

Adoption of environmentally friendly urban freight logistics practices: the role of communication and governance

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Abstract

Purpose – Environmental emissions are increasing in the urban areas. Much of the emissions arise from public procurement activities given that public sector firms are major customers to many supplying firms. Given the tremendous contribution, this study aims to examine the adoption of environmentally friendly urban freight logistics practices among public sector firms through assessing the impact of urban environmental governance, government environmental communication and organizational environmental governance.

Design/methodology/approach – Data for the study were collected in a single time period from central procuring and disposing entities (public sector firms) in the urban areas. A sample of 105 public sector firms in were used. One procurement officer and one member of the contracts committee were the key informants in the study. AMOS SPSS version 26 was used to obtain the results for the structural model and measurement model, respectively.

Findings – The findings indicate that the adoption of environmentally friendly urban freight logistics practices among public sector firms is significantly influenced by government environmental communication, organizational environmental governance and urban environmental governance. Urban environmental governance significantly influences organizational environmental governance. Urban environmental governance fully mediates the relationship between government environmental communication and public sector firms' adoption of environmentally friendly urban freight logistics practices. Also, urban environmental governance and organizational environmental governance mediate the relationship between government environmental communication and adoption of environmentally friendly urban freight logistics practices.

Research limitations/implications – This study examined the adoption of environmentally friendly urban freight logistics practices among public sector firms. However, the study was conducted in a public procurement setting rather than a private sector procurement setting. Also, the study examined the impact of government environmental communication on public sector firms' adoption of environmentally friendly urban freight logistics practices ignoring the impact of internal communications made within the public sector firms on environmental issues.

Originality/value – This study examined the adoption of environmentally friendly urban freight logistics practices among public sector firms. Freight logistics in public sector procurement has not been given significant attention in earlier research. Emphasis is placed on sustainable public sector procurement ignoring other aspects that would help curb environmental emissions that may arise during and after the delivery of public procurement requirements.

Keywords Government environmental communication, Organizational environmental governance, Urban environmental governance, and adoption of environmentally friendly urban freight logistics practices, Procuring and disposing entities (public sector firms)

Paper type Research paper



1. Introduction

Urban freight logistics is an integral component of the urban transport structure (Bartuška *et al.*, 2023). Urban freight logistics refers to the movement of supplies within, through or out of urban areas (Amaya *et al.*, 2021). Research on urban freight logistics is largely neglected in the public sector procurement literature (Rzeźny-Cieplińska *et al.*, 2023). Despite that, an increased surge in the demand for urban freight logistics is identified due to the rapidly emerging trends that include increased procurement orders from public sector firms (Quak *et al.*, 2019). Urban freight logistics plays a crucial role in improving sustainability in public sector procurement, achieving sustainable development goal 13, and is an evolving phenomenon in cities that contributes to economic development. Worldwide, the demand for urban freight logistics measured as ton-kilometers, is forecasted to increase by 150% between 2015 and 2050 (International Transport Forum, 2021). Despite the benefits, urban freight logistics is identified with negative effects that include but are not limited to environmental emissions, traffic congestion and accidents. In addition, urban freight logistics represents between 8% and 18% of city traffic and 21% of CO₂ emissions (Nocerino *et al.*, 2016; Russo *et al.*, 2016).

Despite the negative effects, previous research on the adoption of environmentally friendly freight logistics practices focuses on influencing factors toward e-shoppers' adoption of green last-mile delivery (Kader *et al.*, 2023); adaptative approaches to implementing good practices to support environmentally friendly urban freight transport management (Iwan, 2014); environmental sustainability and the choice of the freight transport mode (Bask and Rajahonka, 2017); board gender diversity, corporate social responsibility strategy and eco-friendly initiatives in the transportation and logistics sector (Kuzey *et al.*, 2022); a framework of measures to mitigate greenhouse gas emissions in freight transport (Miklautsch and Woschank, 2023); environmental awareness and pro-environmental behavior within China's road freight transportation industry (Fu *et al.*, 2020); and the role of operational research in green freight transportation (Bektaş *et al.*, 2019). The majority of the published work is on green supply chain practices, green logistics, sustainable urban freight transport and sustainable public procurement. Published work on environmentally friendly freight logistics practices and sustainable urban freight logistics is in nations at a higher level of development compared to African nations (see Bask and Rajahonka, 2017; Kumar, 2021; Ellram and Golicic, 2015), while others are systematic literature reviews (Ellram and Murfield, 2017) and qualitative studies (Torvanger *et al.*, 2023). Besides, existing research on green logistics mainly takes a holistic approach despite the contribution urban freight logistics make toward the overall carbon emissions worldwide (Osman *et al.*, 2023; Tian *et al.*, 2023).

Limited research examines urban freight transport (Comi *et al.*, 2024) and the determinants of environmentally friendly freight logistics practices for public sector firms in public sector procurement contexts and urban settings. Yet public sector firms are the major buyers for most suppliers worldwide and are key in the global endeavors for achieving a greener world (Huang *et al.*, 2023). For instance, Balm, van Amstel, Mackaay and Schulz (2015) on page 1 advance that "the buying power of public organizations makes them important customers to their suppliers and by using this power they can act as a game changer in urban freight distribution".

Furthermore, public sector firms initiate several freight flows through public procurement that result in the generation of high carbon emissions. However, there is limited or no freight information available for most supplies acquired (de Radiguès *et al.*, 2019). Also, several factors are identified to contribute to the adoption of environmentally friendly freight logistics practices in public sector procurement although not empirically examined (Arvidsson, 2013;

[Adenso-Díaz and Lozano, 2023](#)). Existing works are conceptual, normative and use mathematical modeling ([Bask and Rajahonka, 2017](#); [Torvanger et al., 2023](#)). Factors brought forth include urban environment governance, organizational environmental governance, government environmental communication, freight transport operation efficiency and public sector procurement practices ([Gatta et al., 2019](#); [Teixeira Dias et al., 2023](#); [Adenso-Díaz and Lozano, 2023](#)). Much of the focus is placed on public procurement governance yet an integration of environmental governance mechanisms may yield more better results. Environmental governance in the urban space is key to enhancing sustainability ([Jacobi and Peres, 2016](#); [Corrêa de Faria et al., 2009](#); [Thiers et al., 2018](#); [Kigochi, 2023](#)); environmental governance in firms involves the formulation and implementation of policies or regulations that enhance environmental protection ([Sadiq et al., 2023](#)); and government environmental communication involves communication of environmental management policies to the public ([Karunaratne, 2023](#)).

Environmentally friendly urban freight logistics management practices are important given that 99% of the world's population lives in urban areas. In Europe, 70% of the population resides in urban areas while in Uganda 60% are in urban areas ([Statista, 2023](#); [Marcucci et al., 2020](#)). Freight vehicles travel 15%–25% of the kilometers in urban areas, use 20%–40% of the urban road space and produce 20%–40% emissions ([Marcucci et al., 2020](#)). People in Uganda are more likely to die from air pollution than those in Tanzania, and Rwanda, and twice as likely as those in Kenya ([World Air Quality Report, 2018](#)). Furthermore, Kampala, Uganda's capital city, has the second worst air in Africa ([World Air Quality Report 2018, 2019](#)) with an expected 19% increment in Green House Gases (GHG) emissions in the road transport mode between 2040 and 2050 ([Sheldon et al., 2022](#)) and a continuous increment in aviation freight emissions over the years from 2003 to 2050. Furthermore, GHG emissions were seen to increase by 5.3% from 18% in 2019–23.3% in 2020 and 3 metric tons in 2021 ([Sheldon et al., 2022](#)). Although the presence of emissions from urban freight logistics is recognized and despite the enactment of the 2021 National Climate Change Act, the 2015 National Climate Change Policy and the National Green Growth Strategy, efforts to curb them are still minimal.

