

## EXAMINING THE INFLUENCE OF SUPPLY CHAIN KNOWLEDGE ON SUSTAINABLE HOSPITAL PROCUREMENT: EVIDENCE FROM POLAND

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**Purpose:** The aim of the study was to assess the level of supply chain knowledge among hospital employees and analyze the impact of this knowledge on sustainable procurement in these facilities.

**Design/methodology/approach:** The study was based on a research questionnaire by Chiarini A. et al., which assesses sustainability requirements among suppliers. The study was conducted on a sample of 178 hospital employees in Poland. Structural equation modeling was used for the study.

**Findings:** Strong relationships were found between the exogenous and endogenous variables and their indicator variables, indicating that all indicator variables significantly describe the latent variables. Furthermore, supply chain knowledge among mid-level staff has a moderate impact on the frequency of sustainable sourcing activities.

**Research limitations/implications:** The study was conducted solely among hospital medical staff, who are not key decision-makers. Furthermore, the statistical unit in the study was employees (not healthcare providers), who may have varying levels of expertise in shaping sustainable procurement practices.

**Originality/value:** This study adds a new perspective to the sustainable procurement literature by examining the impact of supply chain knowledge on the frequency of actions, taking into account the mediating role of supplier and sub-supplier requirements in hospitals. The results reveal a weak mediating role of supplier and sub-supplier requirements, which provides a cognitive contribution to understanding the barriers to implementing sustainable procurement principles in the healthcare sector.

**Keywords:** sustainable procurement, supply chain awareness, supplier requirements, mediation model.

**Category of the paper:** Research paper.

## 1. Introduction

The contemporary healthcare system faces the challenge of providing medical care that is effective, accessible, and sustainable. The framework for action in this regard is defined by the 2030 Sustainable Development Goals, also adopted by Poland. Moreover, the deepening global climate crisis makes these goals extremely relevant, including for healthcare facilities. This results from the fact that, according to a Deloitte Report, healthcare worldwide accounts for nearly 5% of global greenhouse gas emissions, with G20 countries responsible for over 75% of this share (Global Health Care, 2024). Within healthcare, three principal categories of greenhouse gas emissions have been identified:

- facility-level emissions associated with service delivery,
- emissions generated through the use of externally purchased energy,
- supply chain emissions (Global Health Care, 2024).

Only 17% of these emissions originate directly from healthcare facilities, while the remaining share consists of indirect emissions from purchased electricity (12%) and emissions associated with the healthcare supply chain (71%) (Global Health Care, 2024). These data clearly indicate that, in the context of healthcare, the supply chain constitutes a sector that requires targeted corrective actions in the area of decarbonization.

Knowledge and understanding of the supply chain represent one of the most important factors enabling improvements in its performance (He et al., 2019), including in the context of sustainable development. However, in organizations such as hospitals, supply chains are highly complex, which makes a traditional, top-down approach to knowledge development potentially inadequate (McLaughlin, 2009) and necessitates the involvement of lower-level staff. This stems from the fact that insufficient awareness of logistics processes may lead to excessive costs, waste, and consequently increased greenhouse gas emissions, which adversely affect both the financial standing of healthcare institutions and the natural environment. A better understanding of the supply chain by all employees engaged in its operation can contribute to enhancing the quality and accessibility of healthcare services, reducing costs, and minimizing negative environmental impacts. It is also worth emphasizing that the introduction of the concept of sustainable development into supply chain management should not be perceived by organizations as a limitation, but rather as a means of improving outcomes, thereby strengthening the competitiveness of the enterprise and its supply chain organization (Chardine-Baumann, Botta-Genoulaz, 2014).

The research conducted aimed to assess the level of supply chain knowledge among hospital employees and analyze the impact of this knowledge on sustainable procurement in these units. The research was partly based on the survey questionnaire developed by Chiarini et al. (Chiarini et al., 2017), designed to evaluate sustainability requirements among suppliers. In the present

study, this questionnaire was extended to include requirements concerning subsuppliers, as well as the participants' knowledge of the supply chain, suppliers, and subsuppliers.

To achieve the stated objectives, the following research hypotheses were formulated:

H1: Supply chain knowledge determines the requirements imposed on suppliers.

H2: Supply chain knowledge determines the requirements imposed on subsuppliers.

H3: Requirements imposed on suppliers determine (i.e., mediate) the frequency of actions related to sustainable procurement.

H4: Requirements imposed on subsuppliers determine (i.e., mediate) the frequency of actions related to sustainable procurement.

H5: Supply chain knowledge determines the frequency of actions related to sustainable procurement.

