

Aligning ProcurComp^{EU} Competencies with Healthcare Innovation and Procurement of Innovation Challenges: A Systematic Literature Review

Author: Samuel Klucar
University of Twente
P.O. Box 217, 7500AE Enschede
The Netherlands

ABSTRACT,

The future of European healthcare faces a difficult path forward. With ageing populations, increasing healthcare demands, and escalating sustainability issues, the industry is under more pressure than ever to innovate. The healthcare procurement function, as the acquirer of innovation sourcing and implementation, thus faces a strong strategic responsibility to achieve these innovations, remedying these difficulties through increased labour productivity and sustainability. However, due to the stated challenges of rising costs, expenditures, and labour shortages, most healthcare procurement follows a cost-focused approach. This is problematic, as research shows a cost-focused approach negatively correlates with innovation sourcing & implementation. Managing costs and innovations requires innovation competencies, which are further complicated by organisational issues, a lack of R&D funding in healthcare organisations, and limited research on procurement innovation competencies, specifically in the intersection of sustainability, innovation, and healthcare procurement. The ProcurComp^{EU} framework, which was introduced to help professionalise an approach against such challenges in the EU, offers solutions, but only transactionally, meaning sustainable innovation is likely underexplored. This study aims to address this gap, using a systematic literature review to identify and analyse the competencies required for sustainable healthcare innovation. It maps these competencies against the ProcurComp^{EU} framework and evaluates whether they sufficiently address the intersection of healthcare procurement, innovation, and sustainability.

Graduation Committee members:
Dr. Klaas Stek, Dr. Liubov Pakhomova

Keywords

Healthcare Procurement, Healthcare Purchasing, Healthcare Supply Chain, Innovation, Sustainability, Competency, Competencies, Competence, Capability, Capabilities, Skill, Skills, ProcurCompEU, EU, Europe, European, European Union

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1. INTRODUCTION

1.1 Problem Statement

Healthcare plays a central role in reducing human suffering, elevating quality of life, extending life expectancy, and enabling the advancement and prosperity of economies around the world (Eurostat, 2024).

However, when looking towards its future in the European Union, two critical situations arise: (1) The first situation concerns the escalating pressures of ageing populations, rising healthcare demands, workforce shortages, higher costs, and increasingly constrained budgets. Healthcare demand and ageing population factors are particularly evident in the EU, as one of the world's oldest populations, with the projected demand for healthcare professionals being roughly 30 % higher than feasible in the next 46 years, when looking towards the future in a current status quo or 'disease burden' scenario. This forecast is especially concerning due to the EU's shrinking working-age population, limited pool of high-skilled talent in science and technology, and due to the stated budgetary limitations, which are problematic for accommodating healthcare needs, alongside rising costs and expenditures (Alba et al., 2024; Smatana, 2024). (2) The second situation concerns the increased pressure of environmental sustainability in healthcare. Climate change is arguably one of the 21st century's most significant and imminent threats, and the healthcare sector is not only a victim of its impacts but is also a major contributor to its causes and progression. The sector contributes a significant 4.6 % to total carbon emissions globally; a figure which is continuously rising. Within the EU's health care sectors, this burden is primarily driven by inefficient waste management, high volumes of single-use medical consumables, and limited circular economy implementations, and is exacerbated by upcoming regulatory initiatives from the European Commission, such as the European Green Deal, which aims to reduce emissions 55 % by 2030 compared to 1990 levels, with aims for the EU to become the world's first climate-neutral continent by 2050. Although the term 'sustainability' also concerns economic and equity factors in industries, this study focuses specifically on the environmental dimension due to its urgency and relevance to the current EU healthcare challenges stated above (Commission, 2023; Huijben et al., 2025; Kouwenberg et al., 2024; Opp & Saunders, 2013a; Watts et al., 2019).

To address these demographic, economic, and sustainability challenges, it has become increasingly important for healthcare organisations to innovate, as innovations can lead to increases in labour productivity and sustainability (Beske-Janssen et al., 2023; Woltjer et al., 2021).

According to Roberts (2001), innovations are mainly acquired or co-developed with suppliers, meaning procurement and supply chain professionals have the critical strategic responsibility of introducing such innovations into their organisational systems.

Two complications arise from this: (1) The first complication concerns the previously identified demographical and economic factors of rising healthcare demands, rising costs, limited budgets and low supply of labour, meaning most healthcare procurement officers are cost-oriented instead of innovation-focused and thus exploitation focused, as opposed to exploration focused. Such a focus is problematic, as innovation procurement significantly deviates from traditional transactional procurement, with research showing a 'cost-focus' approach negatively correlates with 'innovation sourcing & implementation' (Alba et al., 2024; Crisan, 2020; Stek & Schiele, 2021).

The adaptation of innovation competencies is thus a metaphorical tug-of-war between the two contradicting approaches of managing costs and innovations, also referred to as

ambidexterity, further complicated by organisational issues, a lack of R&D funding in healthcare organisations, and limited research in procurement innovation competencies, specifically in the intersection of sustainability, innovation, and procurement (Andrews et al., 2023; Beske-Janssen et al., 2023; Koch et al., 2020; Kristal et al., 2010).

(2) The second complication, concerning environmental sustainability can be identified using the 10-R circularity framework, where the factors of 'refuse' and 'reduce' were found to be most impactful in reducing waste. Particularly, the 'refuse' factor of this framework is important, as it highlights the need for procurement managers to have capabilities outside of cost and compliance from training and regulations, to reduce purchasing volumes. In other words, achieving sustainability may also require an overlap of exploration-focused or innovation-focused activities, outside the scope of what procurement officers are normally trained on, leaving a competency gap (Huijben et al., 2025).

The European Commission has publicly acknowledged the difficult state of public procurement in the Union, as well as its need for improvement and in 2017 released the 'Recommendation on the professionalisation of public procurement', followed by the ProcurComp^{EU} framework in 2020, alongside this recommendation, designed to create a professionalized procurement approach across organisations in the Union (PwC, 2020).

However, the ProcurComp^{EU} framework is limited in scope as a public-only procurement framework, focusing on transactional procurement. The future of healthcare requires different competencies for the procurement of innovations and the procurement of sustainability. Specifically, as previously stated, research that considers competencies in the intersection of sustainability, innovation, and procurement, where a research gap is identified. This study, therefore, aims to systematically identify and analyse the competencies required for sustainable healthcare innovation, mapping these competencies against those recommended by the ProcurComp^{EU} framework, evaluating whether they sufficiently address healthcare innovation and sustainability demands found in research. Finally, a framework is created that incorporates both the coded elements of research from the systematic literature review, along with the ProcurComp^{EU} framework, addressing the required competencies that procurement managers must incorporate to successfully achieve sustainable innovation.

1.2 Research Question

The following research question is studied:

- *RQ1:* Which competencies are needed for the intersection of healthcare procurement of sustainable innovations, and how can these competencies be mapped by the ProcurComp^{EU} framework?

1.3 Contributions

The aim of this study is to find conclusions or snowballs towards the intersection of healthcare procurement of sustainable innovations in the healthcare industry, that when implemented can lead to healthcare procurement innovations, and thus increases in help to an ageing population, budget allocation, economic prosperity, a lower carbon footprint, efficiency, accuracy, and responsiveness, whilst lowering workforce reliance. This study follows an EU scope and through a SLR, adapts the existing ProcurComp^{EU} framework, later discussing the practical implications of these results.

2. THEORETICAL BACKGROUND

2.1 Definition of Innovation

According to the OECD (2018, pp. 21, 24), the definition of a innovation is a “new improved product or process or combination of both that differs significantly from the unit’s previous products or processes that has been made available to potential users, in the form of a product, or brought into use by the unit, or process”. Product innovations refer to new and improved goods or services, whereas process innovations refer verbatim to new and improved processes.