To address the research problem and achieve the intended objectives, six research questions (RQs) are established that include:

- RQ1. Does government environmental communication enhance the adoption of environmentally friendly urban freight logistics practices in public sector firms?
- RQ2. Does urban environmental governance affect organizational environmental governance in public sector firms?
- RQ3. Does urban environmental governance promote the adoption of environmentally friendly urban freight logistics practices in public sector firms?
- RQ4. Does organizational environmental governance promote the adoption of environmentally friendly urban freight logistics practices in public sector firms?
- RQ5. Does urban environmental governance mediate the relationship between government environmental communication and the adoption of environmentally friendly urban freight logistics practices in public sector firms?
- RQ6. Do urban environmental governance and organizational environmental governance mediate the relationship between government environmental communication and the adoption of environmentally friendly urban freight logistics practices in public sector firms?

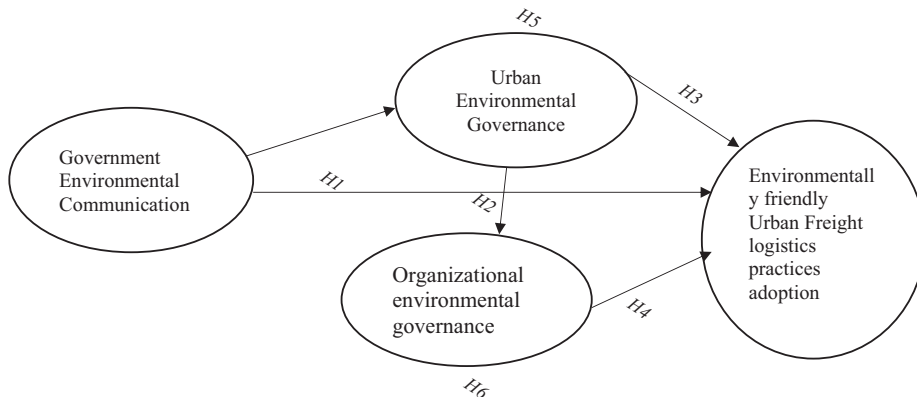
2. Literature review

This subsection presents the literature review based on the six established research hypotheses. The hypotheses are presented by the flow of arrows in [Figure 1](#) below.

2.1 Government environmental communication and environmentally friendly urban freight logistics practices adoption

The effect of government environmental communication on the adoption of environmentally friendly urban freight logistics practices has not received significant attention in both the logistics management literature and environmental management literature. Much of the research is on external environmental communication and the research is much more pronounced in private sector firms than public sector firms ([Oware and Awunyo-Vitor, 2021](#); [Li et al., 2023b](#); [Torelli et al., 2020](#)). Furthermore, apart from external communications, other studies examining green communication relate it to green behavior of customers and restaurants in the hospitality industry ([Lee and Oh, 2014](#)); and green supply chain management ([Cahyadi et al., 2023](#)). Nonetheless, [Henriques and Sadorsky \(1996\)](#) argue that green behavior can be enhanced through communication; [He et al. \(2023\)](#) advance that environmental communication can be used to achieve environmentally desired behaviors while [Deng et al. \(2024\)](#) assert that environmental communications improve carbon performance. Contrarily, [Cahyadi et al. \(2023\)](#) argue that adoption of green practices enhances environmental communications. However, such communications are external firm communications. In addition, [Tagliatela et al. \(2024\)](#) show that firms find difficulties in aligning environmentally friendly practices with environmental communications. Besides, [Schoeneborn et al. \(2020\)](#) and [Torelli et al. \(2020\)](#) argue that environmental communications do not enhance environmental management practices. With this discussion, it can be hypothesized that:

- H1. Government environmental communication significantly influence the adoption of environmentally friendly urban freight logistics practices in public sector firms.



Sources: [Xue et al. \(2022\)](#), [Kiogora, Chege, and Arani \(2023\)](#), [Böröcz \(2023\)](#), [Adenso-Díaz and Lozano \(2023\)](#)

Figure 1. Conceptual framework

2.2 *Urban environmental governance and organizational environmental governance*

The term governance is defined differently by different scholars. Regardless of the many definitions, governance involves developing governing styles where no boundaries exist between the public and private sectors (Corrêa de Faria *et al.*, 2009). Besides the definition of governance, environmental governance refers to procedures, institutions or policies through which action to protect the environment is taken (Salih *et al.*, 2024). Urban environmental governance is a critical aspect in addressing environmental problems (Wu *et al.*, 2018). Earlier researchers advance that urban environmental governance takes place in a multilevel form that includes centralized and decentralized governance (van Stigt *et al.*, 2016) and occurs in form of environmental policies, regulations, laws, guidelines or programs (Liu *et al.*, 2024a). In addition, existing research examines urban environmental governance in relation to wetlands (Herrera, 2024); green investment (Li *et al.*, 2023a; Yang *et al.*, 2024); firm efficiency (Li *et al.*, 2019); and role of nongovernmental organizations (Foo, 2018).

Besides the above, earlier research shows that urban environmental governance contributes to organizational environmental governance although not empirically tested. Organizational environmental governance is seen in form of substantive approaches aimed at improving environmental management activities of a firm (Rodrigue *et al.*, 2013).

The influence of urban environmental governance may be observed through strict urban environmental enforcements. For example, Xu and Liu (2024) argue that stringent environmental regulations in urban environments push firms to adapt and adjust their operation models through developing appropriate environmental governance mechanisms. Furthermore, urban environmental governance enhances the development of environmental policies, initiatives or programs in firms (Li *et al.*, 2024; Nishimura, 2022). Also, Yan (2023) finds that urban environmental regulations contribute to corporate environmental responsibility although focus is placed on technology environmental innovations and government environmental support. Similarly, Lo, Liu, Pang and Li (2020) argue that with established environmental regulations, regulated firms come up with environmental governance mechanisms such as environmental strategies to cope with the mounting pressure to comply. Contrarily, Liu *et al.* (2024b) argue that government environmental regulations have no effect on environmental governance in organizations. However, much of the emphasis is on the private sector firms rather than the public sector firms. With the above discussion, it can be hypothesized that:

H2. Urban environmental governance significantly influences organizational environmental governance in public sector firms.

2.3 *Urban environmental governance and the adoption of environmentally friendly urban freight logistic practices*

Governance is a concept that is increasingly being discussed in environmental issues (Corrêa de Faria *et al.*, 2009). Governance in the public sector setting refers to interactions among structures, processes and traditions that determine how power and responsibility are applied, how decisions are made or what citizens or other stakeholders have to say (Corrêa de Faria *et al.*, 2009). Environmental governance in the urban space is key to enhancing sustainability (Jacobi and Peres, 2016). Furthermore, Corrêa de Faria *et al.* (2009), Thiers *et al.* (2018) and Kigochi (2023) argue that urban environmental governance is a critical aspect of achieving sustainability goals. For instance, environmental regulations are external governance mechanisms that may lead to the performance of environmentally friendly practices.

Whereas environmental governance is examined in previous research, the majority of the research focuses on various forms of environmental governance, for instance, urban

climate governance, industrial environmental governance, food-energy-water nexus environmental governance, government environmental governance and digitalization environmental governance (Ren *et al.*, 2023; Shao *et al.*, 2023; Yuan and Lo, 2022; Lihua *et al.*, 2020), while others look at urban logistics governance in general (Shrestha *et al.*, 2024). Governance mechanisms for promoting environmentally friendly urban freight logistics management practices among public sector firms are under researched. Urban environmental governance is examined in relation to aspects like water management (Jacobi and Peres, 2016). Besides, a dearth of research examines the concept of environmentally friendly urban freight logistics management practices in the public sector procurement literature (Cowie and Fiske, 2023). However, previous research recognizes the relevancy of environmental management governance in enhancing environmentally sustainable urban freight logistics. Although examined in various disciplines, scholars including Teixeira Dias *et al.* (2023) call for more research on urban environmental governance while existing research on green logistics mainly takes a holistic approach despite the contribution urban freight logistics makes toward the overall carbon emissions worldwide (Osman *et al.*, 2023; Tian *et al.*, 2023). Other scholars argue that urban governance promotes the uptake of environmentally friendly actions (Brand, 2007); and urban environmental governance enables identification of environmental problems that may require adoption of environmentally friendly solutions (Putkowska-Smoter *et al.*, 2024). With the above discussion, it is hypothesized that:

- H3. Urban environmental governance positively influences the adoption of environmentally friendly urban freight logistics practices in public sector firms.