This study adds a new perspective to the sustainable purchasing literature by examining the impact of supply chain knowledge on the frequency of supply chain activities. It considers the mediating role of supplier and sub-supplier requirements in hospitals. The obtained results will enable the development of recommendations for hospital managers, which may contribute to the implementation of policies fostering a more efficient and environmentally sustainable organization of supply chains in healthcare institutions.

## 2. Literature review

In the literature, the healthcare supply chain is defined as a sequence of physical and technical resources necessary to provide patients with high-quality service while ensuring satisfaction and cost optimization (Arora, Gigras, 2018). This chain encompasses a broad network of connections enabling the delivery of products, semi-finished goods, and raw materials to the organization. The main links of this chain include manufacturers, purchasers, suppliers, product intermediaries, and financial intermediaries (Ramakrishna, 2018; Burns 2005). Supply chain management is understood as a continuous process in which goods, services, information, and funds flow simultaneously between various participants in the chain (Srivastava, Agarwal, 2020). It should be emphasized, however, that there is no single universal model of a supply chain, as each organization possesses its own unique network of connections and relationships (Ćwik, 2011).

In light of the 2030 Sustainable Development Goals, a sustainable approach to supply chain management has become a necessity, particularly as research indicates that the implementation of sustainable supply chain practices in hospitals may generate not only environmental but also social and economic benefits (Duque-Urbe et al., 2024). These same pillars form the foundation of the ISO 20400 program for sustainable procurement, which encompasses:

1. Environmental protection (environmental benefits) - reducing the impact of products and services on the environment throughout their life cycle, with particular attention to aspects such as product energy efficiency, recycled material content, toxins and emissions, packaging, and durability.
2. Social responsibility (social benefits) - ensuring that procured goods and services support social responsibility, including issues such as working conditions, the prevention of forced labor, child labor, and human trafficking.
3. Economic prosperity (economic benefits) - supporting enterprises of various sizes, investing in research and development, and maximizing process efficiency.

Recent studies highlight the importance of knowledge, as well as collaboration and coordination, in sustainable supply chain management (Srivastava, Agarwal, 2020). Knowledge management processes are identified as catalysts that enable sustainable development at both strategic and operational levels (He et al., 2019). Research findings by Birou indicate that training and knowledge in the field of sustainability positively influence sustainable supply chain practices, which in turn lead to improved operational and economic performance (Birou et al., 2019). Similar conclusions were reached by Bartos et al., who observed that sustainability training enhances supplier performance in the area of sustainable development (Bartos et al., 2024). It should therefore be emphasized that partnerships among supply chain members are crucial and facilitate sustainable supply chain management (Teixeira et al., 2022). The complexity of processes in the context of knowledge transfer is also underlined by Ahmed et al., who argue that this complexity constitutes a significant factor affecting knowledge sharing (Ahmed et al., 2024). Knowledge transfer, in turn, holds a priority role in the supply chain, as it contributes to risk reduction (Christopher, Lee, 2004). In this context, strategic collaboration within the supply chain, focused on sharing both internal and external knowledge, gains importance, as it positively influences the overall process (Mehdikhani, Valmohammadi, 2019). Numerous studies indicate a positive relationship between knowledge and supply chain performance (Sangari et al., 2015; Alam et al., 2023; Dhaigude et al., 2021), while processes such as knowledge creation, capture, organization, storage, and dissemination have a significant impact on supply chain efficiency (Sangari et al., 2015). Furthermore, the implementation of knowledge transfer mechanisms may enhance the effectiveness of the entire supply chain (McLaughlin, 2009). Of particular importance is the effective sharing of knowledge among team members (Madani, Rungtornsupatt, 2019), especially tacit knowledge (Schoenherr et al., 2014). In summary, it can be concluded that employees' knowledge of the supply chain significantly influences its overall efficiency.

The sustainable procurement procedure involves considering environmental aspects throughout the entire supply chain, from raw material acquisition to product disposal (Beamon, 1999), which implies that the entire supply chain, including suppliers and subcontractors, should adhere to the principles of sustainable development (Chaabane et al., 2011). Consequently, all supply chain participants must comply with sustainability requirements,

and environmental criteria should also be considered when selecting suppliers (Bhardwaj, 2016), with knowledge of these criteria made accessible to all participants in the process.

To date, research on sustainable purchasing in the healthcare sector has primarily focused on identifying factors that facilitate the implementation of sustainable development principles, such as management commitment, regulatory pressure, and resource availability. The literature also emphasizes the importance of supplier collaboration and the integration of activities across the supply chain as prerequisites for the successful implementation of sustainable practices. However, relatively few studies have examined the mediating role of requirements placed on suppliers and subcontractors in this process, particularly within the context of hospital operations. To the best of our knowledge, no studies have addressed or reported on the impact of supply chain knowledge on the frequency of activities, while considering the mediating role of supplier and subcontractor requirements in hospitals. This study aims to fill this research gap.