However, specific definitions of innovation vary significantly among academia, industry, and the public sector, and are thus heavily context dependent. As this study aims to explore innovation in the healthcare sector, we can look towards the definition of public innovation procurement, which can be defined as the “commissioning and procuring of goods or services that are new to the purchasing organisation and enable a novel service to citizens or enable a more efficient or effective delivery of that service” (Taylor & Taylor, 2017; Yeow & Edler, 2012, p. 474).

The ProcurComp^{EU} framework is consistent with this definition, stating that innovation procurement involves “the buying process of R&D services”, or the “buying of outcomes of innovative solutions of others” (PwC, 2020, p. 38).

This is the innovation scope this study adopts, addressing both product and process innovations and how they can contribute to sustainable healthcare procurement.

2.2 Definition of Sustainability

Although no census amongst scholars exists for a universally accepted definition of sustainability, a widely accepted definition is from the Brundtland Report of the United Nations (1987, p. 15), as “meeting the needs of the present without compromising the ability of future generations to meet their own needs”.

Another commonly used framework to explain sustainability is the Three E’s Framework of Opp and Saunders (2013a). According to this framework, sustainability concerns the environmental, economic, and equity factors of industries. In this context, this study is only concerned with the environmental sustainability factor, given its previously stated urgent and immediate impact on the EU healthcare industry (Commission, 2023; Huijben et al., 2025; Kouwenberg et al., 2024; Nations, 2025; Opp & Saunders, 2013a; Watts et al., 2019).

2.3 Definition of Competencies

From a resource-based view, organisations are made up of resources, which when used and combined, function as competencies; the knowledge, skills and abilities that individuals in an organisation need to successfully and efficiently complete tasks. According to Le Deist and Winterton (2005), these competencies can be either conceptual and operational, for achieving occupational effectiveness, or meta-competence and social for achieving personal effectiveness. Conceptual competencies regard the ability to gain knowledge and understand it, while operational competencies entail the functional and applied skills of a given occupation. Meta competences regard the ability to learn and reflect, and finally social competences regard having necessary behaviours and attitudes. Each of these dimensions are relevant towards achieving competencies at the intersection of sustainability healthcare and innovation. In the context of the EU, the ProcurComp^{EU} framework has been the most instrumental in

standardising these practices (Halley & Beaulieu, 2001; Kiers et al., 2022; Lado et al., 1992).

2.4 Dynamic Capabilities Theory

Dynamic capabilities theory refers to an organisation’s “capacity to sense and shape opportunities and threats, seize opportunities, and to maintain competitiveness through enhancing, combining, protecting, and, also when necessary, reconfiguring the business enterprise’s intangible and tangible assets”. This theory builds on the resource-based view, addressing the strategic need to not only make use of resources, but to be able to adapt to and transform these resources when needed. Sensing refers to identifying technological and market opportunities. Seizing refers to capturing the value of opportunities. Reconfiguring, finally, refers to transforming competencies to current needs (Teece, 2007, p. 1319).

In the context of this study, European healthcare requires such competencies, due to the status quo of the increasing and previously stated demographic, economic, and sustainability challenges. The current landscape of healthcare procurement can no longer afford to act transactionally. Healthcare organisations must adopt sensing capabilities, to find implementable sustainability and innovation solutions. They must also adopt seizing capabilities to be able to capture these opportunities through suppliers. Lastly, they must be able to reconfigure these capabilities, when needed. The ProcurComp^{EU} framework, although a highly valuable tool for enhancing public procurement competencies, is limited in this exact area, due to its transactional focus. This study thus uses this framework, as both an explanation for why dynamic capabilities are needed, examining whether ProcurComp^{EU} sufficiently addresses sustainable innovation procurement in healthcare.

2.5 Explanation of ProcurComp^{EU}

The ProcurComp^{EU} framework developed by the European Commission in 2020, is a competency framework designed to professionalise public procurement across organisations in the EU. The framework consists of thirty competencies, grouped under two broad categories (1) Procurement-specific competences, (2) Soft competences, each of which are subdivided into their own three clusters. (1) Procurement-specific competences are subdivided into (1a) Horizontal, (1b), Pre-award (1c) Post-Award clusters. (2) Soft competences are subdivided into (2a) Personal, (2b) People, (2c) Performance clusters. Horizontal clusters refer to competencies that are applicable through all stages in the procurement process. In contrast, pre-award clusters are only applicable before the tender stage, and post-award clusters are only applicable after the tender stage. Regarding soft competencies, personal clusters address the behaviours and attitudes individuals should possess to procure successfully. In contrast, the people cluster addresses the competencies individuals should have when interacting with others, and finally, the performance cluster refers to the competencies that increase value for money. Each are described in detail under the proficiency levels of (1) Basic, (2) Intermediate, (3) Advanced, (4) Expert. This ranking reflects the success of procurement departments in reaching the framework’s pre-determined targets. This is helpful for identifying and structuring procurement roles, performing individual gap analysis, performing a gap analysis within an organisation, and defining measures; for example, for training or recruitment. (PwC, 2020)

In the context of this study, the full competency matrix found in [Appendix 1](#), will be used a comparative tool to address whether

healthcare sustainable innovation competencies are sufficiently covered by results of the conceptual framework.

2.6 Hypothesis

The hypothesis of this study is:

- *H1*: It is the belief of this study, that the ProcurComp^{EU} framework does not sufficiently cover the competencies required for the procurement of sustainable innovations in healthcare, because of the framework's transactional focus.

3. RESEARCH METHODOLOGY

3.1 Systematic Literature Review

To reduce bias and errors, the systematic literature review framework of Durach et al. (2017), of six steps is followed throughout the methodology of this paper.

(1) The first step of this framework, or the 'defining of the research question' step, has already been, for the most part, answered in the previous section. To further build on this part in more detail, the unit of analysis explored in this study are healthcare organisations, board and policy makers, medical staff and finally the procurement department itself. This is due to research showing that each has the capability to influence procurement efforts, for example, through maverick buying (Karjalainen et al., 2009).

(2) In step two of the SLR framework, inclusion/exclusion criteria are developed. As the scope of this research targets public healthcare organisations in the EU, this study considers research on EU public hospitals, healthcare procurement and EU-funded procurement programs. The scope of the private sector is excluded. Non-EU material is also excluded, except for synthesised studies targeting multiple countries simultaneously. This decision was made due to the limited number of studies available and the generalisations of these findings, as opposed to the findings of specific countries outside the EU, which are more likely to hold greater bias. Furthermore, as the context of this research concerns the intersection of healthcare procurement, innovation, and sustainability, studies that focus on only one of these factors are also excluded. For example, papers which only concerned innovation or only concerned sustainability in a healthcare procurement context were treated as invalid and removed. Lastly, only peer-reviewed journal articles and reviews were used to capture the most recent research. Non-peer-reviewed materials, such as textbooks, were excluded from the review. (3) In step three of the framework, keywords for our systematic search are developed. See Figure 1 for a visual demonstration of the logic behind why the chosen search string was chosen. The grey area represents the intersection of healthcare procurement, sustainability, and innovation, which the study aims to capture. The following string was used to find articles on the Scopus database: TITLE-ABS-KEY ("Healthcare procurement" OR "Healthcare purchasing" OR "Healthcare supply chain") AND ("Sustainability") AND ("Innovation") AND ("Competency" OR "Competencies" OR "Competence" OR "Capability" OR "Capabilities" OR "Skill" OR "Skills" OR "ProcurCompEU") AND ("EU" OR "Europe" OR "European" OR "European Union") AND (LIMIT-TO (SUBJAREA , "BUSI") OR LIMIT-TO (SUBJAREA , "SOCI") OR LIMIT-TO (SUBJAREA , "MEDI") OR LIMIT-TO (SUBJAREA , "ECON") OR LIMIT-TO (SUBJAREA , "HEAL") OR LIMIT-TO (SUBJAREA , "NURS") OR LIMIT-TO (SUBJAREA , "MULT")) AND (LIMIT-TO (LANGUAGE , "English")).

Through limiting the number of papers using filters, a total of 14 papers were identified as useful for conducting our analysis. See [Appendix 2](#) for keyword search details.