2.4 Organizational environmental governance and the adoption of environmentally friendly urban freight logistics practices

Curbing environmental pollution in cities is a key aspect of environmental governance currently. Like the private sector firms, public sector firms must come up with mechanisms through which environmental emissions can be overcome. Environmental governance enhances a firm's efforts to improve environmental performance (Mahmood *et al.*, 2021; Roscoe *et al.*, 2019; Sadiq *et al.*, 2023). Environmental governance in firms involves the formulation and implementation of policies or regulations that enhance environmental protection (Sadiq *et al.*, 2023). In the public sector space, public sector organizations develop environmental policies or initiatives that match the public sector context characteristics (Ramos *et al.*, 2021). Other scholars look at environmental governance in the form of the presence of environmental committees, environmental incentives and environmentally aware directors (Rodrigue *et al.*, 2013). With good environmental governance, it is expected that firms will have an environmental concern and mitigate environmental impacts.

Although environmental governance is identified as a key aspect of promoting good environmental behavior, the concept has not attracted significant attention in the green urban freight or sustainable urban freight management literature. Existing research on environmental governance is focused on examining environmental governance and sustainability development goals (SDGs) in Association of Southeast Asian Nations countries (Sadiq *et al.*, 2023); environmental governance and the achievement of the sixth SDG (Vollmer *et al.*, 2021); environmental governance in a digital age (Fan *et al.*, 2022); role of political parties in firm environmental governance (Huang and Yang, 2024) and environmental governance and local environmental protection expenditure in China (Vega-Muñoz *et al.*, 2021). Besides that, research in the shipping industry focuses on transnational environmental governance in maritime shipping (Lister *et al.*, 2015); and environmental governance in shipping in general.

While issues of green shipping are emerging, questions about effective governance are generally not addressed (Lister *et al.*, 2015). Furthermore, rather than focusing on governance at a firm level, most research is at an international level and majorly atheoretical. In addition, Lun, Lai, Wong and Cheng (2015) confirm the scantiness of research on firm environmental governance in the shipping literature.

Despite the above, Boakye *et al.* (2020) argue that use of governance mechanisms such as environmental policies enables firms achieve set environmental emission reduction targets. Environmental governance in firms helps them strategically respond to environmental issues (Mehedi *et al.*, 2024). Faraz *et al.* (2024) also advance that integrating environmental aspects at a management level inspires employees to undertake environmentally friendly actions.

Besides, earlier researchers see procurement as an avenue through which transport emissions are reduced. Emissions can be reduced when public sector firms have governance mechanisms in place that promote the selection of suppliers with environmentally friendly transport practices (Kaur and Singh, 2019). Nina *et al.* (2020) advance that group purchasing among firms and consolidation of procurement requirements enhance the adoption of environmentally friendly transport practices among suppliers. In addition, other scholars (e.g. Lun *et al.*, 2015; Hou *et al.*, 2023; Sun *et al.*, 2023) see contracting as a key area that could be used to engage with only suppliers whose transport practices are environmentally friendly while Balm *et al.* (2015) advance supplier selection, incoterms to be used, freight delivery schedules and performance indicators as key in enhancing environmentally friendly freight logistics practices among public sector firms. Thus, public sector firms with environmental values, policies or processes are key in reducing transport emissions from contracted supplier firms (UK Environmental Agency, 2004). With the above, it can be hypothesized that:

H4. Organizational environmental governance positively influences the adoption of environmentally friendly urban freight logistics practices in public sector firms.

2.5 *The mediating role of urban environmental governance on the relationship between government environmental communication and adoption of environmentally friendly urban freight logistics practices*

Environmental communication is a multidisciplinary concept that is used across disciplines that include business, government and civic life. Empirical research examining the mediating role of urban environmental governance on the relationship between government environmental communication and the adoption of environmentally friendly urban freight logistics practices in public sector firms is scarce. Nonetheless, governments worldwide formulate environmental policies or develop environmental programs that enhance the uptake of environmentally friendly practices (Karunarathne, 2023). To achieve positive results, public environmental communications including mass media campaigns are used to ensure compliance with established governance mechanisms, even when they have not yet lived their potential (De Vries, 2020). In addition, scholars in the field of urban environmental governance recommend governments to strengthen their communication capacity if they are to effectively govern urban societies (Peng *et al.*, 2020). Furthermore, Newig *et al.* (2023) argue that intensive communication results in effective governance outcomes.

Although existing research associate communication with urban environmental governance (Corrêa de Faria *et al.*, 2009), the research also shows that most of the time, the public lacks an understanding of environmental management policies and is skeptical or at times resistant to comply. Thus, the use of clear and concise messages, utilization of multiple communication channels and involvement of community members in the policy formulation

process result in effective communication (Karunaratne, 2023). Other scholars argue that paying attention to social and psychological processes is key to improving the effectiveness of environmental communications while others advance that the effectiveness of government environmental communications depends on the communications model applied [linear (knowledge-attitude-behavior model and the Shannon–Weaver model of communication) or rational choice models].

Although effective environmental communication is argued to affect the effectiveness of government environmental governance mechanisms that may result in the adoption of environmentally friendly practices, earlier research shows that people may fail to adopt environmentally friendly practices more especially when they sense inconveniences and have psychological obstructions (De Vries, Rietkerk and Kooger, 2020). Furthermore, providing credible and quality information yields positive benefits for environmental governance (Chen *et al.*, 2023).

Despite the relevance of both government environmental communication and environmental governance mechanisms in enhancing the adoption of environmentally friendly practices, previous research on government/public environmental communications are atheoretical (De Vries, 2020; Karunaratne, 2023) and qualitative. Given the above, it can be hypothesized that:

- H5. Urban environmental governance mediates the relationship between government environmental communication and the adoption of environmentally friendly freight logistics practices.

2.6 *The mediating role of urban environmental governance and organizational environmental governance on the relationship between government environmental communication and adoption of environmentally friendly urban freight logistics practices*

Environmental communications help address environmental governance issues. Earlier researchers argue that environmental communication enhances the implementation of government environmental governance aspects (De Vries, 2020). Other researchers see environmental communications as a basis for implementing policies geared toward environmental sustainability (Santi and Grenna, 2003) while others argue that communication is critical for effective governance such as policy implementation (Burger, 2015). Besides, government environmental governance enhances participation in environmental governance in firms (Lindenberg and Steg, 2013; Luan *et al.*, 2024). Contrarily, Luan *et al.* (2024) argue that organization environmental governance mechanisms affect government environmental governance and engagement in environmentally friendly practices. Firms are more likely to establish effective environmental governance mechanisms to avoid being punished most especially in private sector firms (Zhu *et al.*, 2022) while lack of effective environmental governance mechanisms in public sector firms may result in increased green procurement trainings to public sector buyers. The establishment of effective environmental governance mechanisms in public sector firms results in not only the acquisition of green products but also selection of suppliers with environmentally friendly freight delivery practices. For instance, Wang and Chu (2024) argue that good environmental governance in organizations improves their sustainability position. Although the literature shows that urban environmental governance and organizational environmental governance may mediate the relationship between government environmental communication and environmentally friendly urban freight logistics practices, empirical research confirming the findings from the review of the literature is missing. Thus, given the above, it can be hypothesized that:

H6. Urban environmental governance and organizational environmental governance mediate the relationship between government environmental communication and environmentally friendly urban freight logistics practices adoption in public sector firms.

3. Methodology

This section presents the research design, population of the study, sample size and sampling method, data collection and preliminary results.

3.1 Research design

The study was cross-sectional with a positivistic approach. Cross-sectional surveys involve gathering information at a single point in time. A positivistic approach was used because the study involved testing research hypotheses that were developed based on the literature review findings.

