

Article

Effect of Sustainable Supply Chain Management on Procurement Environmental Performance: A Perspective on Resource Dependence Theory

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Abstract: To reduce medical waste, attention must be paid to the environmental friendliness of products during procurement. Thus, environmental awareness among hospital procurement personnel is crucial. Sustainable development, which effectively utilizes limited external resources, is the common goal of hospitals and suppliers. This study aims to establish a research framework that combines the theories of resource dependence and environmental relationship quality, incorporating environmental factors, subjective environmental norms, and perceived environmental values. Whether the environmental awareness of hospital procurement personnel is related to the quality of supplier relationships was investigated using a questionnaire survey method with hospital procurement personnel as the subjects. A total of 443 valid questionnaires were collected, and structural equation modeling was used to verify the hypotheses. The results show that (1) substitutability and uncertainty have a positive and significant effect on environmental relationship quality; (2) environmental subjective norms have a positive and significant effect on environmental relationship quality; (3) importance and perceived environmental value have a positive and significant effect on environmental commitment; (4) environmental relationship quality has a positive and significant effect on environmental performance. These results provide a reference for the promotion of relevant policies, education, and training in medical institutions.

Keywords: sustainable supply chain; environmental relationship quality; resource dependence theory



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1. Introduction

In recent years, environmental pollution caused by anthropogenic forces has intensified the greenhouse effect, gradually increasing our environmental awareness. In 2015, the United Nations released 17 Sustainable Development Goals (SDGs) that primarily covered three aspects: economic growth, social progress, and environmental protection. Among them, Goal 12 (“Ensure sustainable consumption and production patterns”) mentions the proper handling of chemicals and waste before 2020 to minimize their impact on the environment. In addition, it emphasizes waste reduction through prevention, reduction, recycling, and reuse by 2030. Therefore, the reduction of medical waste is a significant issue. There are currently approximately 20,000 medical institutions in Taiwan, with an average amount of waste generated of approximately 120,000 tons/year in the past five years. Additionally, as a result of the COVID-19 pandemic, the amount of medical waste has increased by 10% annually. Therefore, choosing suppliers who provide environmentally friendly products, such as recyclable or eco-friendly materials, during procurement can greatly help to reduce medical waste.

However, owing to the unique nature of the healthcare industry, its supply chain is diverse and specialized, in addition to providing medical services. Managers face multiple challenges, including cost control and maintaining the quality of patient care, underlying

the healthcare industry's concerns regarding supply resources [1,2]. Hospital procurement policies and supplier management affect medical supply chains [3–6]. Therefore, relationships with suppliers are crucial, and limited external resources make it necessary for hospitals to establish good supply chain partnerships. As a result, mutual trust and commitment with suppliers, as well as ongoing cooperation, are essential and important indicators of company performance [1,7]. However, increasing costs and demand have led to increased interdependence in the medical supply chain and a greater emphasis on supply chain efficiency [8]. Particularly during the COVID-19 pandemic, highly dependent supply chain relationships resulted in a shortage of medical supplies [4,6,9,10]. Therefore, resource dependence theory (RDT) provides a research framework for external resource uncertainty and dependence that is suitable for exploring the dependence relationship in the constantly changing environment of the medical supply chain [11,12].

Previously, the definition of relationship quality has been used to examine the strength of relationships between marketing personnel and customers and to obtain information from customers [13]. Barry and Graca [14] stated that trust, acceptance, and satisfaction can be used to measure relationship quality in a business-to-business trading (B2B) context. Most scholars consider trust and commitment to be the core attributes and basic conditions for measuring relationship quality, as well as being the variables most scholars use to measure the same [15,16]. However, previous studies on relationship quality have mostly been conducted in the marketing field, with relatively little exploration of the relationship between hospital procurement personnel and suppliers. As frontline contacts with suppliers, mutual trust and commitment between procurement personnel and suppliers can affect company performance, with a high level of trust in and commitment placed on supply chain partners [17]. Therefore, the relationship between hospital procurements and suppliers has become increasingly important.

Procurement personnel play an important role in reducing medical waste. At the same time, attention must be paid to the environmental friendliness of products during the process of procurement; namely, suppliers and the products they provide must comply with relevant regulations on environmental protection. This makes the environmental awareness of hospital procurement personnel crucial. Previous research highlights the significance of subjective environmental norms (based on environmental awareness and peer perception of whether to purchase green products) [18] and perceived environmental values (people's expectations of environmental protection) [19]. Procurement personnel believe that green procurement is a reliable means of protecting the environment and that its performance is worth expecting [20].

Limited external resources make it important to maintain good relationships between hospital purchasing staff and suppliers. Therefore, the concept of sustainable development that effectively utilizes limited external resources is a common goal of hospitals and suppliers. However, few studies have combined the perspectives of RDT and relationship quality to explore the relationship between hospital purchasing personnel and suppliers. In addition, in recent years, in order to reduce medical waste, hospitals have focused on medical waste management but the items purchased by the hospital play an important role in reducing medical waste. Therefore, it is important to determine whether a hospital's procurement environment is environmentally conscious. Based on the above, this study aims to establish a research framework combining RDT with relationship quality theory, incorporating environmental factors and the variables of subjective environmental norms and perceived environmental values, to investigate whether the environmental awareness of hospital procurement personnel is related to the quality of their relationships with suppliers. By improving a hospital's procurement environmental performance, this study provides a reference for hospitals to formulate green procurement policies.