### 3. Methods

Both sustainable procurement and employees' knowledge regarding the implementation of sustainable procurement activities in the supply chain are categories that are difficult to measure. For this reason, the study on the impact of supply chain knowledge on sustainable procurement in hospitals employed the structural equation modeling (SEM) method. To verify the formulated research hypotheses, the following variables were distinguished to describe hospital employees' knowledge regarding the implementation of sustainable procurement activities within the supply chain:

1. Supplier requirements - a latent variable described by the following observed variables:
  - 1\_1 Demands on suppliers to comply with applicable statutory and regulatory requirements concerning environmental and safety standards.
  - 1\_2 Demands on suppliers for continuous improvement of overall environmental performance over time (e.g., reduction of greenhouse gas emissions, energy and water consumption, product disposal, recyclability, material hazards, etc.).
  - 1\_3 Demands on suppliers for continuous improvement of occupational health and safety performance over time.
  - 1\_4 Preference for local suppliers (solely for environmental reasons, such as carbon footprint).
  - 1\_5 Demands on suppliers to comply with voluntary environmental standards for products and packaging.
  - 1\_6 Requests for suppliers to adhere to voluntary social responsibility standards (e.g., ISO 26000, SA8000, AA1000, etc.).

- 1\_7 Demands on suppliers to comply with social requirements, such as prohibition of child labor, forced labor, discrimination, and respect for freedom of association (irrespective of the country - all are considered highly important).
2. Subsupplier requirements - a latent variable described by the following observed variables:
  - 2\_1 Demands on subsuppliers to comply with applicable statutory and regulatory requirements concerning environmental and safety standards.
  - 2\_2 Demands on subsuppliers for continuous improvement of overall environmental performance over time (e.g., reduction of greenhouse gas emissions, energy and water consumption, product disposal, recyclability, material hazards, etc.).
  - 2\_3 Demands on subsuppliers for continuous improvement of occupational health and safety performance over time.
  - 2\_4 Preference for local suppliers (solely for environmental reasons, such as carbon footprint).
  - 2\_5 Demands on subsuppliers to comply with voluntary environmental standards for products and packaging.
  - 2\_6 Requests for subsuppliers to adhere to voluntary social responsibility standards (e.g., ISO 26000, SA8000, AA1000, etc.).
  - 2\_7 Demands on subsuppliers to comply with social requirements, such as prohibition of child labor, forced labor, discrimination, and respect for freedom of association (irrespective of the country - all are considered highly important).
3. Frequency of Actions - a latent variable described by the following observed variables:
  - 3\_1 Purchase of products with packaging suitable for reuse/recycling.
  - 3\_2 Purchase of products in naturally biodegradable containers.
  - 3\_3 Purchase of products containing recycled materials.
  - 3\_4 Purchase of “green” cleaning agents.
  - 3\_5 Limiting the purchase of products with a short lifespan.
  - 3\_6 Preference for purchases from local suppliers.
  - 3\_7 Preference for suppliers using lower-emission transportation means (e.g., electric vehicles).
  - 3\_8 Preference for suppliers whose distribution relies on a network of warehouses and connections (more efficient utilization of trucks).
4. Degree of supply chain knowledge - a latent variable described by the following observed variables:
  - 4\_1 Knowledge of the origin of raw materials, goods, and services.
  - 4\_2 Knowledge of the sources of suppliers’ human resources.
  - 4\_3 Verification of how and by whom goods are transported.
  - 4\_4 Obtaining information on the supplier’s past performance in terms of sustainability.

All variables were measured using a five-point scale:

1. For variables 1, 2, and 3, where 1 indicates no implementation and 5 indicates implementation in every purchase.
2. For variable 4, where 1 indicates no knowledge and 5 indicates having the specified knowledge for every purchase (always).

The study was conducted on a sample of 178 hospital employees in Poland: 151 employees from public hospitals and 27 from non-public hospitals. The basic characteristics of the sample are presented in Table 1.