3.2 Population of the study, and sampling

The target population consisted of central procuring and disposing entities in Uganda. A total of 173 central procuring and disposing entities (public sector firms) in urban areas in Uganda were considered ([Government of Uganda E-Procurement Portal, 2024](#)). The unit of analysis consisted of central procuring and disposing entities. The unit of inquiry consisted of one procurement officer and one member of the contracts committee. These were chosen because they have adequate information on the variables under study. The respondents were purposively selected and the collected data was aggregated to the unit of analysis.

Out of 173 central procuring and disposing entities, a sample size of 121 central procuring and disposing entities was considered. The sample size was determined using [Krejcie and Morgan \(1970\)](#). The firms were selected using the rand () function in excel where random values were generated for each central procuring and disposing entity. The central procuring and disposing entities were arranged in ascending order thereafter. The actual sample size for the study was 105 central procuring and disposing entities thus indicating a response rate of 86%.

3.3 Data collection method

A drop-off and pick-up method was used during the data collection exercise. A survey questionnaire plotted on a five-point Likert scale was used in the data collection exercise. The respondents were given two weeks to complete the questionnaire and failure to complete the questionnaire in the stipulated time meant non-willingness of the respondent to participate in the study. The questionnaire had four variables (urban environmental governance, environmentally friendly urban freight logistics practices adoption, government environmental communication and organizational environmental governance). Urban environmental governance was measured using [UN Habitat \(2004\)](#); environmentally friendly urban freight logistics practices adoption was measured using items from [Kumar \(2021\)](#); government environmental communication was measured using [Karunarathne \(2023\)](#), while organizational environmental governance was measured using measures from [UK Environmental Agency \(2004\)](#).

3.4 Data analysis

Data were first entered in the Statistical Package for Social Scientists software (SPSS). Using both the SPSS and SMART Smart PLS version 4 software, preliminary tests that include

normality, collinearity, reliability, common method variance and construct validity (convergent and discriminant validity) were carried out. Common method variance tests were obtained using SPSS while normality, reliability, construct validity (convergent and discriminant validity) and factor analysis results were obtained using Smart PLS version 4. Skewness values for the variables were less than 3 while kurtosis values were less than 10 (see [Appendix 1](#)) as brought forth by [Matore and Khairani \(2020\)](#). There were no collinearity issues as the variance inflation factors (VIF) were below 10.0 ([Ahmad, 2021](#)). Common method variance results were below 0.50. These ranged between 33.94 and 46.865 (see [Appendix 1](#)). Such results do not affect research findings ([Uzir et al., 2021](#)). Reliability values were above 0.70 and a value above 0.70 indicates that the scale used is reliable ([Sürücü and Maslakçı, 2020](#)) (see [Appendix 1](#)), while composite reliability results were above 0.40 (ranged between 0.8 and 0.90) showing the presence of convergent validity ([Ju et al., 2024](#)) (see [Appendix 1](#)). Similarly, average variance extracted (AVE) results were above 0.50 (ranged between 0.58 and 0.679) confirming the presence of convergent validity. Discriminant validity values were obtained using the heterotrait–monotrait method and the values were below the established threshold of 0.9 (values ranged between 0.691 and 0.849) ([Habes et al., 2023](#)), thus indicating the presence of discriminant validity (see [Appendix 2](#)).

3.5 Factor analysis

Factor analysis results were obtained using AMOS version 26. A factor analysis examines the relationship between the measurement items and their constructs. This can be done through the generation of factor loadings. A factor loading shows the relationship between the measurement item and the factor. A factor loading higher than 0.30 shows the presence of a moderate relationship between the measurement item and the factor. All the measurement items' loadings were higher than 0.30 (see [Tables 1–4](#)), had significant *p*-values and critical ratios above 1.96 which is the recommended threshold ([Grilo et al., 2024](#)). The constructs covered in the study included the adoption of environmentally friendly urban freight logistics practices, government environmental communication, organizational environmental governance and urban environmental governance. The factor analysis was run using AMOS SPSS version 26.

4. Findings

The structural model results were obtained using AMOS (Analysis of Moment Structures) SPSS version 26. The results were obtained by testing the six established research hypotheses. Sample characteristics describing the sample used were also provided. Below is the presentation and discussion of the findings.

4.1 Sample characteristics

The respondent firms for the study consisted of public sector firms that belonged to any of the seven groupings as shown below (see [Table 5](#) below). The majority of the firms were agencies and parastatals followed by ministries. The majority of the firms have over 50 employees and have been in existence for 15 years. The number of years in existence shows that firms have enough knowledge in public procurement given that the public procurement practice commenced in 2003 in Uganda.

4.2 Government environmental communication and environmentally friendly urban freight logistics practices adoption

Observations from the findings indicate that government environmental communications positively and significantly influence the adoption of environmentally friendly urban freight

Table 1. Organizational environmental governance

Codes		Loadings	p-value	Critical ratio
Organization 1	Our firm has a vision for contracting providers who use environmentally friendly freight transport services during the delivery of supplies	0.76	$p \leq 0.001$	5.109
Organization 2	Our firm has established strategies for reducing environmental emissions during supplies delivery	0.79	$p \leq 0.001$	6.813
Organization 3	Our firm has employees in charge of overseeing the contracted supplier's environmental freight transport performance	0.88	$P \leq 0.001$	7.151
Organization 4	Our firm trains employees on how emissions during the delivery of supplies can be mitigated	0.79	$p \leq 0.001$	6.528
Organization 5	Our firm requests for suppliers' environmental assessment reports prior to having the contract signed	0.64	$p \leq 0.001$	5.256

Source: Authors' own creation

Table 2. Government environmental communication

Codes	Items	Loadings	p-values	Critical ratio
COM1	We hold public meetings, host workshops and events, and provide opportunities for public input and feedback	0.68	$p \leq 0.001$	5.111
COM2	We engage with the community to build trust and support for environmental management policies	0.67	$p \leq 0.001$	3.990
COM3	We use multiple channels of communication when communicating environmental policies	0.55	$p \leq 0.001$	4.324
COM4	Different members of the public prefer diverse types of communication	0.75	$p \leq 0.001$	4.297
COM5	We provide education and training to build public understanding and support for environmental management policies	0.64	$p \leq 0.001$	2.632

Source: Authors' own creation

logistics practices (see [Figure 2](#)). An in-depth analysis of the results shows that holding public meetings, hosting workshops and events and providing opportunities for public input and feedback, engaging with the community so as to build trust and support for environmental management policies, using multiple channels of communication when communicating environmental policies, using different types of communication and providing education and training to build public understanding and support for environmental management policies improves the adoption of environmentally friendly urban freight logistics practice adoption (see [Appendix 7](#)).

Although not conducted in the public sector setting, earlier research shows that green behavior can be enhanced through communication ([Henriques and Sadorsky, 1996](#)); and environmental communication can be used to achieve environmentally desired environmental behaviors ([He et al., 2023](#)). Whereas the results are supported by earlier research, some scholars argue that environmental communications have no effect on the implementation of environmental management practices ([Schoeneborn et al., 2020](#); [Torelli et al., 2020](#)).