2. Literature Review and Hypothesis

2.1. Environmental Relationship Quality and Environmental Performance

Relationship quality can be viewed as a form of interpersonal relationship. This intangible value meets the cooperative partners' needs and expectations. In addition to increasing the seller's sales, it can serve as a basis for evaluating the strength, depth, and quality of a relationship, based on past successful or unsuccessful events encountered by the partner. From a business perspective, it benefits from the information provided by customers [13,21,22]. Extensive research has been conducted on relationship quality in the past, and trust, commitment, and satisfaction are considered key indicators of relationship quality by most scholars [14,16]. Skarmeas and Robson [23] argue that relationship quality can reduce conflicts with partners and enhance trust and commitment, thereby increasing satisfaction with partners. However, because trust and commitment are considered core attributes of relationships, many studies have used only trust and commitment as indicators of relationship quality, which are also key indicators of relationship strength [15,16,24–27].

Trust refers to an organization's belief that a partner is reliable and that neither party will abandon long-term interests for personal gain or engage in activities that would negatively impact relationships or businesses [13,28,29]. Trust encourages sustainable development between organizations, the establishment of stable relationships, and the pursuit of goals, such as friendly relations and environmentally friendly supply chains. Therefore, trust is an important resource among organizations [30]. This study views environmental trust as the belief, value, and relationship of moral integrity between hospital procurement and suppliers in the joint pursuit of environmentally friendly goals that contribute to sustainable business development. Commitment helps maintain clear relationships and enhances efficiency and effectiveness among supply chain partners [29,31,32].

For suppliers, shared goals enable information and resource exchange, ultimately fostering commitment between the parties [33]. In a green supply chain, companies can establish environmental assessment criteria for suppliers, provide regular feedback through environmental audits, reduce information asymmetry, align suppliers' environmental goals with those of the company to reduce uncertainty, and encourage suppliers to make environmental commitments [34]. Environmental assessment helps suppliers comply with corporate environmental standards and guides their internalization of these standards to develop and enhance their environmental commitment.

This study argues that environmental commitment is a shared environmental protection goal of hospitals and their suppliers. Hospitals have supplier environmental assessment criteria and encourage suppliers to make environmental commitments in order to maintain clear relationships between parties. Most previous studies have discussed environmental trust or commitment between supply chain partners separately, specifically in the context of relationships between people. In addition, trust and commitment are the core attributes of relationship quality. Therefore, this study considers environmental trust and commitment to be environmental relationship qualities, extending the exploration of the relationship between individuals and the environment.

Establishing partnerships with suppliers is a key factor influencing and enhancing business performance [7,35]. Environmental performance, on the other hand, refers to the relationship between a company's operations and the environment, such as the impacts of resource consumption, products, and services on the environment and compliance with environmental laws and regulations [36]. Paying attention to environmental protection issues in business operations and maintaining high-quality environmental relationships with suppliers are integral components of a company's operations. By focusing on and maintaining the quality of environmental relationships, significant benefits can be derived by improving environmental performance. Hospital procurement personnel and suppliers can be considered to represent a supply chain relationship, where relationship quality forms the foundation of supply chain partnerships. Although previous studies have explored the relationship between hospital procurement personnel and suppliers from the perspective of trust and commitment, proving a high level of trust and commitment between hospitals

and supply chain partners [17], as well as increasing environmental awareness, has led hospitals to place great emphasis on resource utilization in the face of medical efficacy and environmental impacts [1].

If both procurement personnel and suppliers possess environmental consciousness and foster relationships with implications in terms of environmental protection, this will contribute to enhancing the procurement environmental performance of hospitals. Therefore, we hypothesized that a quality environmental relationship between procurement personnel and suppliers will improve the procurement environmental performance of hospitals:

Hypothesis 1 (H1). *Environmental trust has a positive effect on environmental performance.*

Hypothesis 2 (H2). *Environmental commitment has a positive effect on environmental performance.*

2.2. Resource Dependence Theory

Resource dependence theory (RDT) explains how supplier involvement and procurement can enhance a firm's core competitiveness, facilitate successful procurement policies, and ultimately improve its performance [37–39]. However, RDT argues that organizations cannot be self-sufficient and must rely on external resources. Organizations rely on their relationships with external entities to acquire vital resources based on their organizational strategies and internal resources. Such reliance on external resources can lead to imbalances and potential crises [12,40,41]. The flow of resources from suppliers can be interrupted, creating uncertainty, which organizations aim to reduce or even eliminate, making RDT highly applicable to supply chain research [42,43]. Salam et al. [44] used RDT to explore the impact of the relationship between supply chain strategy and supply chain uncertainty on organizational performance, which is helpful for research on sustainable supply chain management. Gebhardt et al. [45] explored the influence of a circular economy based on RDT and found that a circular economy can effectively reduce the dependence on the supply chain. Esfahbodi et al. [46] developed a framework based on RDT to explore the performance of sustainable supply chains and linked the practice of sustainable supply chains to organizational performance. RDT is also suitable for discussing the sustainability of supply chains.