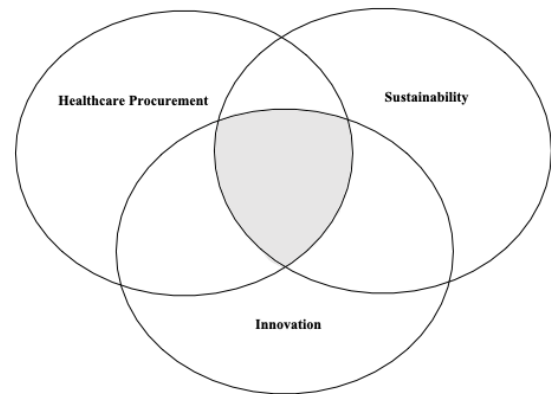


Figure 1. Logic of Systematic Literature Review (SLR), adapted from Beske-Janssen et al. (2023)

(4) In step four of the SLR framework, inclusion/exclusion criteria are applied. The following diagram adapted from Page et al. (2021), showcases when and how exclusion criteria were applied in a visual format. The final number of sources to be used for the next stage of our SLR is 14 sources. See Figure 2 for this flow diagram. Furthermore, Table 1, found in [Appendix 3](#) showcases the literature matrix of the chosen papers.

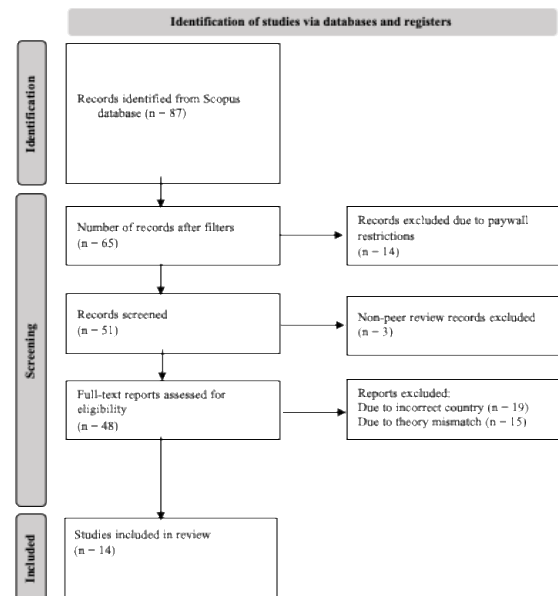


Figure 2. Systematic Literature Review (SLR) Flow Diagram, adapted from (Page et al., 2021)

(5) Following step four, where a total of 14 sources were chosen, the next step involved applying coding schemes and extracting pertinent information from the selected literature. The process in step five was completed manually using Microsoft 365 Excel. When coding, each source was chosen according to its relevance to the research question, where an overlap in sustainability, innovation and healthcare procurement was found. Selection was based on both implicit and explicit definitions of

innovation and sustainability in healthcare procurement and in the research bounds of each individual article. For example, if an article stated innovations in disruption management led to increased sustainability, this was not considered as knowledge when coding for disruption in another paper. Furthermore, as previously defined, only environmental sustainability was coded. Lastly, duplicate mentions of a single variable, such as disruption, were coded only once per article. In this way, an academically sound frequency overview of codes across the chosen papers was possible. A frequency table of the 74 codes from the raw data can be found in Figure 3. See Appendix 4, for a detailed overview per code.

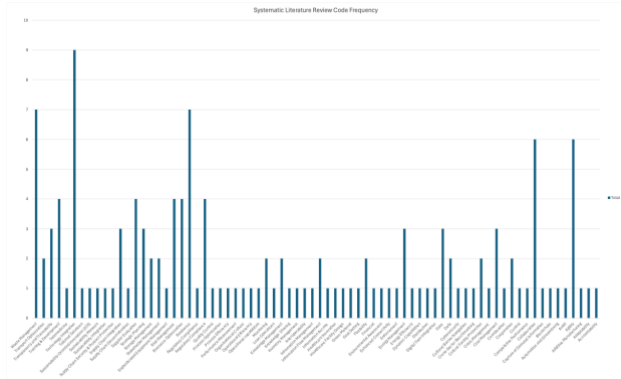


Figure 3. Systematic Literature Review (SLR) Code Frequency Diagram

Next, to synthesise these findings, all codes were summarised and integrated or cumulated according to their findings. From the analysis, six common themes appeared amongst our codes: (1) Environmental Codes, (2) Digital & Technological Codes, (3) Risk & Compliance Codes, (4) Operational Codes, (5) Collaborative & Training Codes, (6) Adaptive Codes.

3.2. Codes

3.2.1 Environmental Codes

For this initial cluster, the raw codes of waste management, energy management, environmental awareness, green materials, sustainability-oriented innovation (SOI), sustainability mimesis, sustainability integration, and energy efficiency were considered as contributors to environmentally sustainable innovation outcomes in healthcare procurement.

3.2.2 Digital & Technological Codes

Digital & technology codes concern the adoption of new and emerging technologies. The raw codes were found to be blockchain, automation and streamlining, technology integration, enhanced connectivity, interoperability, data, cybersecurity, information access, information management, transparency and traceability, sophisticated equipment management and healthcare innovation.

3.2.3 Risk & Compliance Codes

For risk & compliance, the raw codes of risk management, resilience, crisis management, supply chain security & product protection, regulatory compliance, accountability, and enforcement were chosen.

3.2.4 Operational Codes

For operational codes, or codes which emphasises efficiency, performance management and other day-day operations, the codes of process optimisation, process efficiency, operational efficiency, lean operations, resource optimisation, performance measurement, competitive performance, monitoring, and control were chosen.

3.2.5 Collaborative & Training Codes

Collaborative and training codes concern all the people centric codes we found. These were found to be cooperation, coordination, collaboration, organisational culture, stakeholder management, cultural barrier navigation, knowledge management, knowledge sharing, capture and demand information, training and development and cross-sector benchmarking.

3.2.6 Adaptive Codes

Lastly, regarding adaptive codes. These were the combination of codes needed to respond and adapt to changing environments. The codes used for this cluster were strategic planning, goal setting, dynamic capabilities, adaptability, agility, flexibility, operational capabilities, and tailored solutions.

4. RESULTS

4.1 Thematic Analysis

Following the compilation of the codes, key competency areas from these codes were synthesised in a thematic analysis. In the next steps each of the aforementioned codes are analysed, and relevant competencies are extracted to be mapped to the existing structure of the ProcurComp^{EU} framework in a new framework, forming a basis for comparison. Finally, for step (7) of Durach et al. (2017), the conceptual framework of this study and its results are presented.

4.1.1 Environmental Competencies

The theme of environmental sustainability showcases the enabling competencies required to reduce an organisation's environmental impact, alongside innovation. In this theme, horizontal, pre-award and post-award procurement clusters were identified. Further, performance and personal soft clusters were also identified.

For the horizontal cluster, sustainability integration and sustainability-oriented innovation (SOI) competencies are extracted from our codes. Sustainability integration was found as the competence required for future healthcare success, due to the significant environmental impacts of the healthcare industry and an increasingly scrutinising external environment, demanding more sustainability. Furthermore, when looking across the industry, transformative changes are increasingly adopting sustainability practices, marking an important innovative shift, where the competencies to successfully integrate innovations have grown in importance (Ebrahimzadeh-Afrouzi & Asadpour Ahmadchali, 2023; Jia et al., 2025).

Sustainability-oriented innovation (SOI) is the competency for implementing new and improved practices within an organisation's systems and processes to drive innovation. Specifically, SOI targets innovations that "create social and environmental value, as well as ... promote economic returns"; a

crucial competency for sustainable procurement transformation (Adams et al., 2015; Elabed et al., 2024, p. 295; Kusi-Sarpong et al., 2019).

Next, for the pre-award cluster, green materials selection and energy-efficiency criteria competencies are extracted. These competencies arise from the need to reduce environmental issues such as pollution, and to increase circularity and reduce costs. Specifically for green materials selection, when negotiating contracts for new healthcare equipment, “medical products should be designed to be biodegradable and recyclable ... made from natural non-toxic materials”, allowing for environmental, circular and cost-reduction solutions (Kanokphanvanich et al., 2023, p. 12).