Table 3. Urban environmental governance

Codes	Items	Loading	<i>p</i> -values	Critical ratio
Urban1	Government has regular, organized and open consultations with citizens on matters relating to city emissions and other important issues	0.59	$p \leq 0.001$	5.294
Urban2	Government has established codes of conduct for governments' commitment toward integrity of its officials when enhancing the adoption of environmentally friendly freight transport practices	0.65	$p \leq 0.001$	4.193
Urban3	Government has improved processes and mechanisms for efficient goods delivery	0.62	$p \leq 0.001$	3.702
Urban4	Government has established mechanisms for addressing civil society concerns relating to emissions from urban freight transport	0.47	$p \leq 0.001$	3.285

Source: Authors' own creation

Table 4. Adoption of environmentally friendly freight logistics practices

Codes	Items	Loadings	<i>p</i> -values	Critical ratio
Adopt1	Our firm has established environmental sustainability goals for freight delivery suppliers	0.67	$p \leq 0.001$	4.878
Adopt2	Our suppliers have adopted Environmental management systems (EMS), i.e. ISO:14001	0.71	$p \leq 0.001$	5.293
Adopt3	Our firm encourages the use of recyclable freight packaging during freight delivery	0.73	$p \leq 0.001$	5.415
Adopt4	Our firm encourages the use of the green container during freight delivery	0.75	$p \leq 0.001$	5.489
Adopt5	Our firm is concerned with the quality of the suppliers' human resource in charge of freight delivery	0.57	$p \leq 0.001$	4.280
Adopt6	Our firm provides collaborative green awareness training programs to staff	0.61	$p \leq 0.001$	4.505
Adopt7	We cooperate with suppliers on reverse logistics and recycling programs	0.67	$p \leq 0.001$	4.850
Adopt8	Our suppliers have a collaborative partnership with other freight transport companies and freight shippers	0.76	$p \leq 0.001$	5.590
Adopt9	Our firm engages in coordinated freight logistics and transportation programs	0.77	$p \leq 0.001$	5.903
Adopt10	Our firm tasks its suppliers to produce environmental certification of freight carriers prior to contract signing	0.68	$p \leq 0.001$	5.057

Source: Authors' own creation

However, such an outcome happens when the environmental message is not well designed, a wrong communication media is used, staff to implement lack the required skills, there is lack of the required resources to implement the environmental practices and poor or negative environmental attitudes exist among the employees and the enforcers.

Table 5. Sample statistics

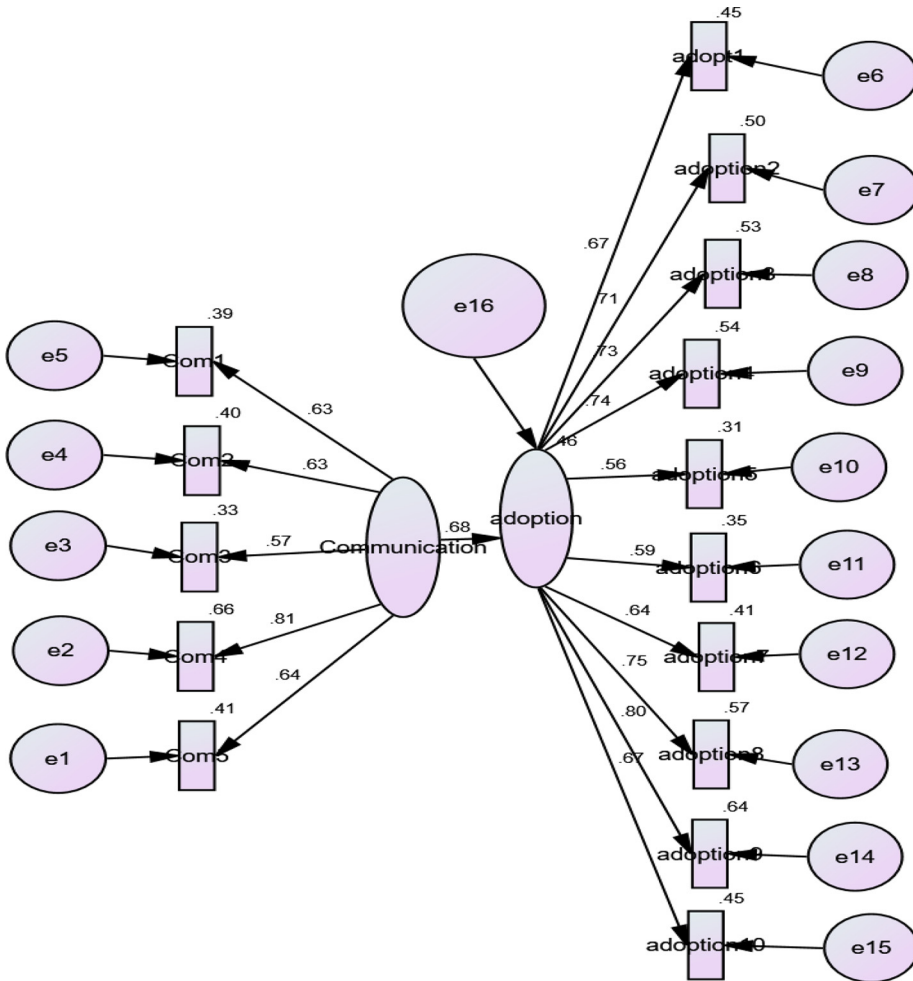
Central procuring and disposing entities (public sector firms)	Frequency	%
<i>Firm category</i>		
Commissions	9	8.6
Ministries	19	18.1
Agencies	29	27.6
Parastatals	24	22.9
State enterprises	4	3.8
Universities	2	1.9
Hospitals	6	5.7
Statutory bodies	10	9.5
Training institutions	2	1.9
<i>Total</i>	<i>105</i>	<i>100</i>
<i>Firm size</i>		
Less than 50	12	11.4
50–100	58	55.2
101–150	23	21.9
Over 150	12	11.4
<i>Total</i>	<i>105</i>	<i>100</i>
<i>Firm age</i>		
5–10 yrs	4	3.8
11–15 yrs	8	7.6
Over 15 yrs	93	88.6
<i>Total</i>	<i>105</i>	<i>100</i>

Source: Authors' own creation

4.3 Urban environmental governance and organizational environmental governance

Results indicate that urban environmental governance positively and significantly influences organizational environmental governance (see [Figure 3](#) and [Table 6](#) below). A more detailed analysis of the results shows that organizational environmental governance improves when government has regular, organized and open consultations with citizens on matters relating to city emissions and other important issues, establishes codes of conduct for governments' commitment toward integrity of its officials when enhancing the adoption of environmentally friendly freight transport practices, and mechanisms for addressing civil society concerns relating to emissions from urban freight transport (see [Appendix 6](#)). However, organizational environmental governance is constant when government improves processes and mechanisms for efficient goods delivery (see [Appendix 6](#)). Thus, the findings indicate that public sector firms establish strategies for reducing environmental emissions during supplies delivery, put employees in charge of overseeing the contracted supplier's environmental freight transport performance, train their employees on how to mitigate emissions during the delivery of supplies and request for environmental assessment reports from suppliers' firms prior to awarding them contracts as a result of urban environmental governance.

The results are in line with the arguments by earlier researchers who argue that stringent environmental regulations in urban environments push firms to adapt and adjust their operation models through developing appropriate environmental governance mechanisms ([Xu and Liu, 2024](#)). Furthermore, [Li, Zheng, Liao, and Niu \(2024\)](#) and [Nishimura \(2022\)](#) argue that urban environmental governance results in the development of environmental policies, initiatives or



Notes: Standardized Regression Weight = 0.68; $p \leq 0.001$; CR = 3.800

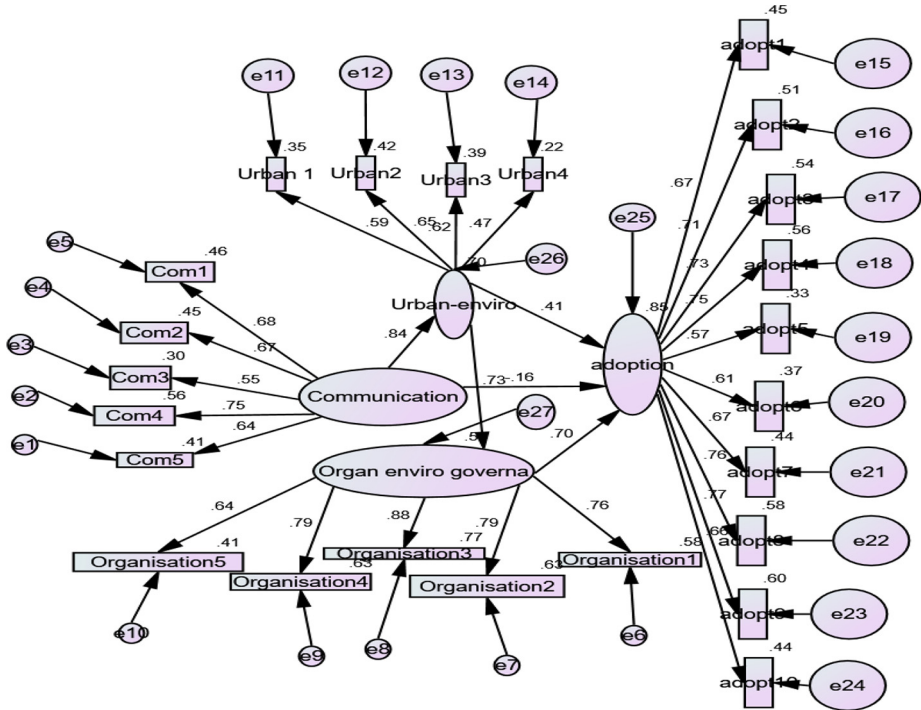
Source: Authors' own creation

Figure 2. Findings on the direct effect of government environmental communication and the adoption of environmentally friendly urban freight logistics practices

programs in firms. Also, regulated firms develop environmental governance mechanisms so as to cope with the mounting pressure for compliance (Lo et al., 2020).