Researchers have found that RDT is suitable for studying the relationship between hospitals and the external environment by considering hospital performance and strategies [47]. Hospital supply chains exhibit high flexibility, as demonstrated during the COVID-19 pandemic. The scheduling and allocation of medical resources must be highly flexible to meet significant healthcare demands. The perspective of RDT that resource supply and demand changes are constrained by inter-organizational dependencies aligns well with the healthcare industry [12,41]. The relationships between hospital procurement personnel and suppliers are based on trust and commitment, which positively impact supply chain relationships [17,18]. As awareness of environmental protection increases, hospitals must pay attention to resource use and environmental impacts, making the quality of environmental relationships between hospital purchasers and suppliers very important. Furthermore, hospitals must also prioritize resource utilization and its impact on the environment.

RDT also suggests that a firm's survival depends on its relationships with its partners. When partners control important resources, a firm depends on them [12]. Terpend and Krause [48] argue that a manufacturer's dependence on a supplier arises from the supplier's ability to fulfill specific objectives, emphasizing the importance of maintaining a relationship with the supplier and highlighting the significance of suppliers. Therefore, this study considers the importance of being a characteristic of RDT and proposes the following hypotheses:

Hypothesis 3 (H3). *The importance of green suppliers has an impact on environmental trust.*

Hypothesis 4 (H4). *The importance of green suppliers has an impact on environmental commitment.*

The degree of dependence on external resources is influenced by the importance of resources and the substitutability of suppliers. If a cooperative partner possesses more important resources and maintains control over them, it can ally with them [12]. In other words, when a supplier possesses critical resources, they become highly important and less substitutable, requiring the maintenance of a good relationship with the supplier. Another point of view of RDT is that when a partner turns to another partner to obtain important resources, the company's resources become unstable [49]. Therefore, good relations should be maintained to ensure the stability of supplier resources. When external resources are limited, supplier importance and substitutability are important for maintaining relationships with each other. Therefore, this study considers supplier substitutability as a characteristic of RDT, proposing the following hypotheses:

Hypothesis 5 (H5). *The substitutability of green suppliers has an impact on environmental trust.*

Hypothesis 6 (H6). *The substitutability of green suppliers has an impact on environmental commitment.*

The main objective of stakeholders in the supply chain is to reduce dependence on external resources or increase the dependence of other organizations on them to reduce uncertainty [50]. However, uncertainty can also be seen as a driving force for organizations to establish partnership relationships and cope with environmental uncertainty and dependence on the external environment [51]. Scholars have noted that trust in suppliers has a positive impact, mitigates the negative effects of dependence, and reduces uncertainty and risk [52–54]. Therefore, this study considers uncertainty as a characteristic of RDT, proposing the following hypotheses:

Hypothesis 7 (H7). *The uncertainty of green suppliers has an impact on environmental trust.*

Hypothesis 8 (H8). *The uncertainty of green suppliers has an impact on environmental commitment.*

2.3. Perceived Environmental Value

Perceived value is an individual's overall evaluation of a product or benefit based on equity theory and can be perceived through fair, truthful, or appropriate assessments [19,55,56]. It can also be used to assess the level of trust that users have in a particular person or object [57]. Perceived value is often used to evaluate consumers' purchase intentions and loyalty, allowing businesses to understand the importance of the customer perspective in managing performance indicators and utilizing technology to improve customer-related operational performance indicators, thereby further enhancing perceived value [58,59]. In the context of supply chains, customers' perceived value is related to the value created through supplier relationships [60], with a good perceived value helping to enhance relationships with suppliers. Because environmental values contribute to the formation of environmental attitudes, which in turn influence behavior, the development of environmental values is also a primary framework [61]. Chen [18] suggested that perceived environmental value is an individual's evaluative expectation of the environment; the more benefits are perceived from environmental value, the more it influences the level of trust. Therefore, this study posits that when hospital procurement personnel perceive green procurement as beneficial for environmental protection, they are more likely to choose green suppliers to achieve environmental protection goals and are more willing to trust these suppliers. Additionally, this builds trust and commitment between hospital procurement personnel and suppliers [17]. Therefore, we hypothesized that the perceived environmental value of purchasing personnel has an impact on the quality of environmental relations:

Hypothesis 9 (H9). *The perceived environmental value of procurement personnel impacts environmental trust.*

Hypothesis 10 (H10). *The perceived environmental value of procurement personnel impacts environmental commitment.*