**Table 1.**  
*Research sample characteristics*

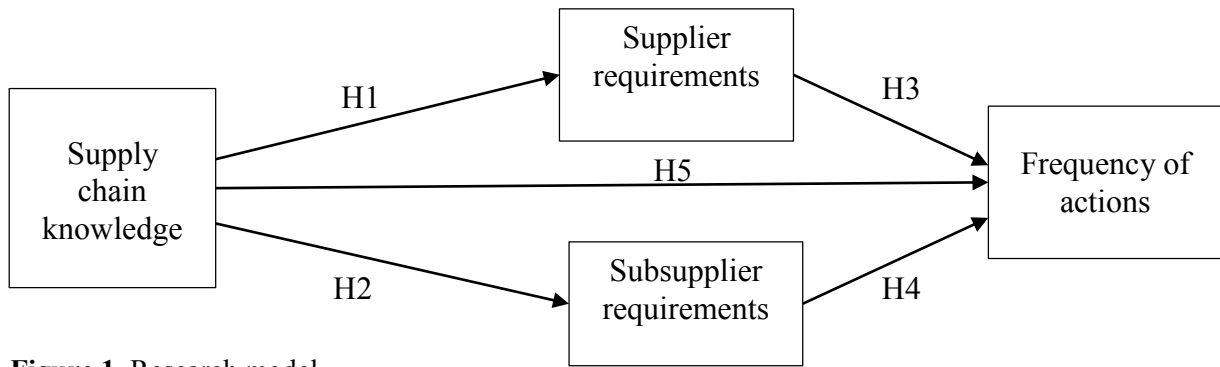
Characteristics of hospitals		Number of surveyed employees
Ownership type	Public	151
	Non-public	27
Level of reference	Clinical	68
	Voivodeship	54
	County	56

Source: Author's own elaboration.

In the first step of the research procedure, the test reliability was analyzed using Cronbach's alpha coefficient. The assessment of test reliability using Cronbach's alpha was considered appropriate because all statements derived from the conducted survey pertain to the same theoretical construct - evaluation of implemented actions in relation to sustainable procurement requirements.

Next, the relationships between the identified constructs were determined using a structural equation modeling approach, which was applied to all hospitals (Model I) and public hospitals (Model II). The model for non-public hospitals was not constructed due to the small number of cases (27). The use of structural equation modeling allows for the verification of hypotheses formulated based on theoretical considerations regarding the relationships between the variables (Nachtigall et al., 2003). Structural equation models are characterized by much greater flexibility in describing interactions between variables than multivariate regression models, particularly for qualitative variables for which the classical regression assumptions are not met (Sagan, 2003). This method is widely used in analyses focused on issues related to sustainable procurement (Mardani et al., 2020; Chandra, Kumar, 2021; Alamelu et al., 2022).

The cause-and-effect relationships between the identified variables were illustrated using a path diagram. The research model is presented in Figure 1.



**Figure 1.** Research model.

Source: own elaboration.

The proposed research model represents an attempt to capture the relationships between supply chain knowledge, supplier and subcontractor requirements, and the frequency of sustainable purchasing activities in hospitals. This model serves as a basis for the empirical verification of the assumed relationships and for assessing the mediating role of supplier-related factors.

## 4. Results

Based on the Cronbach's alpha coefficient (Table 2), a high level of internal consistency of the test was confirmed. The obtained results indicate excellent reliability both for the analysis including all hospitals (public and non-public) and for public hospitals alone (values above 0.9).

Additionally, an analysis was conducted to determine the effect of removing an individual items from the scale concerning specific variables. The results show that eliminating any item from the set of questions does not reduce the reliability of the test below an acceptable level, and moreover, in no case does it increase the value of Cronbach's alpha. Therefore, it was concluded that there is no need to remove any questions from the test.

**Table 2.**

*Cronbach's alpha values*

	<b>All hospitals</b>	<b>Public hospitals</b>
Variable	Cronbach's alpha	Cronbach's alpha
1	0.928	0.927
	Cronbach's alpha if item deleted	Cronbach's alpha if item deleted
1 1	0.914	0.913
1 2	0.914	0.910
1 3	0.915	0.914
1 4	0.927	0.926
1 5	0.918	0.917
1 6	0.918	0.915
1 7	0.918	0.915
	Cronbach's alpha	Cronbach's alpha
2	0.935	0.927

	Cronbach's alpha if item deleted	Cronbach's alpha if item deleted
2_1	0.926	0.925
2_2	0.922	0.923
2_3	0.923	0.923
2_4	0.928	0.930
2_5	0.924	0.925
2_6	0.924	0.924
2_7	0.926	0.927
	Cronbach's alpha	Cronbach's alpha
3	0.953	0.954
	Cronbach's alpha if item deleted	Cronbach's alpha if item deleted
3_1	0.948	0.949
3_2	0.944	0.945
3_3	0.944	0.945
3_4	0.945	0.945
3_5	0.952	0.953
3_6	0.949	0.950
3_7	0.946	0.947
3_8	0.948	0.950
	Cronbach's alpha	Cronbach's alpha
4	0.958	0.958
	Cronbach's alpha if item deleted	Cronbach's alpha if item deleted
4_1	0.950	0.947
4_2	0.939	0.939
4_3	0.943	0.943
4_4	0.947	0.949

Source: Author's own elaboration.