4.4 Urban environmental governance and the adoption of environmentally friendly urban freight logistics practices

The findings indicate the presence of a significant positive influence of urban environmental governance on the adoption of environmentally friendly logistics practices in public sector



Source: Authors' own creation

Figure 3. Simultaneous analysis findings on the effect of government environmental communication, urban environmental governance and organizational environmental governance on the adoption of environmentally friendly logistics practices

firms ($\beta = 0.41$; $p = 0.004$; $CR = 2.843$) (see [Figure 3](#) and [Table 6](#)). A comprehensive analysis of the results shows that having regular, organized and open consultations with citizens on matters relating to city emissions and other important issues by government, establishing codes of conduct for government's commitment toward integrity of its officials when enhancing adoption of environmentally friendly practices, improving processes and mechanisms for efficient goods delivery by government, and establishing mechanisms for addressing civil society concerns relating to emissions by government all improve the adoption of environmentally friendly urban freight logistics practices (see [Appendix 4](#)).

Environmental governance in Uganda is enhanced through both the National Urban Policy of 2002, the National Environmental Management Act (NEMA) (2019) and the Constitution of 1995. NEMA gives the environmental management duty in urban areas to both the urban and district councils ([Order of the Government, 2019](#)). The National Environmental Management Act (2019) advances that an individual is not allowed to cause pollution or engage in any activity that may result in pollution. Also, the NEMA Act requires individuals concerned to develop strategies, techniques or best practices for pollution prevention. Furthermore, Article 39 in the 1995 constitution shows that everyone in Uganda is entitled to a clean and healthy environment. The same constitution gives government the

Table 6. Critical ratios and *p*-values

Variables	Critical ratios	<i>p</i> -values
Urban environmental governance ← government environmental communication-	7.053	$p \leq 0.001$
Organizational environmental governance ← urban environmental governance	6.464	$p \leq 0.001$
Environmentally friendly urban freight logistics practices adoption ← urban environmental governance	2.843	$p = 0.004$
Environmentally friendly urban freight logistics practices adoption ← government environmental communication	0.141	0.888
Environmentally friendly urban freight logistics practices adoption ← organizational environmental governance	6.072	$p \leq 0.001$

Source: Authors' own creation

mandate to develop laws, policies or programs that minimize environmental pollution. Currently, the Public Procurement and Disposal of Public Assets Act has been amended to cater to sustainability aspects. For instance, the Act provides for environmental aspects when sourcing for suppliers (Turamye, 2024).

Besides, Uganda uses a multisector approach to environmental governance that includes government ministries and councils. The councils are responsible for the management of the environment under their jurisdiction and have the authority to regulate various aspects of the environment within their jurisdiction (Order of the Government, 2019). Thus, the public sector firm's adoption of environmentally friendly urban freight logistics practices can be enhanced by the environmental governance mechanisms approved by the urban and district councils and other government bodies. Although environmental governance is in place and freight trucks make up 9.2% of the vehicles used in the urban center, there is still a lack of the required capacity to achieve the mandate for sustainable urban development (Ministry of Lands and Housing and Urban Development, 2017).

The findings are also supported by earlier research. Previous research shows that the adoption of environmentally friendly practices depends on how firm activities are governed (Lun *et al.*, 2015). Thus, effective environmental governance improves environmental performance for firms by aligning their shipping activities to their environmental goals. Also, Zhang *et al.* (2023) argue that environmental governance enhances the formulation of appropriate government environmental regulations and restrains environmental violations by firms. Other scholars argue that urban governance promotes the uptake of environmentally friendly actions (Brand, 2007); and urban environmental governance enables identification of environmental problems that may require the adoption of environmentally friendly solutions (Putkowska-Smoter *et al.*, 2024).

4.5 Organizational environmental governance and the adoption of environmentally friendly urban freight logistics practices

The findings indicate that organizational environment governance positively and significantly influences the adoption of environmentally friendly urban freight logistics practices ($\beta = 0.70$; $p \leq 0.001$; CR = 6.072) (see Figure 3 and Table 6). An intensive review of the findings indicates that public sector firms with a vision for contracting providers who use environmentally friendly freight transport services while delivering supplies will enhance the environmentally friendly urban freight logistics practices adoption in their firms (see

[Appendix 3](#)). Furthermore, monitoring of the contracted supplier's environmental freight transport performance by employees promotes the adoption of environmentally friendly urban freight transport practices in public sector firms. Besides, training employees on how emissions during the delivery of supplies can be mitigated, requesting for environmental assessment reports from suppliers' firms before having the contract signed, establishing policies that govern the internal movement of supplies within the firm and contracting suppliers who use environmentally friendly transport systems during the delivery of supplies enhance the adoption of environmentally friendly urban freight logistics practices in public sector firms. Currently, centralization of procurement requirements is a key criterion in reducing the number of times suppliers have to move to public sector organizations while making deliveries.

Furthermore, the findings are supported by previous researchers who argue that good firm environmental governance enhances environmental protection ([Tang et al., 2012](#)). For example, establishing green policies and an environmental performance score leads to the adoption of environmentally friendly urban freight logistics practices. [Boakye et al. \(2020\)](#) also argue that use of governance mechanisms such as environmental policies enables firms achieve set environmental emission reduction targets. Environmental governance and policy in firms helps them strategically respond to environmental issues ([Mehedi et al., 2024](#)). [Faraz et al. \(2024\)](#) advance that integrating environmental aspects at a management level inspires employees to undertake environmentally friendly actions (see [Appendix 5](#)). In addition, public sector organizations in western economies have developed policies to mitigate the environmental footprint of their activities ([Rajjani, 2023](#)). Some public sector organizations in developing economies have established protocols that enhance engagement in diverse environmentally friendly programs or initiatives while others have not ([Rajjani, 2023](#)). Furthermore, some scholars see procurement as an avenue through which freight logistics emissions are reduced. The emissions can be reduced when public sector firms have policies in place that promote the use of suppliers with environmentally friendly transport practices ([Kaur and Singh, 2019](#)). [Nina et al. \(2020\)](#) advance that group purchasing among public sector firms and consolidation of procurement requirements enhance the adoption of environmentally friendly logistics practices among suppliers, while [de Radiguès et al. \(2019\)](#) argue that centralization of procurement requirements and establishment of freight delivery performance indicators for suppliers reduces environmental emissions from the suppliers' freight delivery activities.

4.6 The mediating role of urban environmental governance on the relationship between government environmental communication and the adoption of environmentally friendly freight logistics practices

The direct effect of government environmental communication on the adoption of environmentally friendly urban freight logistics practices was first obtained prior to testing the mediation effect of urban environmental governance on the relationship between government environmental communication and the adoption of environmentally friendly urban freight logistics practices. Government environmental communication positively influenced the adoption of environmentally friendly urban freight logistics practices (see [Figure 2](#)). A simultaneous mediation analysis was then run with all the variables included in the model. Results from the analysis indicate that urban environmental governance fully mediates the relationship between government environmental communication and the adoption of environmentally friendly urban freight logistics practices by public sector firms (see [Figure 3](#)). This is because the direct effect of government environmental communication ceases with the introduction of urban environmental governance in the analysis.