2.4. Environmental Subjective Norms

Subjective norms refer to an individual's belief with regard to whether they should express an opinion on certain behavior and can be influenced by others, namely the belief of most people regarding the endorsement of certain behavior [62,63]. A subjective norm is an interactive behavior between individuals who can mutually influence one another [64]. Jovanović et al. [65] argue that subjective norms can be used to assess the level of trust that users have toward a particular person or thing. In recent years, the United Nations and other international organizations have actively promoted environmental awareness, leading individuals to increasingly value the consequences of exploiting the Earth's limited resources. This has gradually made environmental protection an emerging social norm, encouraging individuals to engage in environmentally beneficial behaviors [66]. Davies, Foxall, and Pallister [67] propose that environmental subjective norms represent an individual's environmental values, but also their attitudes with regard to others' values. That is, individuals expect others to act ethically, and vice versa. Chen [11] explored the public's willingness to use public bicycles and found that subjective environmental norms had a positive impact on environmental trust. Therefore, this study posits that if hospital procurement personnel perceive environmental protection as an act in line with their moral conscience, they would expect green suppliers with which the hospital collaborates to have environmental awareness. Additionally, there is trust and commitment to hospital procurement personnel and suppliers [17]. Therefore, this study hypothesized that the environmental subjective norms of purchasing personnel affect the quality of environmental relations:

Hypothesis 11 (H11). *The environmental subjective norms of procurement personnel affect environmental trust.*

Hypothesis 12 (H12). *The environmental subjective norms of procurement personnel affect environmental commitment.*

Figure 1 presents the research framework that combines RDT with environmental relationship quality to examine the relationship between procurement personnel and suppliers and its impact on procurement's environmental performance.

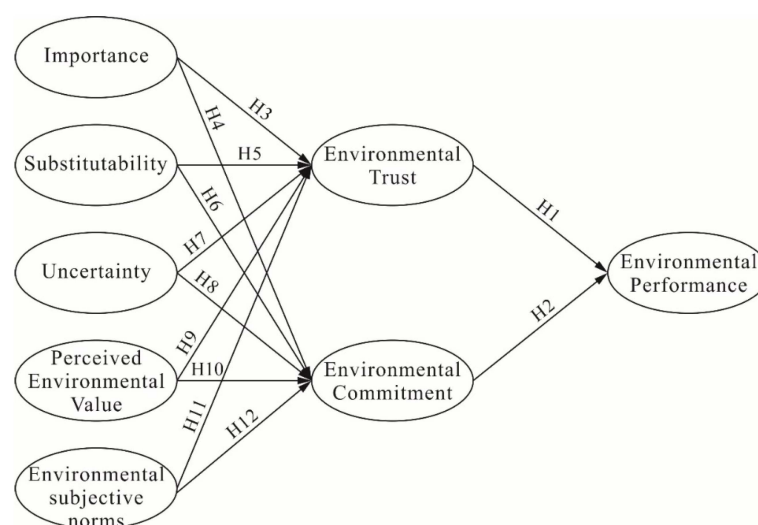


Figure 1. Research framework.

3. Research Methodology

3.1. Survey Instruments

This study integrates RDT and environmental relationship quality theory as its foundation. The three variables of importance, substitutability, and uncertainty from the RDT were combined with the variables of environmental trust and commitment from environmental relationship quality theory. Additionally, the variables of perceived environmental value and subjective environmental norms were included. This framework explores whether the environmental awareness of hospital procurement personnel enhances the environmental performance of hospital procurement. A questionnaire was used as the primary instrument for data collection.

A standardized survey was created according to Churchill [68] and DeVellis [69]. Each evaluation dimension was derived from the literature. Following Brislin's [70] recommendation, a back-translation process was used to translate all survey items into Chinese. Four supply chain, procurement, and hospital experts (two academics and two industry professionals) were then consulted to assess the validity of the included items. Their feedback on the content and clarity of the questionnaire items was used to refine and improve its readability. Finally, after confirming the content validity of the survey tools, a pre-test was conducted to ensure the items were clearly understood before administering the final official questionnaires. The modified questionnaire is included in Table A1 (Appendix A).

To ensure the validity of the research content, the questionnaire was designed as follows. First, a questionnaire was constructed by collecting and summarizing domestic and international literature and expert opinions. In addition to collecting basic information about the respondents (gender, hospital type, job title, and education level), the questionnaire included variables of importance, alternatives, and uncertainty based on the RDT literature [12,44,51], as well as expert opinions. These variables were primarily used to assess the importance, uncertainty, and substitutability of suppliers.

The perceived environmental value variable was developed based on the scales proposed by Chen [11], Patterson and Spreng [55], and Wang et al. [6] to assess the hospital procurement personnel's perceived value of the procurement environment. Environmental subjective norms were developed based on the scales proposed by Chen [18], Kwon and Onwuegbuzie [71], and Nordfjærn et al. [50] to evaluate the environmental norms and ethical perceptions of the procurement personnel.

Environmental relationship quality variables (environmental trust and commitment) were developed based on a synthesis of studies by Nath and Ramanathan [72], Chen [73], Schurr and Ozanne [74], Beukers et al. [20], and Hennig-Thurau et al. [75] to assess the level of environmental relationship quality between hospital procurement and suppliers. To evaluate the level of environmental performance in hospital procurement, the environmental performance was developed based on the scales proposed by Longoni et al. [76] and Al Kerdawy [77]. A five-point Likert scale with five answer options was used to quantify the constructs.