Figure 2 presents the path diagram for Model I, constructed for all hospitals (public and non-public).

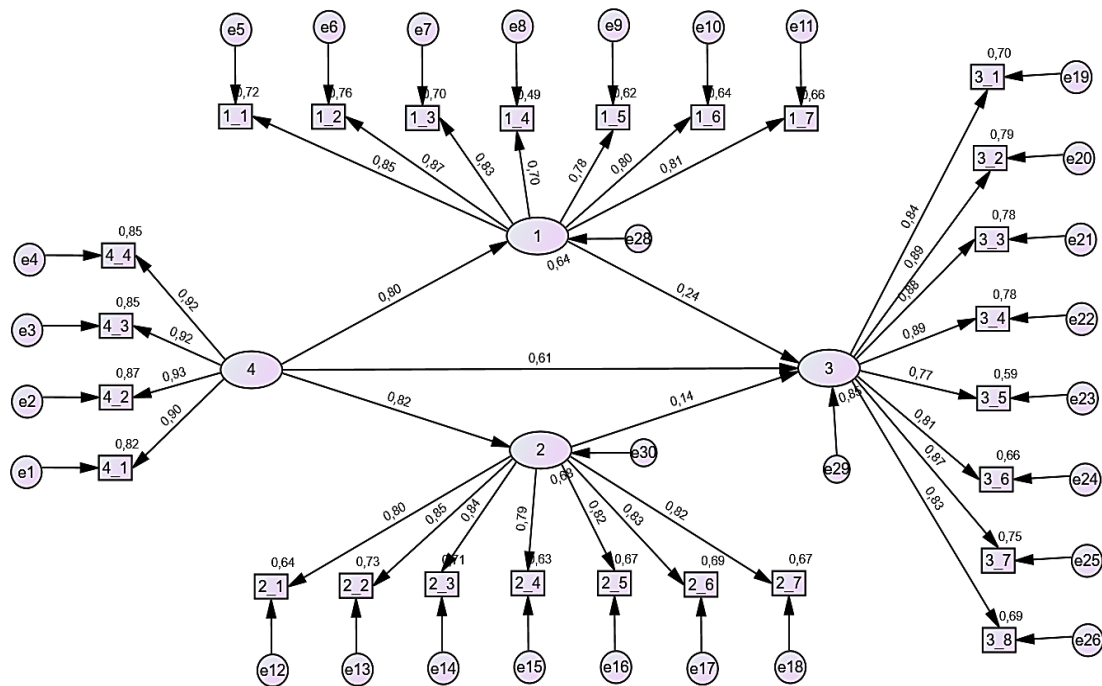


Figure 2. Path diagram for Model I (public and non-public hospitals).

Source: own calculations using IBM SPSS AMOS.

The model exhibits relatively strong relationships between the latent exogenous variable, “degree of supply chain knowledge,” and its indicator variables. All indicators are highly significant for describing this construct, with standardized regression weights ranging from 0.90 to 0.93.

Similarly, strong relationships are observed between the endogenous variables and their indicator variables. For the variable “supplier requirements”, the standardized regression weights range from 0.70 to 0.87; for “subsupplier requirements”, they range from 0.79 to 0.85; and for “frequency of actions”, they range from 0.77 to 0.89. The relationships between both exogenous and endogenous variables and their indicators should be interpreted positively - all indicator variables significantly contribute to the description of their respective constructs.

It can therefore be concluded that all indicator variables significantly and strongly influence the unobserved exogenous and endogenous variables. Moreover:

1. The degree of supply chain knowledge is best described by knowledge of the sources of suppliers’ human resources.
2. Slightly less important in describing the degree of supply chain knowledge are the verification of how and by whom goods are transported and obtaining information on the supplier’s past performance in sustainability, while the least important (though still high) is knowledge of the origin of raw materials, goods, and services.
3. Supplier requirements are best described by demands on suppliers to comply with applicable statutory and regulatory requirements concerning environmental and safety standards.
4. A less significant factor in describing supplier requirements is the preference for local suppliers (solely for environmental reasons, such as carbon footprint).
5. Subsupplier requirements are best described by demands on subsuppliers for continuous improvement of overall environmental performance over time (e.g., reduction of greenhouse gas emissions, energy and water consumption, product disposal, recyclability, material hazards, etc.).
6. A less significant factor in shaping subsupplier requirements is the preference for local subsuppliers (solely for environmental reasons, such as carbon footprint).
7. The frequency of actions related to sustainable procurement is best described by the purchase of products in naturally biodegradable containers and the purchase of “green” cleaning agents.
8. The least significant factor in describing the frequency of sustainable procurement actions is limiting the purchase of products with a short lifespan.