To obtain the mediation effect, the product of the two paths [the path from government environmental communication to urban environmental governance ($\beta = 0.84$) and the path from urban environmental governance to adoption of environmentally friendly urban freight logistics practices ($\beta = 0.41$)] was obtained. Demming *et al.* (2017) argue that mediation results can be obtained by multiplying the standardized beta coefficients of the path from the independent variable to the mediator variable and from the mediator variable to the dependent variable as long as the paths have significant *p*-values. Thus, the mediation effect was ($\beta = 0.34$).

Based on the results, establishing urban environmental governance mechanisms, e.g. environmental policies and environmental initiatives is not enough. The established mechanisms have to be communicated to the public or the right audience. Effective communication of environmental policies and environmental initiatives leads to the adoption of environmentally friendly practices by the public sector suppliers and other members of the public through enhancing a clear understanding of governance mechanisms. Furthermore, an in-depth analysis of the results shows that holding public meetings, hosting workshops and events and providing opportunities for public input and feedback, engaging with the community to build trust and support for environmental management policies, using multiple channels of communication when communicating environmental policies, educating and training to build public understanding and support for environmental management policies, and using various methods of communication all improve urban environmental governance in Uganda which in turn enhances the adoption of environmentally friendly urban freight logistics practices.

In Uganda, urban environmental mechanisms are communicated through radios, newspapers, websites for the public sector organization concerned and televisions. Although communication of the governance mechanisms may be done, a given proportion of the community may be left out due to lack of access to the various media houses, language barrier problems and lack of community involvement when formulating the environmental governance mechanisms.

Furthermore, previous research shows that the effectiveness of government environmental communications influences the impact government environmental governance mechanisms may have on the adoption of environmentally friendly practices (De Vries, 2020). Effective communication is a prerequisite for positive governance outcomes for government (Gao and Yu, 2020). Also, providing credible and quality information yields positive benefits for environmental governance (Chen *et al.*, 2023). Although, effective environmental communication is argued to affect the effectiveness of government environmental governance mechanisms, earlier research shows that people may fail to adopt environmentally friendly practices especially when they sense inconveniences and have psychological obstructions (de Vries *et al.*, 2020).

4.7 The mediating role of urban environmental governance and organizational environmental governance on the relationship between government environmental communication and the adoption of environmentally friendly urban freight logistics practices

The direct effect of government environmental communication on the adoption of environmentally friendly urban freight logistics practices was first established. Observations showed that government environmental communication positively influenced the adoption of environmentally friendly urban freight logistics practices (see Figure 2). The results show that both urban environmental governance and organizational environmental governance fully mediate the relationship between government environmental communication and

environmentally friendly urban freight logistics practices adoption (see [Figure 3](#) and [Table 3](#)). Thus, implying the presence of a mediated mediation.

To obtain the mediated mediation effect, the product of the three paths [the path from government environmental communication to urban environmental governance ($\beta = 0.84$), the path from urban environmental governance to organizational environmental governance ($\beta = 0.73$) and the path from organizational environmental governance to adoption of environmentally friendly urban freight logistics practices ($\beta = 0.70$)] was derived. Mediation results can be achieved when the standardized beta coefficients of the path from the independent variable to the mediator variable and from the mediator variable to the dependent variable are multiplied as long as all paths have significant p -values ([Demming et al., 2017](#)). Thus, the mediation effect was ($\beta = 0.43$).

From the results, good environmental communications enhance the impact of urban environmental mechanisms established by the government that later influence environmental governance mechanisms used in public sector firms. Established governance mechanisms in public sector firms that include having a vision of contracting suppliers with environmentally friendly freight logistics services influence public sector firms' adoption of environmentally friendly freight logistics practices. Besides established environmental governance mechanisms in firms, established government environmental mechanisms in Uganda have culminated in the development of sectoral governance mechanisms, e.g. green public procurement governance that aim at addressing the specific environmental concerns arising from public procurement ([Akello, 2007](#)). It is from the established green public procurement governance mechanisms that public sector firms derive their organization governance mechanisms. Such mechanisms include considering suppliers with environmental impact assessments showing a negative effect of their freight delivery operations on the environment or with environmental audit reports that show that their freight delivery operations do not impact the environment.

Besides the above, previous research shows that government has a duty of both establishing environmental governance mechanisms and also ensuring that the established governance mechanisms are communicated effectively for purposes of achieving the intended goal ([Van Buren et al., 2016](#); [Kazancoglu et al., 2021](#)). Also, [Manninen et al. \(2018\)](#) argue that government plays an important role in stimulating the formulation of environmental governance mechanisms in public sector firms through enacting governance mechanisms that enhance green public procurement. Furthermore, [Lindenberg and Steg \(2013\)](#) assert that governance mechanisms in government influence the environmental governance mechanisms in firms that promote the adoption of environmentally friendly practices.

4.8 Model fit

AMOS SPSS v26 was used to find out whether the collected data was in line with the theorized model. Model fit findings indicate that the collected data fits the theorized model meaning that there were no cases of model misspecification. Model fit indices (Goodness of Fit Index = 0.983, Adjusted Goodness of Fit Index = 0.914, Normed Fit Index = 0.984, Comparative Fit Index = 0.993, root mean square residue = 0.008, Tucker-Lewis Index = 0.978, chi-square value/DF = 1.860) confirm that the model is well specified.

5. Conclusion

The study aimed at obtaining answers for six research questions. The conclusion is based on each research question:

- The *RQ1* was on the effect of government environmental communication on the adoption of environmentally friendly urban freight transport practices. Access to environmental information and participation in environmental decision-making are key rights under the Principle 10 of the Rio Declaration to which Uganda is a signatory. Observations from the analysis show that government environmental communication positively and significantly leads to the adoption of environmentally friendly urban freight transport practices. Despite the findings, government environmental communication can only be effective when an appropriate communication media is used and the message to be communicated is clear and can easily be understood by the target audience. Also, government environmental communications influence the adoption of environmental practices if the practices to be implemented are within the abilities of the firms supposed to be undertaking them.
- *RQ2* examined the effect of urban environmental governance on organizational environmental governance. Current research is silent on the link between urban environmental governance and organizational environmental governance. Urban environmental governance was found to be a significant influencer for organizational environmental governance in this study. Firms have to comply to environmental demands from government. Compliance can be achieved through development of environmental governance mechanisms that guide activities of firms. Whereas compliance may differ in both the private and public sector firms, compliance to government environmental demands in public sector procurement is over emphasized across public sector firms not only in Uganda but across the world. Public sector firms have to devise mechanisms that help them reduce the amount of environmental damage caused by their procurement activities right from the initiation of the procurement requirement through to its delivery.
- The focus of the *RQ3* is on whether urban environmental governance promotes the adoption of environmentally friendly urban freight logistics practices in public sector firms. Research findings confirm that urban environmental governance enhances the adoption of environmentally friendly urban freight logistics practices. Governments formulate environmental laws that govern the adoption of environmentally friendly practices regardless of the sector. Besides the establishment of environmental laws, environmental governance in several cities is done through city/urban councils. For instance, in Kampala, Uganda's capital, Kampala City Council and Kampala Capital City Authority play a key role in its governance. Councils formulate by-laws in addition to existing laws to govern various aspects in cities including freight movement in urban centers. However, existing environmental laws apply to both urban and rural-urban freight implying that they are general in nature.
- The *RQ4* aimed at finding out whether organizational environmental governance promotes the adoption of environmentally friendly urban freight logistics practices in public sector firms. The findings attest that organizational environmental governance enhances the adoption of environmentally friendly urban freight logistics practices through establishment of policies or strategies. Organizational environmental governance in public sector firms involves using group purchasing, selecting suppliers that are ISO 14000 certified, consolidating freight and emphasizing environmentally friendly practices as a precondition for signing a contract. Freight consolidation improves vehicle efficiency, which in turn is linked to

being environmentally responsible. Group purchasing reduces delivery trips given that the supplier makes deliveries to the procuring and disposing entities all at once. Furthermore, procurement and freight delivery are strongly related thus providing a starting point for discussions on changing freight delivery patterns and freight consolidation flows. Although sustainability/green procurement has culminated in development of governance mechanism for procurement processes in public sector firms, much more needs to be done if environmental sustainability is to be achieved in all stages of the procurement process including the freight delivery stage. The majority of the procurement practitioners are at the early adopters stage in the public sector firms. Furthermore, current research in the area of public sector procurement is promoting sustainable procurement where much of the focus is placed on specification, evaluation and contracting. Freight logistics in public sector firms has not been given significant attention yet public sector firms are major buyers worldwide that contribute greatly to environment emissions in urban areas.