After completing the questionnaire, several experts and scholars (including hospital management and green supply chain scholars) were invited to simultaneously review the scale and provide feedback. The final questionnaire was refined based on the feedback received from the experts. Finally, a pre-test was conducted before the formal distribution of the questionnaires, and 78 questionnaires were collected. After the reliability analysis, Cronbach's α ranged from 0.618 to 0.928, indicating a high level of consistency in the questionnaire.

3.2. Data Collection

This study primarily focused on regional and district hospitals and medical centers given by the Ministry of Health and Welfare in Taiwan. The study participants were procurement personnel who had been employed in these hospitals for at least six months and had a considerable understanding of the processes for the procurement of medicinal materials and resource equipment in the hospital setting. Before distributing the questionnaire, an email was sent to inquire whether participants were willing to participate. If they agreed to participate, a questionnaire was sent, along with a prepaid return envelope. Respondents

possessed knowledge and norms related to procurement and their distribution covered various regions to avoid potential biases [78]. In total, 600 questionnaires were distributed. After excluding incomplete and invalid responses, 443 valid questionnaires were collected.

3.3. Common Method Variance Testing

Common method variance (CMV) refers to an internal consistency error that can arise when using the same method or data source to collect research data, which can lead to bias [79]. In this study, several measures were taken to minimize the influence of CMV. First, the questionnaire items were divided into five sections based on RDT: environmental relationship quality, environmental performance, environmental subjective norms, and perceived environmental value. Second, respondents provided their responses anonymously. Lastly, the one-factor test was employed to examine CMV [80]. The results showed that six eigenvalues were greater than 1, and the total explained variance was 70.31. However, the first factor accounted for only 40.72% (<50%) of the explained variance, indicating the absence of CMV.

3.4. Structural Equation Modeling

This study employed structural equation modeling (SEM) for model validation, namely to validate theories and explore causal relationships between measured variables [81]. This method of data analysis is commonly used in empirical confirmatory studies, combining regression-based analysis with path analysis to enable the simultaneous examination of relationships among multiple sets of variables. SEM analysis involves two stages: measurement model analysis and structural model analysis. The measurement model analysis evaluated the reliability and validity of the measurement model and used two commonly employed indicators recommended by Bagozzi and Yi [82]: composite reliability (CR) and average variance extracted (AVE).

Structural model analysis determines the model fit and the overall explanatory power of the research model. There are many adaptability observation indicators for the model, such as the standardized root mean square residual (SRMR). The smaller the SRMR, the better the model fit. An SRMR less than 0.05 is generally considered a good fit [72], and less than 0.08 is an acceptable fit, although some scholars believe that values below 0.08 are considered a good model fit [83]. Although Chi-square is the most useful indicator, it is easily affected by sample size and model complexity. However, this is the basis for calculating fit indicators [84].

4. Results

4.1. Descriptive Statistics

This study focused on procurement personnel in hospitals in Taiwan. A total of 600 questionnaires were distributed and 498 were collected. After excluding incomplete and invalid questionnaires, 443 valid questionnaires were obtained, with an effective response rate of 73.83%. The background analysis of the respondents is shown in Table 1, where males accounted for 65.7%, district hospitals accounted for the majority at 54.2%, graduates were the most common at 66.1%, and non-supervisory positions accounted for the majority at 74.3%.

Table 1. Profiles of respondents ($N = 443$).

Demographics and Level	N	Percentage	Demographics and Level	N	Percentage
Gender			Education		
Male	291	65.7	Nursing high schools	23	5.2
Female	152	34.3	Graduate	293	66.1
Hospital-level			Postgraduate above	127	28.7
District hospital	240	54.2	Position		
Regional hospitals	160	36.1	Supervisory	114	25.7
Teaching hospital	43	9.7	Non-supervisory	329	74.3

Average age: 46.45 (SD: 8.96).

4.2. Reliability and Validity Analysis

Table 2 presents the results of our research model. The factor loadings for each variable's reliability ranged from 0.701 to 0.949, meeting the recommended threshold of greater than 0.6 by Hair et al. [84] for factor loadings. In terms of reliability, Cronbach's alpha for each variable exceeded 0.7, which is above the threshold of 0.6 recommended by Hair et al. [84]. The CR for all the variables was above 0.8, satisfying the threshold of greater than 0.7 recommended by Fornell and Larcker [85] and indicating high reliability. In terms of validity, the AVE for each variable ranged from 0.652 to 0.872, surpassing the threshold of 0.5 recommended by Fornell and Larcker [85] and demonstrating good convergent validity. This indicated that the variables used in this study were highly consistent.

Table 2. Construct reliability results.

Construct	No. of Items	Item Loading	Cronbach's α	CR	AVE
Importance	2	0.919–0.949	0.855	0.932	0.872
Substitutability	4	0.733–0.867	0.828	0.885	0.660
Uncertainty	4	0.701–0.769	0.772	0.833	0.556
Perceived environmental value	4	0.789–0.875	0.861	0.906	0.706
Environmental subjective norms	5	0.804–0.864	0.900	0.926	0.714
Environmental trust	5	0.847–0.914	0.921	0.940	0.759
Environmental commitment	5	0.712–0.874	0.864	0.903	0.652
Environmental performance	4	0.750–0.902	0.837	0.892	0.675

AVE: average variance extracted; CR: composite reliability.