The main challenge in the modeling was to determine the impact of the variable “degree of supply chain knowledge” on the variable “frequency of actions”, considering the mediating role of “supplier requirements” and “subsupplier requirements”. The influence of supply chain knowledge on the frequency of actions related to sustainable procurement can be considered moderate, with a standardized regression weights of 0.61. While the relationships between supply chain knowledge and supplier requirements, as well as between supply chain knowledge and subsupplier requirements, can be regarded as strong (standardized regression weights of 0.80 and 0.82, respectively), the relationships between supplier requirements and the frequency of sustainable procurement actions, and between subsupplier requirements and the frequency of sustainable procurement actions, are weak, with standardized regression weights of 0.24 and 0.14, respectively. The following conclusions can be formulated:

1. Supply chain knowledge has a moderate effect on the frequency of actions related to sustainable procurement.
2. Supply chain knowledge has a strong effect on supplier and subsupplier requirements.
3. Supplier and subsupplier requirements have a weak effect on the frequency of actions related to sustainable procurement, indicating their limited mediating role.

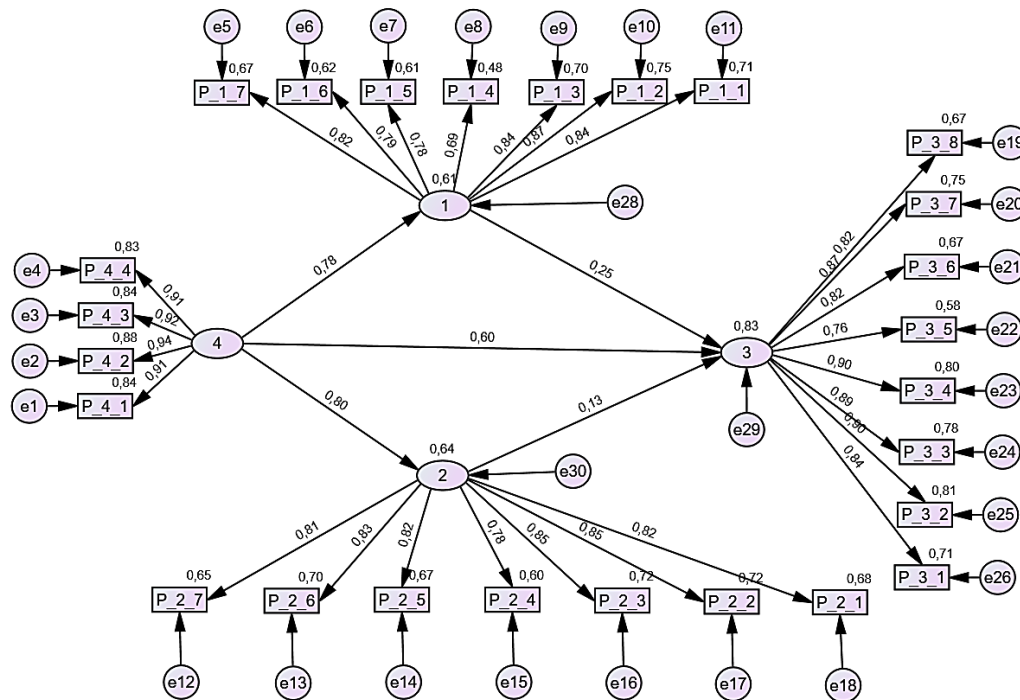
Table 3 presents the goodness-of-fit measures used to evaluate Model I.

**Table 3.**  
*Model I Fit Summary*

Measure	Value	Desired value
CMIN/DF	2.673	<5
NFI	0.850	≥0.9
RFI	0.834	close to 1
IFI	0.900	≥0.9
TLI	0.889	close to 1
CFI	0.900	close to 1
RMSEA	0.097	≤0.08 (values more than 0.1 indicate model rejection)
HOELTER 0.01	80	≥200

Source: calculations performed using IBM SPSS AMOS.

Analyzing the obtained values, it can be concluded that Model I exhibits a relatively low level of fit. However, this does not necessarily imply that Model I should be rejected, as fit indices such as CMIN/DF and RMSEA indicate an acceptable level of model fit. Figure 3 presents the path diagram for Model II, constructed for public hospitals.



**Figure 3.** Path diagram for Model II (public hospitals).

Source: own calculations using IBM SPSS AMOS.

The model exhibits relatively strong relationships between the latent exogenous variable “degree of supply chain knowledge” and its indicator variables. All indicators are highly significant for describing this construct, with standardized regression weights ranging from 0.91 to 0.94.