For energy-efficiency criteria, procurement managers can also achieve the above-stated solutions by having the competencies to successfully select suppliers, which prioritise energy efficiency in their operations, as practices such as optimising HVAC systems, implementing energy-efficient lighting, and redesigning processes to minimise waste were particularly effective ... in reducing energy consumption and waste generation” (Jia et al., 2025, p. 12).

For the post-award cluster, competencies in waste management and reverse logistics are extracted. These competencies ensure that upon contract fulfilment, procurement bodies are able to implement best practices, reduce costs and increase sustainability. Such practices include implementing partnerships with specialised waste management suppliers or offering incentives to healthcare facilities for returning unused or expired medication, leading to increased recovery rates in a closed-loop supply chain system (Elabed et al., 2024; Jia et al., 2025; Scavarda et al., 2019).

For the soft competencies cluster, divided into performance and personal clusters, the competency of environmental awareness was extracted alongside sustainability mimesis. Finally, the competency of environmental awareness was extracted, which addresses the need for healthcare procurement bodies to be able to “carefully assess the environmental impacts across the entire supply chain”, due to the rising importance of sustainability (Jia et al., 2025, p. 17).

4.1.2 Digital & Technology Competencies

The theme of digital & technology competencies showcases the enabling competencies for technological innovations in healthcare procurement, enhancing capabilities in areas such as sustainability and cost reduction. In this theme, horizontal and post-award procurement clusters were identified. Further, the personal soft cluster was also identified.

For the horizontal cluster, technology integration and innovation integration competencies were extracted. The competency of technology integration is important, as it has the capabilities to “boost productivity, bring in new possibilities for the circular economy, and increase transparency, product customisation, and sustainability”, for example, through the application of Industry 4.0 technologies across the procurement body. These technologies, such as artificial intelligence (AI), internet of things (IoT), automation and robotics, are significantly relevant according to numerous scholars and recent research in 2025 (Godinho Filho et al., 2022; Muhammad Ibrahim Khan, 2024, p. 333).

Innovation integration concerns the ability for procurement managers to implement innovations successfully, for example, through process improvements like helping support the commonly persisting issues of monitoring and transparency when implementing digitised Industry 4.0 technologies, which affect sustainability (Ma et al., 2023; Muhammad Ibrahim Khan, 2024).

For the pre-award cluster, the competency of data analytics was extracted, specifically the use of big data to create analytics. Such analytics allow for the development of “resilient, innovative, responsive, and sustainable SC flows”, with the specific pre-award use of improving supplier selection, through improved information capabilities (Bag et al., 2020; Chatterjee et al., 2023). For the post-award cluster, the competency of transparency & integrity was extracted. In research, this competency is more specific to the integration of blockchain technology, allowing for “more transparent transactions, decentralised power mechanisms, and stronger trust amongst parties”. In turn, these benefits enable more accurate sustainability monitoring, lower costs through negotiations, and increase the likelihood of working with the most innovative suppliers (Muhammad Ibrahim Khan, 2024, p. 334).

For the soft competencies personal cluster, the competency of digital literacy was extracted, with healthcare managers needing to be “proficient at both managerial and technical levels to promulgate innovative technologies and organisational methods efficiently”. In turn, this competency thus leads to sustainable healthcare innovation procurement (Elabed et al., 2024; Oloyo et al., 2019).

4.1.3 Risk & Compliance Competencies

The theme of risk & compliance competencies showcases the enabling competencies for adaptable and adherent supply chains. In this theme, horizontal and post-award procurement clusters were identified. Further, performance and personal soft clusters were also identified.

For the horizontal cluster, the competency of resilience is extracted, as it not only drives competitiveness, through for example “reducing energy consumption, effective logistics strategies, optimising transport routes, and using technology to spot inefficiencies early”, but also the survival of organisations, which increasingly need to adjust to dynamic situations”, especially in healthcare. One lesson from COVID-19, one of these dynamic situations, was that resilient supply chains not only enabled agile logistics but also contributed to sustainability. Thus, resilience is not only important for ensuring daily operations, but also for helping the environment (Muhammad Ibrahim Khan, 2024, p. 332; Senna et al., 2024).

For the post-award cluster, the competency of regulatory enforcement is extracted, as research shows that when crises arise, regulation importance fluctuates. It’s crucial to enforce regulations, especially in procurement departments, to ensure that sustainable innovation goals are met accordingly (Jia et al., 2025).

Regulatory enforcement can be built on by the competency of accountability found in the personal soft competency cluster, with findings showing that by “taking accountability into consideration, supply chain entities contribute to environmental sustainability and promote responsible practices throughout the product disposition process”; all of which are once again key to developing sustainable innovation in healthcare procurement (Giri et al., 2024, pp. 504-505).

4.1.4 Operational Competencies

The theme of operational competencies highlights the focus on optimising processes, reducing waste, and ensuring the maximisation of resources. In this theme, no new procurement clusters or competencies were found. However, two competencies in the performance soft cluster were identified.

For this performance cluster, competencies in performance management and resource optimisation were extracted. The importance of performance management is well-documented in

research as a means of improving performance, particularly in sustainable healthcare supply chains, through innovative management methods. As further evidence of its importance, numerous scholars have created models for its best implementation. For example, through new models in “maintaining customer and stakeholder satisfaction by considering both sustainability and intangible characteristics” (Elabed et al., 2024, pp. 299-300; Leksono et al., 2019). The competency of resource optimisation is essential, as lower resources mean less service availability and consequently, less sustainability and innovation, especially in procurement departments (Elabed et al., 2024; Mathur et al., 2018).

4.1.5 Collaborative & Training Competencies

The theme of collaborative and training competencies focuses on the people aspect of the organisation, including the learning and development aspects of organisations. In this theme, no new procurement clusters or competencies were found. However, competencies in people and performance soft clusters were identified.

In the people cluster, the competencies of stakeholder management and collaboration were extracted. Stakeholder management competencies are necessary for procurement departments due to the complex relationships within healthcare organisations. Namely, changes in, for example, implementing innovations are complicated by organisational mindsets, inner-organisation baronies, tribalism, and scepticism. These resistance networks, alongside expertise implementation issues, are problematic and negatively influence both innovation and sustainability (Jia et al., 2025).

The competency of collaboration is essential, as sustainability requires collaboration from both inner organisation and outer organisation stakeholders to be successful. Specifically, from an inner and innovation perspective, Industry 4.0 requires collaboration to be successfully integrated within the organisation, including within procurement departments, whereas from an outer perspective, “partnerships with non-profits and advocacy groups have been found to lead to increased sustainability (Jia et al., 2025; Kanokphanvanich et al., 2023).

In the performance cluster, the competency of knowledge-sharing was extracted. Knowledge-sharing competencies are essential, especially in the healthcare sector, as a lack of knowledge can lead to loss of life. However, as this paper concerns innovation and sustainability, the sharing of supply chain processes has been found to help align requirements with purchased resources, increasing innovation. In turn, it can be assumed that the more requirements are aligned, the less waste and thus more sustainability is present in implementing this competence (Ancarani et al., 2016; Elabed et al., 2024).

4.1.6 Adaptive Competencies

The theme of adaptive competencies focused on the competencies needed to successfully adapt to healthcare’s sustainable innovation challenges. In this theme, no new procurement clusters or competencies were found. However, competencies in the performance soft competencies cluster were identified.

In this cluster, the competency of agility was extracted, with the COVID-19 pandemic showing the importance of introducing such a competency, helping healthcare organisations economically in dynamic situations, but also in helping increase sustainability across the supply chain (Kanokphanvanich et al., 2023; Vali-Siar & Roghanian, 2022).

Next, the competency of dynamic capabilities is extracted. This competency not only backs the theoretical background behind

this study but is also valuable, due to its direct capabilities healthcare to help organisations successfully procure sustainable innovations; namely, through sensing, seizing and developing opportunities (Chatterjee et al., 2023).