The diagonal values shown in Table 3 represent the square root of the AVE and the values below the diagonal represent the correlation coefficients. All of the diagonal values were greater than the correlation coefficients in the corresponding rows or columns, indicating good discriminant validity [85]. Furthermore, discriminant validity can also be assessed using the heterotrait–monotrait (HTMT) ratio, where an HTMT value below 0.9 indicates good discriminant validity [86]. From the upper margins of the diagonal (Table 3), all of the HTMT values were below 0.9, indicating good discriminant validity. Correlations between the variables were measured using Pearson's correlation analysis. According to the results, the correlation coefficients between the variables had significant positive correlations (Table 3).

Table 3. Correlations among major constructs.

	1	2	3	4	5	6	7	8
Important	0.934	0.612	0.408	0.537	0.565	0.520	0.795	0.612
Replicability	0.508 **	0.812	0.551	0.566	0.561	0.715	0.843	0.874
Uncertainty	0.323 **	0.430 **	0.746	0.309	0.418	0.374	0.586	0.620
Perceived environmental value	0.461 **	0.476 **	0.232 **	0.840	0.386	0.428	0.671	0.524
Environmental subjective norms	0.495 **	0.487 **	0.343 **	0.338 **	0.845	0.558	0.617	0.592
Environmental trust	0.462 **	0.620 **	0.293 **	0.382 **	0.512 **	0.871	0.610	0.829
Environmental commitment	0.677 **	0.708 **	0.476 **	0.570 **	0.548 **	0.546 **	0.807	0.785
Environmental performance	0.513 **	0.728 **	0.482 **	0.441 **	0.516 **	0.729 **	0.672 **	0.822

Note: $p < 0.01$ with **. The bold numbers on the diagonal represent the square roots of the AVE for each construct. The diagonal was above the HTMT values. Below the diagonal are the correlations between constructs.

4.3. Results of Hypothesis Testing

Table 4 shown the testing outcomes of structural path model's hypotheses. Environmental trust ($\beta = 0.517$) and environmental commitment ($\beta = 0.383$) showed a significant positive relationship with environmental performance, thus supporting H1 and H2. This indicates that the quality of the environmental relationship between hospital procurement personnel and suppliers will help improve a hospital's procurement environmental performance. Furthermore, importance ($\beta = 0.318$) and substitutability ($\beta = 0.351$) were found to have a significant positive relationship with environmental commitment, thus supporting

H4 and H6. This implies that the importance of suppliers can enhance hospitals' and suppliers' commitment to the environment. Substitutability ($\beta = 0.413$) showed a significant positive relationship with environmental trust, thus supporting H5. However, importance did not have a significant relationship with environmental trust, indicating that H3 was not supported. This indicates that supplier substitutability affects environmental trust, whereas importance has no significant impact.

Table 4. Testing outcomes of structural path model's hypotheses.

Hypothesis	Relationships between Variables	Standardized Coefficient	t-Statistic	Test Results
H1	Environmental trust → Environmental performance	0.517 ***	11.803	Accept
H2	Environmental commitment → Environmental performance	0.388 ***	10.059	Accept
H3	Importance → Environmental trust	0.079	1.750	Reject
H4	Importance → Environmental commitment	0.318 ***	8.469	Accept
H5	Substitutability → Environmental trust	0.413 ***	6.889	Accept
H6	Substitutability → Environmental commitment	0.351 ***	8.909	Accept
H7	Uncertainty → Environmental trust	0.085 *	2.162	Accept
H8	Uncertainty → Environmental commitment	0.124 ***	4.441	Accept
H9	Perceived environmental value → Environmental trust	0.047	0.879	Reject
H10	Perceived environmental value → Environmental commitment	0.189 ***	6.116	Accept
H11	Environmental subjective norms → Environmental trust	0.218 ***	4.153	Accept
H12	Environmental subjective norms → Environmental commitment	0.104 **	3.178	Accept

$p < 0.05$ with *, $p < 0.01$ with **, $p < 0.001$ with ***.

Uncertainty had a significant positive influence on both environmental trust ($\beta = 0.085$) and environmental commitment ($\beta = 0.124$), thus supporting H7 and H8. In other words, supplier uncertainty has a significant impact on the quality of environmental relationships. Perceived environmental value ($\beta = 0.124$) had a significant positive influence on environmental commitment, thus supporting H10, but perceived environmental value has no significant influence on environmental trust; therefore, H9 was not supported. This indicates that the perceived environmental value of hospital procurement personnel has an impact on environmental trust but no significant impact on environmental commitment.

Environmental subjective norms had a significant positive influence on both environmental trust ($\beta = 0.218$) and environmental commitment ($\beta = 0.104$), thus supporting H11 and H12. This indicates that the hospital procurement personnel's subjective environmental norms have a positive impact on environmental relationship quality. In terms of explained variances (R^2), the explained variances of environmental trust, commitment, and performance were 46.4%, 71.2%, and 63.6%, respectively. The results of the model path analysis are presented in Figure 2.