Similarly, strong relationships are observed between the endogenous variables and their indicator variables. For the variable “supplier requirements”, the standardized regression weights range from 0.69 to 0.87; for “subsupplier requirements”, they range from 0.78 to 0.85; and for “frequency of actions”, they range from 0.76 to 0.90. The relationships between both exogenous and endogenous variables and their indicators should be interpreted positively - all indicator variables significantly contribute to the description of their respective constructs.

It can therefore be concluded that all indicator variables significantly and strongly influence the unobserved exogenous and endogenous variables. Moreover:

The degree of supply chain knowledge is best described by knowledge of the sources of suppliers’ human resources.

Slightly less important in describing the degree of supply chain knowledge is the verification of how and by whom goods are transported, while obtaining information on the supplier’s past sustainability performance and knowledge of the origin of raw materials, goods, and services are the least important (though still substantial).

Supplier requirements are best described by demands on suppliers for continuous improvement of overall environmental performance over time (e.g., reduction of greenhouse gas emissions, energy and water consumption, product disposal, recyclability, material hazards, etc.).

A less significant factor in describing supplier requirements is the preference for local suppliers (solely for environmental reasons, such as carbon footprint).

Requirements for subsuppliers are best described by demanding that they improve their overall environmental performance over time (e.g., reduction of greenhouse gas emissions, energy and water consumption, end-of-life disposal, recyclability, hazardous materials, etc.), and requiring subcontractors to improve their overall occupational health and safety performance over time.

A less significant factor in shaping subsupplier requirements is the preference for local subsuppliers (solely for environmental reasons, such as carbon footprint).

The frequency of actions related to sustainable procurement is best described by the purchase of products in naturally biodegradable containers and the purchase of “green” cleaning agents.

The least significant factor in describing the frequency of sustainable procurement actions is limiting the purchase of products with a short lifespan.

The main challenge of the modeling procedure was to determine the impact of the variable “degree of supply chain knowledge” on the variable “frequency of actions”, while accounting for the mediating role of the variables “supplier requirements” and “subsupplier requirements”. The influence of supply chain knowledge on the frequency of sustainable procurement actions can be characterized as moderate (standardized regression weight of 0.60). While the relationships between supply chain knowledge and supplier requirements, as well as between supply chain knowledge and subsupplier requirements, can be considered strong (standardized regression weights of 0.78 and 0.80, respectively), the relationships between supplier requirements and the frequency of sustainable procurement actions, as well as between subsupplier requirements and the frequency of sustainable procurement actions, are weak (standardized regression weights of 0.25 and 0.13, respectively). The following conclusions can be formulated:

Supply chain knowledge has a moderate impact on the frequency of actions related to sustainable procurement.

Supply chain knowledge has a strong impact on supplier and subsupplier requirements.

Supplier and subsupplier requirements have only a weak impact on the frequency of actions related to sustainable procurement, which indicates their limited mediating role.

**Table 4.**  
*Model II Fit Summary*

Measure	Value	Desired value
CMIN/DF	2.487	<5
NFI	0.837	≥0.9
RFI	0.820	close to 1
IFI	0.896	>0.9
TLI	0.884	close to 1
CFI	0.895	close to 1
RMSEA	0.1	≤0.08 (values more than 0.1 indicate model rejection)
HOELTER 0.01	73	≥200

Source: calculations in IBM SPSS AMOS.

Based on the obtained values, it can be concluded that Model II is also characterized by a relatively low level of fit. However, similar to Model I, the values of indicators such as CMIN/DF and RMSEA indicate an acceptable level of fit for Model II.

## 5. Discussion

Healthcare supply chains are complex systems designed to ensure high-quality healthcare services while maintaining cost-effectiveness and adhering to sustainable development policies. Attempts to optimize hospital supply chains by transferring knowledge from traditional manufacturing have proven unfeasible due to government regulations and the unique characteristics of healthcare networks, which significantly affect the coordination of activities within these chains (Dobrzykowski, 2019). Therefore, it is necessary to identify factors specific to this type of organization that influence the quality of the supply chain. Previous studies indicate that technological readiness, organizational readiness, perceived benefits, and hospital size significantly impact hospital supply chains. Moreover, they reveal a statistically significant relationship between supply chain management practices and improvements in hospital cost performance (Bialas et al., 2023).