4.2 Conceptual Framework

Together, from the extraction of codes from literature, 23 competencies are found at the intersection of healthcare procurement, innovation, and sustainability. Figure 4 showcases these competencies mapped within a conceptual framework, adapted from the ProcurComp^{EU} framework of the European Commission, serving as a direct comparison to the competencies research recommends for sustainable healthcare innovation procurement.

Category of competence	Cluster of competences	Competence
Procurement Specific	Horizontal	1. Sustainability integration
		2. Sustainability-oriented innovation (SOI)
		3. Technology integration
		4. Innovation integration
		5. Resilience
	Pre-Award	6. Green materials selection
		7. Energy-efficiency criteria
		8. Data Analytics
	Post-Award	9. Waste management
		10. Reverse logistics
		11. Transparency & Integrity
		12. Regulatory enforcement
Soft	Personal	13. Sustainability mindset
		14. Digital literacy
		15. Accountability
	People	16. Stakeholder management
		17. Collaboration
	Performance	18. Environmental awareness
		19. Performance management
		20. Resource optimisation
		21. Knowledge-sharing
		22. Agility
		23. Dynamic Capabilities

Figure 4. Conceptual Framework Adopted from ProcurComp^{EU} Framework

4.3 Comparison of Frameworks

Competency from Research	ProcurComp ^{EU} Competency	Level of Coverage
Sustainability integration	Sustainable Procurement	Match
Sustainability-oriented innovation (SOI)	Innovation Procurement	Partial Coverage
Technology integration	E-Procurement and other IT tools	Match
Innovation integration	Innovation Procurement	Partial Coverage
Resilience		No Coverage
Green materials selection	Technical Specifications	Partial Coverage
Energy-efficiency criteria	Technical Specifications	Partial Coverage
Data Analytics	Analytical and Critical Thinking	Partial Coverage
Waste management		No Coverage
Reverse logistics		No Coverage
Transparency & Integrity	Reporting and Evaluation	Partial Coverage
Regulatory enforcement	Ethics and Compliance	Partial Coverage
Sustainability mimesis		No Coverage
Digital literacy	Adaptability and Modernisation	Partial Coverage
Accountability	Ethics and Compliance	Match
Stakeholder management	Stakeholder Relationship Management	Match
Collaboration	Collaboration	Match
Environmental awareness		No Coverage
Performance management	Business and Performance Orientation	Partial Coverage
Resource optimisation	Business and Performance Orientation	Partial Coverage
Knowledge-sharing		No Coverage
Agility	Adaptability and Modernisation	Match
Dynamic Capabilities		No Coverage

Figure 5. Healthcare Procurement Sustainable Innovation Competency Framework vs ProcurComp^{EU} Framework

In Figure 5. The findings of the competencies identified in research are compared to those found in the ProcurComp^{EU} framework. Using this comparison table, the hypothesis of this study is addressed, specifically whether the ProcurComp^{EU} framework sufficiently covers the competencies required for healthcare procurement of sustainable innovations, or if it lacks in this area due to its transactional focus. To come to a just conclusion, findings are categorised into levels of coverage. No coverage means that, when compared to the ProcurComp^{EU} framework, no equivalent competencies were found. Partial coverage means elements of competencies were similar but lacked a specific focus to be considered a match. A match refers to a strong implicit or explicit alignment of competency factors between the two frameworks. Starting with horizontal competencies, sustainability integration, sustainability-oriented innovation (SOI), resilience, technology integration, innovation integration, and sustainability integration were analysed. Here, sustainability integration was found to match with the ProcurComp^{EU} competency of sustainable procurement, and the competency of technology integration was found to match with the ProcurComp^{EU} competency of e-procurement and other IT tools competency. The remaining competencies were found to be partial matches, except for resilience, which was not identified in the ProcurComp^{EU} framework. Specifically, the ProcurComp^{EU} innovation procurement competence lacked a focus on sustainability compared to sustainability-oriented innovation (SOI). Next, for the pre-award cluster, green materials selection, energy efficiency criteria, and data analytics were all found to be a partial match for the ProcurComp^{EU} competencies of technical specifications and analytical and critical thinking. This is due to a lack of focus on sustainability in these competencies. Furthermore, the competency of big data and digital analytics from this research had a higher innovative and digital focus compared to the underdeveloped ProcurComp^{EU} competency of analytical and critical thinking, leading to a partial coverage result. For the post-award cluster, waste management and reverse logistics competencies were identified as missing by ProcurComp^{EU} competencies. Transparency and integrity were also partially covered, due to a lack of innovation and sustainability in ProcurComp^{EU} competency of reporting and evaluation, which

also gave no recommendations for new technologies, such as blockchain. For regulatory enforcement, the ProcurComp^{EU} of ethics and compliance showed a lack of sustainability or innovation-focused regulations and could thus also be considered a partial coverage competency. For the personal cluster of soft competencies, sustainability mimesis was found to be missing, with digital literacy serving as a partial match, and accountability matching the ethics and compliance competency of the ProcurComp^{EU} framework. For digital literacy, the matching ProcurComp^{EU} competency of adaptability and modernisation lacked specific mentions of digital skills that procurement managers should possess. For the people cluster of soft competencies, both stakeholders and management, as well as collaboration, matched with the competencies of ProcurComp^{EU}, specifically for the framework's stakeholder relationship management and collaboration competencies. Finally, for the performance cluster of soft competencies, agility was found to be a match to the ProcurComp^{EU} competence of adaptability and modernisation. However, environmental awareness, knowledge sharing, and dynamic capabilities were found to be missing. Lastly, performance management and resource optimisation weren't covered sufficiently by the ProcurComp^{EU} competency of business and performance orientation, indicating that performance orientation lacked a strong focus on sustainability and innovation needed to establish a match. (PwC, 2020)

Level of Coverage	Count	Percentage %
Match	6	26,1
Partial Coverage	10	43,5
No Coverage	7	30,4

Figure 6. Healthcare Procurement Sustainable Innovation Competency Framework vs ProcurComp^{EU} Framework Level of Coverage Comparison

The results presented in Figure 6, showcase that roughly only 26 % of ProcurComp^{EU} competencies matched healthcare procurement sustainable innovation competencies, of which roughly 30 % were not covered at all and roughly 43 %, were partially covered. Thus, it can be argued that ProcurComp^{EU} lacks the necessary coverage to successfully influence and improve sustainable innovation procurement in healthcare, thereby supporting *H1*, which states that the hypothesis of this study is correct.

5. DISCUSSION

5.1 Conclusion

In conclusion, the future of European healthcare faces a difficult path forward. With ageing populations, increasing healthcare demands, rising costs, and escalating sustainability issues, more pressure is being put on the industry than ever. The healthcare procurement function, as acquirers of innovation sourcing & implementation, thus now has the strong strategic responsibility of achieving innovations, increasing labour productivity and sustainability in their organisations. However, due to rising costs, expenditures and labour shortages, a cost-focused approach is predominantly seen amongst healthcare departments in this function. This is problematic, as research shows a cost-focused approach

negatively correlates with innovation sourcing & implementation. Managing costs and innovations requires innovation competencies, further complicated by organisational issues, a lack of R&D funding in healthcare organisations, and limited research in procurement innovation competencies, specifically in the intersection of sustainability, innovation, and healthcare procurement. Our findings showcase this intersection and, through an SLR, identify 23 competencies to improve sustainable innovation in healthcare procurement departments. When compared to the ProcurComp^{EU} framework, our hypothesis is supported, indicating that the ProcurComp^{EU} framework is unable to capture the full range of competencies required for sustainable innovation procurement in healthcare.