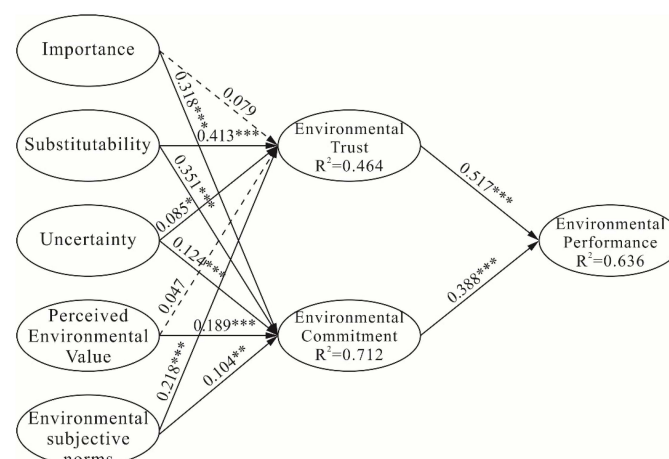


Figure 2. Path coefficients for the research model ($p < 0.05$ with *, $p < 0.01$ with **, $p < 0.001$ with ***).

5. Discussion

Increased environmental protection awareness has led to increased attention in the management of medical waste. By scrutinizing the environmental friendliness of medical products, as well as suppliers' commitment to environmental issues, during the procurement stage, medical waste generation can be reduced. This study evaluated hospital procurement personnel using a combination of RDT and environmental relationship quality theory, incorporating environmental values and subjective environmental norms as variables in the research model. By exploring the environmental quality relationship between hospital purchasing personnel and suppliers and its impact on the hospital's purchasing environmental performance, this study is expected to serve as a reference for the formulation of green procurement policies in hospitals.

Analysis revealed that environmental trust and commitment, in other words, the quality of environmental relationships, positively affect environmental performance. This finding is consistent with that of Findikoglu et al. [7] and Dubey et al. [36]. Therefore, when selecting green suppliers, procurement personnel must seek to establish partnerships based on shared environmental protection goals, moral beliefs, and values, thereby enhancing trust and commitment between parties. Simultaneously, suppliers are encouraged to formulate environmental commitments [34], leading to a more stable relationship among supply chain members and improving hospitals' procurement of environmental performance measures, including reducing the generation of medical waste.

Supplier substitutability positively affects environmental relationship quality. RDT states that the importance of the resources provided by suppliers and their substitutability determines the degree of resource dependence, trust, and commitment that exists between parties [17,49]. Therefore, based on the results of this study, when environmentally conscious procurement personnel seek suitable green suppliers who can provide environmentally friendly products, they attach greater importance to and depend on those suppliers. In addition, if there are numerous green supplier competitors, the likelihood of substitution increases, which means that they must maintain good relationships with hospital procurement. Therefore, in this context, the relationship between green suppliers and procurement personnel is crucial.

Supplier uncertainty is another RDT characteristic that has a positive impact on the quality of environmental relationships. This result is similar to that of Zhang and Huo [54], who found that trust between hospital purchasing personnel and suppliers can reduce the risk of uncertainty, allowing them to face challenges collaboratively. In the face of threats to the external environment, procurement personnel, however, may need to identify alternative suppliers in the case of high levels of uncertainty regarding resource provision. This proactive approach helps mitigate the damage caused by a shortage in supplies. Therefore, by not only providing environmentally friendly products but also ensuring a stable supply, thereby reducing the need for procurement personnel to search for alternative products, suppliers can enhance the quality of the environmental relationship between themselves and procurement personnel.

Importance had a significant positive impact on environmental commitment but did not have a significant impact on environmental trust. Pfeffer and Salancik [49] found that suppliers become very important when they control key resources. This is due to the fact that, although procurement personnel perceive green suppliers as important and the hospital has a well-planned selection process for green suppliers, there may be doubts regarding whether green suppliers can effectively implement environmental protection plans or whether the environmental benefits provided by green suppliers meet expectations. These doubts can affect the procurement personnel's choice of green suppliers, and they may choose to not select green suppliers. From an RDT perspective, when a cooperative partner turns to another partner to obtain important resources, the stability of the company's resources becomes uncertain [38]. Therefore, when hospital procurement personnel perceive green suppliers as untrustworthy, they may seek other green suppliers for collaboration, which may affect the hospital's resource supply.

The subjective environmental norms of procurement personnel have a significant impact on the quality of environmental relationships. In other words, when hospitals begin to prioritize environmental protection and formulate relevant specifications, purchasing personnel should also be encouraged to engage in green purchasing behaviors that are beneficial to the environment [37]. This finding is consistent with those reported by Chen et al. [3] and Davies et al. [65]. When a hospital has clear green procurement norms and procurement personnel perceive green procurement as necessary and environmentally responsible, they are more likely to choose and trust green suppliers with established environmental protection plans. They also have high expectations for the environmental performance of procurement and are willing to promote the hospital's green supplier selection norms to other stakeholders.