According to V. Roy, the key elements for improving performance in sustainable supply chains include supply chain leadership, learning orientation, knowledge management, and knowledge transfer (Roy, 2019). Previous studies have shown that both internal knowledge sharing and external knowledge sharing (with supply chain partners) positively influence sustainable supply chain management (Mehdikhani, Valmohammadi, 2019). Additionally, human capital, such as innovative idea generation and specialized expertise, has a positive impact on the performance and agility of healthcare supply chains (Mandal, 2018). The results of the conducted study indicate that the degree of supply chain knowledge is best described through knowledge. Sangari et al. highlight a strong relationship between organizational knowledge of the supply chain and supplier evaluation processes (Sangari et al., 2015). Similar

findings were reported by Patil and Kant, as well as Srivastava and Singh, who emphasized that knowledge management and knowledge sharing play a crucial role in supply chains, enabling organizations to create, build, and maintain a competitive advantage through the effective use of knowledge and collaborative practices (Srivastava, Singh, 2021; Sachin, Kant, 2013).

Considering supplier requirements, the key factors influencing supplier participation are buyer demands, government involvement, and internal readiness (Lee, 2008). Research by Ghadge et al. suggests that environmental regulations, green purchasing, and sustainable product quality are key criteria for selecting sustainable suppliers (Ghadge et al., 2018). Additionally, buyer requirements and environmental support were found to be positively associated with suppliers' willingness to engage in green supply chain initiatives (Lee, 2008). The results of the present study revealed that supplier requirements are best described by the demand for continuous improvement in environmental performance over time. However, attention should be paid to the intensity of these requirements, as efforts aimed at influencing or improving suppliers' ecological management practices raise critical issues concerning transaction costs and the overall effectiveness of such approaches for the buyer (Simpson, Power, 2005). For this reason, supplier requirements should be grounded in a collaborative model, as organizations with collaboration-based engagement also place strong emphasis on supplier support and development (Sadaat, Seuring, 2018).

The study also indicated that obtaining information on suppliers' past performance in the area of sustainability, as well as knowledge of the origin of raw materials, goods, and services, plays an important role in describing the degree of supply chain knowledge. Understanding the origin and flow of materials and goods is crucial for building efficient, competitive, and customer-satisfying supply chains (Kleab, 2017). Therefore, the enforcement of environmental requirements and supplier improvement programs based on benchmarking can be applied in combination with third-party certification (Styles et al., 2012). This is due to the fact that suppliers' environmental and social sustainability practices influence purchasing decisions and supplier selection, as they affect both the economic and relational aspects of exchange relationships (Thomas et al., 2016). The involvement of supply chain partners in acquiring and processing information on climate change is essential for managing sustainability (Dahlmann, Roehrich, 2019). Previous research also indicates a link between supply chain connectivity and information sharing within the supply chain (Khan et al., 2023).

Sustainable supply chain management requires a multi-level approach to extend sustainability practices across the entire supply chain (Hofstetter, Grimm, 2019). Consequently, it is necessary to broaden requirements not only to direct suppliers but also to sub-suppliers. Organizations should ensure the proper flow of requirements down to lower-tier suppliers as well (Rodrigues et al., 2010; Boozar et al., 2023).

In the context of hospitals, sustainable practices should be considered in the areas of hospital infrastructure, energy consumption patterns, transportation, procurement, waste management systems, and employee behaviors (McGain, Naylor, 2014). Employee behaviors, therefore,

constitute an important element in shaping the sustainable policies of hospitals, including sustainable procurement. Understanding and recognizing how supply chains function contribute to the creation of sustainable procurement patterns. The goal of hospitals should thus be to develop strategic plans that engage staff and other stakeholders in achieving the organization's environmental objectives.

## 6. Summary

This study analyzes the impact of the variable “degree of supply chain knowledge” on the variable “frequency of actions” in relation to sustainable procurement. It also considers the mediating role of the variables “requirements for suppliers” and “requirements for subcontractors”. The analyses were conducted for two groups of hospitals in Poland: public and non-public hospitals combined, and public hospitals only. For both groups, strong relationships were found between the exogenous and endogenous variables and their respective indicators, which indicates that all indicator variables significantly describe the latent variables. Moreover, in both groups, the knowledge of the supply chain among hospital staff had a moderate impact on the frequency of sustainable procurement activities. Although supply chain knowledge strongly influenced the requirements for suppliers and subcontractors, these requirements had only a weak impact on the frequency of sustainable procurement activities. Therefore, it can be concluded that the mediating role of supplier and subcontractor requirements in shaping sustainable procurement activities is weak.

The study, however, has certain limitations. First, it was conducted exclusively among mid-level hospital medical staff. Although this group is involved in shaping supply flows, it is not the main decision-maker in their implementation. The second limitation concerns the unit of analysis. In this research, the respondents were individual employees rather than healthcare institutions, which means that their knowledge of practices aimed at sustainable procurement may vary significantly.

The above limitations highlight the need for more in-depth research in the future, focusing on staff directly responsible for the implementation of procurement processes. It is also important to analyze procurement processes in the context of specific categories of purchased materials, which may reveal differentiated patterns and challenges in implementing sustainable procurement practices.

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