5.2 Practical Implications

With the rising importance of sustainability and innovation in healthcare procurement, this study highlights 23 competencies for the intersection of these needs in research, with the aim of reducing pressure on the healthcare sector. Competencies are adopted by the widely used public procurement framework of ProcurComp^{EU} and split accordingly into (1) Procurement-specific competences, (2) Soft competences, subdivided into their own three clusters. (1) Procurement-specific competences are subdivided into (1a) Horizontal, (1b), Pre-award (1c) Post-Award clusters. (2) Soft competences are subdivided into (2a) Personal, (2b) People, and (2c) Performance clusters. In healthcare, such competencies can be highly useful for the training or career development of employees, for improving the skills of workers and for the strategic benefit of healthcare procurement functions as a whole. (PwC, 2020) Furthermore, healthcare organisations that are already familiar with this framework are able to bypass a learning curve and directly adopt competencies aimed at innovating their departments, increasing their sustainability efforts, and helping them increase their labour productivity, amongst other factors growing in importance in the year 2025.

5.3 Theoretical Implications

The findings of this study contribute to academia by extending the ProcurComp^{EU} framework to a relevant research gap in the literature, targeting a critical real-life problem. This study finds that the ProcurComp^{EU} framework, although relevant across industries in establishing procurement competencies, cannot meet the growing innovation and sustainability needs of procurement departments in healthcare, due to the framework's transactional focus. Thus, procurement theory must evolve to accommodate these factors, especially in the healthcare industry, and further research is needed in this field, given the current lack of knowledge. This study aims to build upon such theory through the creation of a conceptual framework for new sustainable innovation procurement competencies for procurement professionals in healthcare, laying a foundation for future research.

5.4 Limitations

In accordance with Durach et al. (2017), several limitations are present in this study. For the SLR; As no expert searchers were used, there is a risk the sampling stage included sampling bias, retrieval bias or publication bias. To combat this, the keywords of the study were approved by the head supervisor of this paper prior to beginning research. Additionally, only peer-reviewed studies were used.

Furthermore, this is a single study conducted by a single researcher. As there is less expertise, honesty, and transparency in the design of selection criteria, and a higher probability that the inclusion or exclusion of material was subjective. In the coding stage, as no other coders were used, study data may be falsely coded, with incorrect outcomes, due to within-study bias. Finally, in terms of bias, no parallel or blind synthesis involving other researchers was conducted, meaning that the synthesis of the study data may be subjective due to expectancy bias. To remedy these biases, academic honesty and integrity were followed throughout the writing of this paper, and material was used objectively to the greatest extent possible. Next, the scope of research in this paper is limited, as it can be argued that 14 research papers are still insufficient in being able to grasp the entire knowledge of healthcare innovation competencies. The exact number of documents was unavailable due to paywall restrictions, another limitation; however, it is well known that research in this area is limited.

In terms of theory, the definition of sustainability in this paper is also limited, with sustainability encompassing not only environmental concerns, but also social and economic concerns according to the Three E's framework of Opp and Saunders (2013b). The use of environmental sustainability allowed for a strong research focus grounded in practical theory, but its definition is broader than that researched in this study.

5.5 Future Research

Research on capabilities in the intersection of healthcare procurement, sustainability, and innovation is significantly limited. More research is needed in the field to show evidence for the claims of this paper, specifically given the importance of these issues. Furthermore, as procurement theory must evolve to accommodate the needs of innovation and sustainability, research for this intersection may also be applicable to other industries, leading to greater solutions worldwide. Nonetheless, when aiming specifically for healthcare competencies, future research is vital for the upcoming challenges to this industry, and most importantly, to save lives.

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APPENDIX 1. PROCURCOMP^{EU} COMPETENCY FRAMEWORK

1.2. Overview of the 30 ProcurComp^{EU} competences

An overview of the **30 competences** contained in the Competency Matrix is available in the table below.

Table 1: Overview of competences

Category of competence	Cluster of competences	Competence
Procurement specific	Horizontal	1. Planning
		2. Lifecycle
		3. Legislation
		4. e-Procurement and other IT tools
		5. Sustainable procurement
		6. Innovation procurement
		7. Category specific
		8. Supplier management
		9. Negotiations
	Pre-award	10. Needs assessment
		11. Market analysis and engagement
		12. Procurement strategy
		13. Technical specifications
		14. Tender documentation
		15. Tender evaluation
	Post-award	16. Contract management
		17. Certification and payment
		18. Reporting and evaluation
		19. Conflict resolution and mediation
Soft	Personal	20. Adaptability and modernisation
		21. Analytical and critical thinking
		22. Communication
		23. Ethics and compliance
	People	24. Collaboration
		25. Stakeholder relationship management
		26. Team management and Leadership
	Performance	27. Organisational awareness
		28. Project management
		29. Business and performance orientation
		30. Risk management and internal control

PwC (2020, p. 29)

APPENDIX 2. KEYWORD SEARCH DETAILS

Keywords	Initial hits	Hits in relevant subject areas	Usable and assessed papers	Search key
Healthcare procurement, Healthcare purchasing, Healthcare Supply Chain, Sustainability, Innovation, Competency, Competencies, Competence, Capability, Capabilities, Skill, Skills, ProcurCompEU, EU, Europe, European, European Union	87	65	14	TITLE-ABS-KEY ("Healthcare procurement" OR "Healthcare purchasing" OR "Healthcare supply chain") AND ("Sustainability") AND ("Innovation") AND ("Competency" OR "Competencies" OR "Competence" OR "Capability" OR "Capabilities" OR "Skill" OR "Skills" OR "ProcurCompEU") AND ("EU" OR "Europe" OR "European" OR "European Union") AND (LIMIT-TO (SUBJAREA , "BUSI") OR LIMIT-TO (SUBJAREA , "SOCI") OR LIMIT-TO (SUBJAREA , "MEDI") OR LIMIT-TO (SUBJAREA , "ECON") OR LIMIT-TO (SUBJAREA , "HEAL") OR LIMIT-TO (SUBJAREA , "NURS") OR LIMIT-TO (SUBJAREA , "MULT")) AND (LIMIT-TO (LANGUAGE , "English"))

APPENDIX 3. LITERATURE MATRIX TABLE

Author (Date)	Journal	Definition of Innovation /Sustainabi lity	Theoretical/ Conceptual/ Competency Framework	Procurement Context/Strategy	Competencies Addressed	Innovation Type	Sustainability focus	Methodology	Key Findings	Relevance to RQ / Intersection
Arji et al. (2023)	Informatics In Medicine Unlocked	Innovation – new methods ideas, products for SC enhancement / Sustainability general definition	HCSC resilience important amongst emerging technologies / Dynamic capabilities not explored in study but applicable	Focus on HCSC resilience and technology in healthcare procurement	Need for better Integration and Collaboration across different sectors of HCSC, Adaptability, Technology integration, Strategic planning	Technological innovation to enhance resilience and efficiency in disruptions – AI, Big data, Simulation methods in HCSC	Operation efficiency and environmental concerns of transportation impacts, need for efficient logistics – intermodal transport as potential reducer	Systematic literature review	Majority of new research has focused on resilience strategies for COVID-19, while emerging tools rarely explored	Concerns environmental sustainability, Identifies technological innovation for resilience and efficiency – Conceptual overlap / Intersection yes
Kumar et al. (2023)	Journal of Business Research	Innovation is HCSC resilience – flexibility, adaptability / Sustainability – waste reduction, logistics efficiency, circularity	Dynamic capabilities theory implicitly, HCSC resilience	Procurement in logistics, collaboration, waste management, reverse logistics integration perspective procurement	Advanced data analytics, Ability to invest in new channels and processes, Adoption of advanced digital transformative technologies, Responsible supply chains	Process innovation – reverse logistics closed-loop supply chains, waste management systems, Organisational innovation	Environmental sustainability – waste reduction, recycling, circularity	Qualitative case study, Interviews	Collaboration leads to better circularity, Public-private partnerships essential for resilient sustainable logistics - Information sharing, Waste transparency, Logistics innovations key enablers	Addresses real world gaps and competencies related to innovation and sustainability / Intersection yes

