancing value and user experience. Therefore, the proposed research seeks to address this gap by developing an innovative framework using Machine Learning algorithms that not only comprehensively integrates sustainable factors but also leverages the power of AI to recommend data-driven insights by employing advanced data analytics to foster Sustainable Value Creation (SVC) within the ecosystem of Smart Product Service Systems (SPSS) in the B2B context.

SPSS providers actively seek novel market opportunities for delivering servitized offerings, persistently ensuring customer satisfaction for retention (Zheng et al., 2019). This study addresses recent calls by focusing on two of six elements identified in a study by Dwivedi and

Wang (2022), through emphasising the necessity of creating AI solutions to improve the B2B customer experience and creating an innovative framework for B2B marketing aided by AI. The convergence of smart technologies, sustainability, and PSS forms a forefront area of investigation (Boucher et al., 2024).

The primary driving force behind this research is the urgent necessity for manufacturers to figure out how to turn data into a dual-edged sword – a generator of new revenue streams and a catalyst for delivering offering that meet the evolving needs and expectations of our clients and stakeholders, especially in terms of sustainability. This challenge is not merely technical but strategic in nature, demanding a nuanced understanding of data utilisation in enhancing value offerings. This enquiry is essential in a competitive landscape where the ability to provide value-added services through data can be a significant differentiator and a driver of sustainable growth.

By combining the perspectives of the Triple Bottom Line (TBL) and Stakeholder Theory, this study aims to provide a comprehensive view of the diverse types of value created and for whom, recognising stakeholders not only as beneficiaries but also as contributors to the value creation process. Furthermore, incorporating the Service Dominant Logic (SDL) underscores the importance of co-creating value through interactions, particularly crucial in a B2B context where solutions and value-added services play a pivotal role.

	Research Questions
1	How can an integrated Artificial Intelligence (Deep Reinforcement Learning-based Recommender System) framework be developed within Smart Product Service Systems (SPSS) in a B2B context for a sustainable value creation?
2	What are the challenges related the collaborative role of stakeholders in co-creating value within the SPSS in B2B context?
3	What are the essential requirements (business case and technical case) for developing an AI-integrated framework?

Research Methodology

The Design Science Research Methodology (DSRM) (Hevner, 2004) is considered for this study due to the complexity of the challenges and relations regarding the analysis of various data to be used to create a novel framework. DSRM aims to create effective and purposeful artifacts that address specific research needs. It includes 6 steps (figure 3): 1.Problem Identification and Definition 2. Objectives of a solution 3. Design and Development 4. Demonstration 5. Evaluation 6. Communication. DSRM is considered as an effective approach that aligns well with the complexity of real-world problems and focuses on developing innovative solutions (Peffers et al., 2007). This method is employed in this study since the output of the research would be a framework which is integrated with AI models.