Procurement personnel's perceived environmental value has a significant impact on environmental commitment but does not have a significant impact on environmental trust; the opposite was found by Chen [18], who found that the more benefits of perceived value, the more trust in the environment will increase. These results suggest that the procurement personnel consider green procurement meaningful in hospitals. However, this does not stop them from doubting whether green suppliers in hospitals will collaborate to comply with environmental protection regulations. Therefore, hospital management should be cautious when selecting green suppliers. In addition to planning green supplier selection programs, it is essential to ensure that green suppliers implement environmental practices that enhance the trust of their procurement personnel in green suppliers.

Based on the above, this study presents the following conclusions. First, environmental relationship quality has a positive impact on environmental performance, indicating that procurement personnel believe that carrying out green procurement and maintaining good relationships with green suppliers will enhance procurement environmental performance. Therefore, it is recommended that hospital management develop relevant incentive systems to encourage procurement personnel to prioritize environmentally friendly practices. Second, procurement personnel who are environmentally aware tend to choose environmentally friendly suppliers. Sustaining trust and commitment between the two parties in the long term improves the quality of their environmental relationships. Third, among the three characteristics of the RDT proposed in this study, in addition to importance having no significant impact on environmental trust, substitutability and uncertainty were found to have a significant impact on the quality of environmental relationships. Therefore, in addition to formulating environmental protection plans, suppliers must also ensure implementation to enhance trust with hospital purchasing personnel. Fourth, hospitals must select green suppliers who meet the expectations of procurement personnel with regard to environmental protection. Additionally, hospital procurement policies should incorporate the opinions of procurement personnel to achieve the goal of improving hospital procurement environmental performance, aligning the perspectives of hospital management and procurement personnel.

6. Limitations and Future Perspectives

This study has several limitations. First, it adopted a cross-sectional design and explored only the impact of procurement personnel on environmental performance at specific time points. However, it is difficult for environmental performance to show significant effects over a short period of time. Therefore, future research should use qualitative interviews, in addition to questionnaires, to gain a deeper understanding of hospital personnel's views on improving environmental procurement performance.

Second, this study only explored the environmental performance of the procurement department and could not measure the overall environmental performance of the hospital. As this study only explored the environmental performance of the hospital's purchasing department, the overall environmental performance of the hospital also included other departments, such as management and medical departments. Therefore, this study could not measure the overall environmental performance of hospitals because it did not consider

the environmental performance of other departments. Therefore, future studies should explore the factors that affect the environmental performance of various hospital departments and compare the factors that affect different departments to determine the overall factors affecting a hospital's environmental performance.

Thirdly, this study's results show that most procurement personnel have environmental protection awareness and are willing to implement policies that are beneficial to the environment. However, the importance and perception of environmental values had no significant impact on trust in the environment. This may be because the hospital's green procurement policy requires fine-tuning, or due to differences in procurement personnel's perceptions of environmental performance. Future research should investigate these factors further to plan more comprehensive green procurement policies.

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Appendix A

Table A1. Measurement items.

Constructs	Description
Importance	I think that when hospitals adopt green procurement projects, the resources supplied by suppliers are critical to the hospital. I think that suppliers play a crucial role in the green procurement projects enacted by hospitals.
Substitutability	I think that when carrying out green procurement projects, hospitals have the capacity to coordinate with external suppliers. I think that when implementing green procurement projects, hospitals have long-term cooperating suppliers. I think when implementing green procurement projects, the suppliers we choose receive support from the relevant hospital units. I think when implementing green procurement projects, we have other suppliers to choose from.
Uncertainty	I think when implementing green procurement projects, suppliers may leverage insider information unknown to us in order to gain advantages. I think it is difficult for us to control the way suppliers work when implementing green procurement projects. I think that when implementing green procurement projects, suppliers may act in their own self-interest without our awareness. I think if a hospital needs to change its needs in the short term, green suppliers can adjust very quickly.
Perceived environmental value	The hospital's green procurement environment brings meaningful value to me. The hospital's green procurement environmental performance meets my expectations. The hospital's green procurement environment is more environmentally beneficial than other hospitals. I feel the hospital's green procurement is friendly to the environment.
Environmental subjective norms	I feel green procurement in hospitals can take responsibility for the environment. I feel green procurement in hospitals is an act of ethical conscience. I feel the hospital's green procurement is legitimate. I feel green procurement in hospitals is necessary. I feel green procurement in hospitals is beneficial to others and myself.
Environmental trust	I feel the green suppliers the hospital cooperates with are reliable. The environmental benefits of green suppliers that the hospital cooperates with align with my personal aspirations. The green suppliers the hospital cooperates with respect environmental protection and commitment. I can expect environmental performance from the green suppliers the hospital cooperates with. The green suppliers the hospital cooperates with are trustworthy.
Environmental commitment	The green suppliers the hospital cooperates with have perfect environmental protection plans. The green suppliers the hospital cooperates with have a clear mission of environmental protection. The green suppliers the hospital cooperates with have communicated their environmental protection mission to important stakeholders. The hospital has promoted its green supplier selection program to employees. The hospital has good green supplier selection norms.
Environmental performance	I think hospitals should increase the amount of recycled medical materials and reduce waste. I think hospitals should increase the rate of purchasing environmentally friendly products. I think green procurement in hospitals reduces solid waste generation. I think that green procurement in hospitals directly or indirectly reduces toxic pollution.

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