Table 1. Literature Matrix 1/7

Author (Date)	Journal	Definition of Innovation /Sustainabi lity	Theoretical/ Conceptual/ Competency Framework	Procurement Context/Strategy	Competencies Addressed	Innovation Type	Sustainability focus	Methodology	Key Findings	Relevance to RQ / Intersection
Aldrighe tti et al. (2019)	Global Journal Of Flexible Systems Manage ment	Innovation enhances care and costs / Sustainabi ty reduces waste and environmen tal impact	Dynamic capabilities, Institutional Theory, Transactional Cost Theory, Disruption Management	Healthcare procurement and procurement challenges in the EUW	Ambidexterity and supplier collaboration skills	Primary focus on process innovation in healthcare	Environmental sustainability – reducing waste, managing environmental impact in healthcare	Literature review, Discrete-event simulation	Identifies gaps in competencies for sustainable innovations in healthcare	Identifies gaps in competencies for sustainable innovations in healthcare / Intersection yes
Senna et al. (2024)	Producti on Planning & Control	-	Risk identification , Risk assessment, Risk mitigation, Supply chain integration	HCSC resilience factors can lower costs	Competencies which can create HSCS resilience – inexplicitly operational sustainable innovations	Industry 4.0	When unexpected demand spike – operational sustainability needed	Systematic literature review	Literature still lacks studies, which implement industry 4.0	In the next ten years, businesses will have to adapt, reaching new quality levels, while reducing costs to provide healthcare to an increasingly elderly population - Industry 4.0 basic implementation needed / Intersection inexplicitly yes

Table 1. Literature Matrix Continued 2/7

Author (Date)	Journal	Definition of Innovation /Sustainabi lity	Theoretical/ Conceptual/ Competency Framework	Procurement Context/Str ategy	Competencies Addressed	Innovation Type	Sustainability focus	Methodology	Key Findings	Relevance to RQ / Intersection
Agrawal and Madaan (2023)	Internati onal Journal Of Producti vity And Perform ance Manage ment	Innovation uses technology to improve decision- making an optimise healthcare processes, Sustainabi lity efficiency focus	Exploratory factor analysis (EFA), Structural equation modelling (SEM)	Healthcare procurement within supply chain efficiency	To address the many barriers found in this study, data governance, technology expertise, and organisational capabilities – to manage data privacy, technology adoption and organizational change management	Process innovations – mainly for big data analytics	Focus on efficiency and waste reduction through big data – Improving decision- making processes through technology to achieve sustainability	Literature review, EFA, confirmatory factor analysis (CFA)	13 barriers to big data implementatio n in HCSC's, all hypothesis accepted	Combination of both innovation and sustainability factors / Intersection yes
Kanokph anvanich et al. (2023)	Sustaina bility	Innovation – imporving products or processes / Sustainabi lity - economic, social, equity with environmet al challenges	The Fuzzy Delphi Method	Public and private procurement	Clinical process efficiency, Support process efficiency, Collaboration, Waste management, Green material, Green procurement, Energy efficiency, Emissions, Transportation, Healthcare facility design, Legal, Environmental Certification, Process Efficiency, Investment, Relationship Management, Leadership & Governance, Smart, Wearable Devices, Health Application, Telemedicine, Information Management, Transparency and Traceability, Healthcare Innovation	Product and process innovations	Social, Economic, Environmental impact – waste management, carbon emissions	Systematic Literature Review, Fuzzy Dekphi Method	22 appropriate sustainability attributes within the healthcare supply chain, emphasizing the essential role of technology in enhancing healthcare supply chain sustainability	High relevance to research question, with many competencies identified for nexus of innovation, sustainability and healthcare procurement/ Intersection yes

Table 1. Literature Matrix Continued 3/7

Author (Date)	Journal	Definition of Innovation /Sustainabi lity	Theoretical/ Conceptual/ Competency Framework	Procurement Context/Strategy	Competencies Addressed	Innovation Type	Sustainability focus	Methodology	Key Findings	Relevance to RQ / Intersection
Bialas et al. (2023)	Sustaina bility	Innovation defined through ERP integration / Sustainability focuses on cost reduction and environmen tal impact in healthcare	Technology Organization Environment (TOE) framework, Expanded ERP adoption framework	Public healthcare procurement through ERP system adoption – for efficiency	Technological readiness, Organisational culture, Staff expertise	Process innovation through ERP system adoption	Environmental sustainability through waste reductio, Environmental/Econ omic through operational efficiencies of healthcare ERP systems	Structural equation modelling (SEM)	Technological and organizational readiness, Hospital size, and Perceived benefits significantly impact the extent of ERP systems adoption, ERP systems lead to reduce costs – cost efficiencies and technological integration	Nexus of technological readiness, organizational context, and perceived benefits, showcases competencies needed for sustainable innovation procurement / Intersection yes
Sarkar et al. (2024)	Business Strategy & Develop ment	Innovation related to improved healthcare processes / sustainability refers to ecological impact	Stakeholder theory, Critical success factor (CSF) theory, Triple bottom line theory, Fuzzy set theory, and Evidential reasoning approach	Public procurement in rural healthcare context	Critical for HCSCM - Integration, Collaboration, Communication, and Quality	Product and process innovation in healthcare	Focus on environmental sustainability, emissions, and waste management	Literature reviews, Theoretical analysis	Infrastructure development, Data security, Application of predictive tools – critical for success of online healthcare supply chains in rural areas, interdependen cies between these factors enhance efficiency and resource allocation	Strong links for sustainable innovation competencies / Intersection yes

Table 1. Literature Matrix Continued 4/7

Author (Date)	Journal	Definition of Innovation /Sustainabi lity	Theoretical/ Conceptual/ Competency Framework	Procurement Context/Strategy	Competencies Addressed	Innovation Type	Sustainability focus	Methodology	Key Findings	Relevance to RQ / Intersection
Senna et al. (2023)	Producti on Planning & Control	Innovation – New processes/te chnologies / sustainabilit y – reduction of environmen tal impact	Supply chain integration (SCI), Supply chain risk management (SCRM), and Supply chain 4.0 (SC40)	HCSC in public and private sectors	Supply chain integration, Risk management, Collaboration, and Responsiveness	Not stated – In this paper innovation is new processes/tech nologies	Importance in healthcare risk management	Quantitative – Covariance based structural equation modeling (SEM)	Supply chain integration, Supply chain risk management, Technology adoption (SC40) significantly impact healthcare supply chain performance	Links integrated supply chain practices to sustainable innovations / Intersection yes
Giri et al. (2024)	Global Journal Of Flexible Systems Manage ment	Innovation – Product or process improveme nt/ Sustainabili ty – resilience but in environmen tal scope	Argumentati on-based modified total interpretive structural modeling with polarity (ABM- TISMP) / Dynamic capabilities framework	Pharmaceutical supply chain, Healthcare procurement sector	Adaptability, Collaboration, Dynamic capabilities, Agility	More process innovations focus, but product applicable	Resilience means efficient use of resources, which means higher environmental sustainability, with risk-mitigation in disruptions	Mixed- method approach - arguments, network analysis, and scenario analysis	New framework for assessing PSCR, including its problems and capabilities needed for resilience	Link of how procurement competencies can lead to sustainable innovation procurement / Intersection yes
Chatterjee et al. (2023)	Journal Of Cleaner Producti on	Innovation – efficiency / Sustainabili ty – waste and emissions reduction in healthcare operations	Dynamic Capabilities Theory, OIPT	Public healthcare procurement	Innovation ability, Collaboration with suppliers, Dynamic capabilities – must move away from transactional competencies	Using Industry 4.0 technologies for Process innovations - operational efficiency, and Product innovations - healthcare delivery	Industry 4.0 – Reduce waste and move toward circular economy	Quantitative - Partial Least Squares Structural Equation Modeling (PLS-SEM)	Industry 4.0 technology adoption lead significantly better resilience, innovation and sustainability in HCSCs	Presents the competencies needed for sustainable innovation of healthcare procurement / Intersection yes