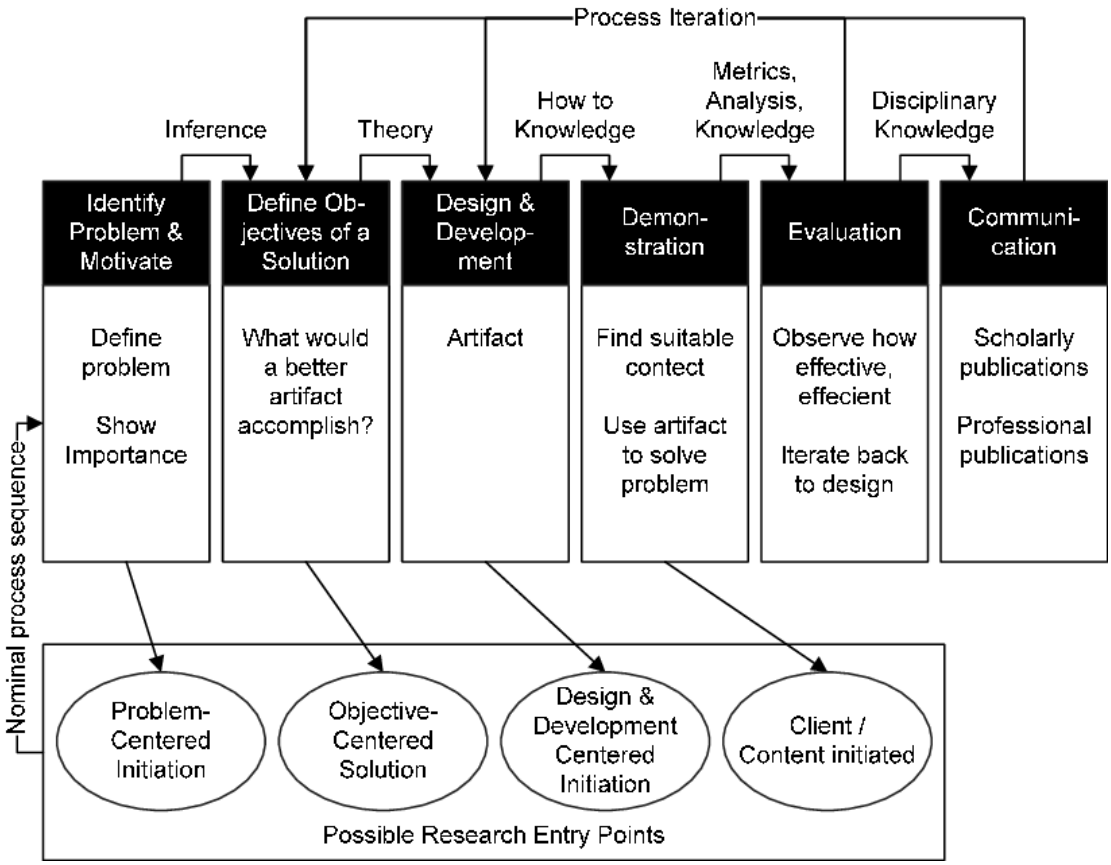

Fig3. Steps of The Design Science Research Methodology (DSRM) (Cleven et al., 2009)

The research technique uses Cognitive Mapping (Gupta, 2017) approach to develop the framework by conducting in-depth interviews with experts in B2B and relevant stakeholders. Cognitive Mapping refers to the use of a visual/mental model that can be created to navigate the understanding of complex interconnected subjects, using the experts' ideas. Regarding the

proposed framework, this technique expands the framework's depth and application, resulting in a robust model performance by the combined expertise of professionals involved. To obtain secondary data, the research will employ a systematic literature review, following the PRISMA Checklist to comprehensively examine existing scholarly literature. The flowchart of research phases is depicted in fig 4.

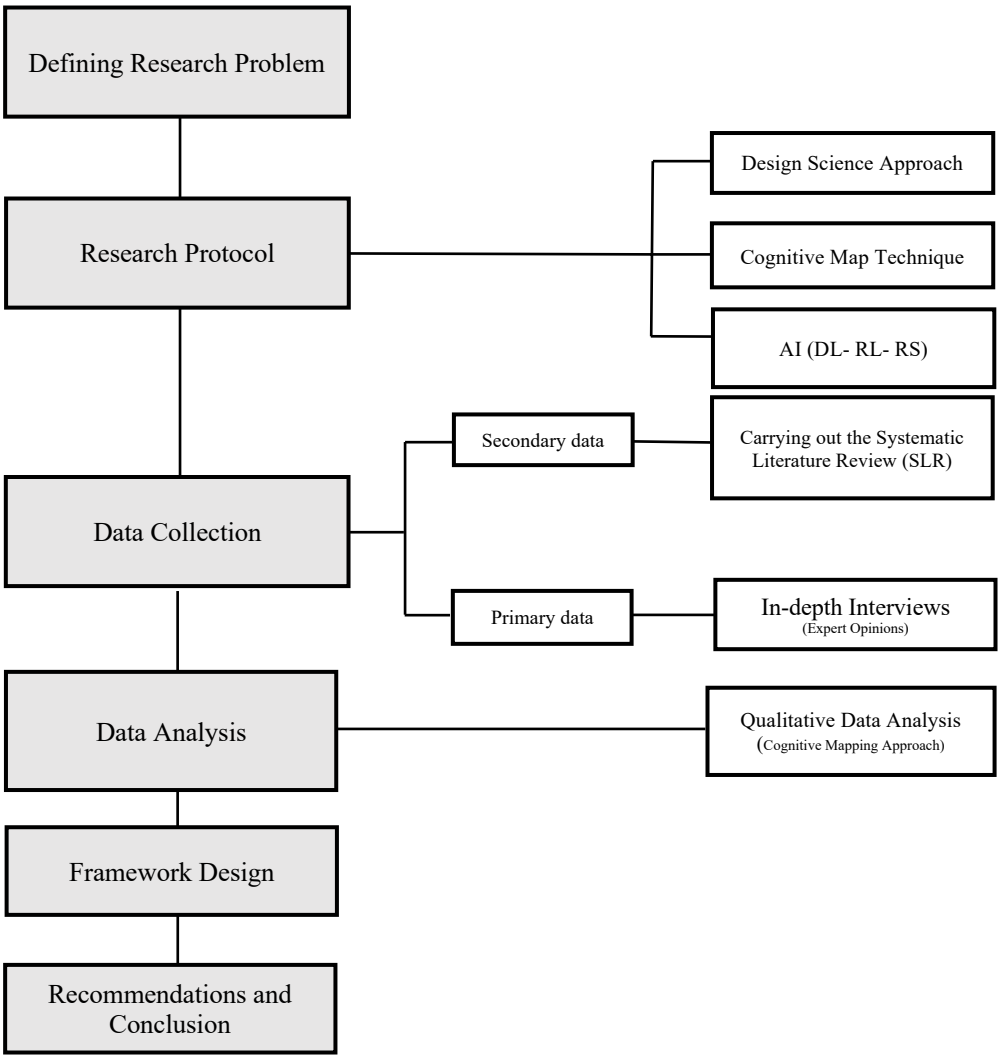

Figure 4. Flowchart of research phases

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