Table 1. Literature Matrix Continued 5/7

Author (Date)	Journal	Definition of Innovation /Sustainabi lity	Theoretical/ Conceptual/ Competency Framework	Procurement Context/Strategy	Competencies Addressed	Innovation Type	Sustainability focus	Methodology	Key Findings	Relevance to RQ / Intersection
Muham mad Ibrahim Khan (2024)	IGI Global	Innovation – adoption of technology / Healthcare	Industry 4.0 framework, Pharma 4.0 framework	Public healthcare procurement	Traceability, Transparency, Collaboration, Product protection and SC security, Research for performance improvement, using cyber- physical technology to increase system smartness	Both product and process innovations	Environmental sustainability - Climate change, waste management, adopting circular economy	Systematic literature review	Industry 4.0 and Pharma 4.0 problems mainly counterfeit medication, transparency issues, and the integration of advanced technologies into procurement processes. Also, a need for better tracking systems. Sustainable practices critical in the future	Alignment of sustainable innovation competencies / Intersection yes
Elabed et al. (2024)	Operatio ns and Supply Chain Manage ment	Innovation – true definition / Sustainabili ty – true environmen tal definition	The circular economy and diffusion of innovation	Public healthcare procurement	Managing costs and innovative requirements, Stakeholder collaboration, Adaptability to regulatory conditions	Both product and process innovations	Environmental sustainability – Waste reduction, Resource efficiency	Systematic literature review, Synthesizing literature from 2000 to 2020 on healthcare supply chain innovation	Innovation is essential for addressing demographic and economic challenges, current procurement practices remain mostly cost-focused. Table 2 suggests guidelines for improving practices	Direct insights into the intersection of sustainability, healthcare procurement and innovation / Intersection - yes

Table 1. Literature Matrix Continued 6/7

Author (Date)	Journal	Definition of Innovation /Sustainabi lity	Theoretical/ Conceptual/ Competency Framework	Procurement Context/Strategy	Competencies Addressed	Innovation Type	Sustainability focus	Methodology	Key Findings	Relevance to RQ / Intersection
(Jia et al., 2025)	International Journal Of Logistics Research And Applications	Innovation – efficiency / Sustainability true definition	Institutional Theory, Technology Organisation Environment (TOE) model	Public healthcare procurement, and specifically sustainable healthcare procurement	Inexplicitly Ambidexterity, Waste reduction, Resource management	Both product and process innovations	Environmental sustainability – Waste reduction, Emissions reduction	Systematic literature review	Multiple pressures on the supply chain identified by the dynamic capabilities model,	Insights on the competencies needed for sustainable healthcare innovation / Intersection - yes

Table 1. Literature Matrix 7/7

APPENDIX 4. RAW CODING FROM STEP 5 (DURACH ET AL., 2017)

Topic		Topic		Topic		Topic	
Topic 1	Topic 1.1	Topic 2	Topic 2.1	Topic 3	Topic 3.1	Topic 4	Topic 4.1
	Topic 1.2		Topic 2.2		Topic 3.2		Topic 4.2
Topic 5	Topic 5.1	Topic 6	Topic 6.1	Topic 7	Topic 7.1	Topic 8	Topic 8.1
	Topic 5.2		Topic 6.2		Topic 7.2		Topic 8.2
Topic 9	Topic 9.1	Topic 10	Topic 10.1	Topic 11	Topic 11.1	Topic 12	Topic 12.1
	Topic 9.2		Topic 10.2		Topic 11.2		Topic 12.2
Topic 13	Topic 13.1	Topic 14	Topic 14.1	Topic 15	Topic 15.1	Topic 16	Topic 16.1
	Topic 13.2		Topic 14.2		Topic 15.2		Topic 16.2
Topic 17	Topic 17.1	Topic 18	Topic 18.1	Topic 19	Topic 19.1	Topic 20	Topic 20.1
	Topic 17.2		Topic 18.2		Topic 19.2		Topic 20.2
Topic 21	Topic 21.1	Topic 22	Topic 22.1	Topic 23	Topic 23.1	Topic 24	Topic 24.1
	Topic 21.2		Topic 22.2		Topic 23.2		Topic 24.2
Topic 25	Topic 25.1	Topic 26	Topic 26.1	Topic 27	Topic 27.1	Topic 28	Topic 28.1
	Topic 25.2		Topic 26.2		Topic 27.2		Topic 28.2
Topic 29	Topic 29.1	Topic 30	Topic 30.1	Topic 31	Topic 31.1	Topic 32	Topic 32.1
	Topic 29.2		Topic 30.2		Topic 31.2		Topic 32.2
Topic 33	Topic 33.1	Topic 34	Topic 34.1	Topic 35	Topic 35.1	Topic 36	Topic 36.1
	Topic 33.2		Topic 34.2		Topic 35.2		Topic 36.2
Topic 37	Topic 37.1	Topic 38	Topic 38.1	Topic 39	Topic 39.1	Topic 40	Topic 40.1
	Topic 37.2		Topic 38.2		Topic 39.2		Topic 40.2
Topic 41	Topic 41.1	Topic 42	Topic 42.1	Topic 43	Topic 43.1	Topic 44	Topic 44.1
	Topic 41.2		Topic 42.2		Topic 43.2		Topic 44.2
Topic 45	Topic 45.1	Topic 46	Topic 46.1	Topic 47	Topic 47.1	Topic 48	Topic 48.1
	Topic 45.2		Topic 46.2		Topic 47.2		Topic 48.2
Topic 49	Topic 49.1	Topic 50	Topic 50.1	Topic 51	Topic 51.1	Topic 52	Topic 52.1
	Topic 49.2		Topic 50.2		Topic 51.2		Topic 52.2
Topic 53	Topic 53.1	Topic 54	Topic 54.1	Topic 55	Topic 55.1	Topic 56	Topic 56.1
	Topic 53.2		Topic 54.2		Topic 55.2		Topic 56.2
Topic 57	Topic 57.1	Topic 58	Topic 58.1	Topic 59	Topic 59.1	Topic 60	Topic 60.1
	Topic 57.2		Topic 58.2		Topic 59.2		Topic 60.2
Topic 61	Topic 61.1	Topic 62	Topic 62.1	Topic 63	Topic 63.1	Topic 64	Topic 64.1
	Topic 61.2		Topic 62.2		Topic 63.2		Topic 64.2
Topic 65	Topic 65.1	Topic 66	Topic 66.1	Topic 67	Topic 67.1	Topic 68	Topic 68.1
	Topic 65.2		Topic 66.2		Topic 67.2		Topic 68.2
Topic 69	Topic 69.1	Topic 70	Topic 70.1	Topic 71	Topic 71.1	Topic 72	Topic 72.1
	Topic 69.2		Topic 70.2		Topic 71.2		Topic 72.2
Topic 73	Topic 73.1	Topic 74	Topic 74.1	Topic 75	Topic 75.1	Topic 76	Topic 76.1
	Topic 73.2		Topic 74.2		Topic 75.2		Topic 76.2
Topic 77	Topic 77.1	Topic 78	Topic 78.1	Topic 79	Topic 79.1	Topic 80	Topic 80.1
	Topic 77.2		Topic 78.2		Topic 79.2		Topic 80.2
Topic 81	Topic 81.1	Topic 82	Topic 82.1	Topic 83	Topic 83.1	Topic 84	Topic 84.1
	Topic 81.2		Topic 82.2		Topic 83.2		Topic 84.2
Topic 85	Topic 85.1	Topic 86	Topic 86.1	Topic 87	Topic 87.1	Topic 88	Topic 88.1
	Topic 85.2		Topic 86.2		Topic 87.2		Topic 88.2
Topic 89	Topic 89.1	Topic 90	Topic 90.1	Topic 91	Topic 91.1	Topic 92	Topic 92.1
	Topic 89.2		Topic 90.2		Topic 91.2		Topic 92.2
Topic 93	Topic 93.1	Topic 94	Topic 94.1	Topic 95	Topic 95.1	Topic 96	Topic 96.1
	Topic 93.2		Topic 94.2		Topic 95.2		Topic 96.2
Topic 97	Topic 97.1	Topic 98	Topic 98.1	Topic 99	Topic 99.1	Topic 100	Topic 100.1
	Topic 97.2		Topic 98.2		Topic 99.2		Topic 100.2