- The *RQ5* involved examining whether urban environmental governance mediated the relationship between government environmental communication and the adoption of environmentally friendly urban freight logistics practices in public sector firms. Results show a full mediation effect. Besides, for effective environmental governance, governments need to use an appropriate communication media and also design the message using simple language or modes, e.g. using both pictures and voice that can easily be understood by the target group if environmentally friendly urban freight logistics practices is to be achieved.
- The *RQ6* focused on whether both urban environmental governance and organizational environmental governance mediated the relationship between government environmental communication and the adoption of environmentally friendly urban freight logistics practices in public sector firms. The results confirm the presence of a mediated mediation implying that both urban environmental governance and organizational environmental governance are relevant in the government environmental communication and the adoption of environmentally friendly urban freight logistics practices relationship. In addition, effective government environmental communication enhances understanding and creates awareness of the established government environmental policies, initiatives or programs. The programs culminate in the development of internal environmental management strategies or policies with an aim of improving freight delivery emission rates.

6. Study implications

The study has theory, practice and policy implications. Theoretically, the study examines the adoption of environmentally friendly urban freight logistics practices in public–private sector procurement transactions for the first time. Also, urban environmental governance, government environmental communication and organizational environmental governance aspects are examined for the first time in the public sector procurement setting.

Practically, research implications include widening the sustainability scope from green public procurement to the inclusion of green freight delivery practices for public sector buyers. Currently, public sector organizations are promoting sustainable procurement to ensure that public sector suppliers have better environmental practices such as the delivery of products using environmentally friendly packaging and environmentally friendly transport systems. Focusing on only sustainable procurement may not solve the emission problems

caused by public sector buyers. However, considering the mode of transport to be used, the frequency of deliveries, the type of fuel or energy consumed and the consumption frequency and the condition of the truck determine the amount of environmental emissions caused as a result of engagement in public procurement activities. Besides, public sector organizations will be able to improve their governance mechanisms through creation of a vision for contracting providers who use environmentally friendly freight logistics services during the delivery of supplies, establishing strategies for reducing environmental emissions during supplies delivery, training employees on how emissions during the delivery of supplies can be mitigated, requesting for environmental assessment reports from the suppliers' firm before having the contract signed and contracting suppliers who use environmentally friendly transport systems during the delivery of supplies. These enhance the use of environmentally friendly urban freight logistics practices among public sector suppliers.

Policywise, government will be able to come up with better ways in which the urban environmental governance mechanisms such as environmental policies, environmental management initiatives or programs, and many other mechanisms are communicated. Furthermore, with urban environmental governance, the government may develop policies that target the city centers rather than taking a holistic approach. This is because city centers like Kampala experience much emissions from urban freight compared to rural settings. In addition, government may carry out trainings that enhance knowledge and expertise among policymakers on issues regarding environmentally friendly urban freight aspects. This not only improves enforcement but also helps obtain an understanding on how the messages going out to the public should be framed.

Other than the implications, the study has limitations and areas of further research. Methodologically, the study used a cross-section survey design and a positivistic approach. Given that the study involves behavioral variables that include governance, communication and adoption of a behavior, the use of a longitudinal design is required because behavior develops over time. Furthermore, a qualitative study is necessary given that there is a need to draw more insights on government environmental communications, and urban environmental governance mechanisms and their relationship with environmentally friendly urban freight logistics practices in public sector firms. Further research may focus on the influence of internal environmental communication in the public sector firms on the adoption of environmentally friendly urban freight logistics practices. Also, the influence of government environmental communications, organizational environmental governance mechanisms and urban environmental governance mechanisms on environmentally friendly urban freight logistics practices in firms in a private sector settings may be examined. Finally, future research may examine the impact of government environmental communication on organizational environmental governance.

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Appendix 1

Table A1. Reliability, common method variance (CMV), composite reliability and collinearity values

Variables	Reliability values	Composite reliability	Collinearity statistics (VIF)	Skewness	Kurtosis	AVE	CMV
Adoption of environmentally friendly urban freight logistics practices	0.899	0.903	N/A	-0.775	0.098	0.527	46.507
Government environmental communication	0.789	0.8	2.171	-0.475	-0.679	0.544	40.15
Organizational environmental governance	0.88	0.888	1.979	-0.833	-0.396	0.679	46.865
Urban environmental governance	0.863	0.869	2.239	-0.296	-1.04	0.58	33.94

Source: Authors' own creation

Appendix 2

Table A2. Discriminant validity

Variables	Heterotrait-monotrait ratio
Government environmental communication → adoption of environmentally friendly urban freight logistics practices	0.704
Organizational environmental governance → adoption of environmentally friendly urban freight logistics practices	0.849
Urban environmental governance → adoption of environmentally friendly urban freight logistics practices	0.751
Urban environmental governance → adoption of environmentally friendly urban freight logistics practices	0.691

Source: Authors' own creation

Appendix 3

Table A3. Organizational environmental governance and adoption of environmentally friendly urban freight logistics practices

Organizational environmental governance Items	Adoption of environmentally friendly urban freight logistics practices	
	Remains constant	Improves
Our firm has established strategies for reducing environmental emissions during supplies delivery	√	
Our firm has established policies that govern the internal movement of supplies with the firm	√	
Our firm has a vision for contracting providers who use environmentally friendly freight transport services during the delivery of supplies		√
Our firm has employees in charge of overseeing the contracted supplier’s environmental freight transport performance		√
Our firm trains employees on how emissions during the delivery of supplies can be mitigated		√
Our firm requests for environmental assessment reports for the supplier’s firm prior to having the contract signed		√

Source: Authors’ own creation

Appendix 4

Table A4. Urban environmental governance and adoption of environmentally friendly urban freight logistics practices

Urban environmental governance Items	Adoption of environmentally friendly urban freight logistics practices	
	Remains constant	Improves
Government has regular, organized and open consultations with citizens on matters relating to city emissions and other important issues		√
Government has established codes of conduct for governments’ commitment toward integrity of its officials when enhancing adoption of environmentally friendly freight transport practices		√
Government has improved processes and mechanisms for efficient goods delivery		√
Government has established mechanisms for addressing civil society concerns relating to emissions from urban freight transport		√

Source: Authors’ own creation

Appendix 5

Table A5. Government environmental communication and urban environmental governance

Government environmental communication Items	Urban environmental governance	
	Remains constant	Improves
We hold public meetings, host workshops and events, and provide opportunities for public input and feedback		√
We engage with the community to build trust and support for environmental management policies		√
We use multiple channels of communication when communicating environmental policies		√
Different members of the public prefer diverse types of communication		√
We provide education and training to build public understanding and support for environmental management policies		√

Source: Authors' own creation

Appendix 6

Table A6. Urban environmental governance and organizational environmental governance

Urban environmental governance Items	Organizational environmental governance	
	Remains constant	Improves
Government has regular, organized and open consultations with citizens on matters relating to city emissions and other important issues		√
Government has established codes of conduct for governments' commitment toward integrity of its officials when enhancing adoption of environmentally friendly freight transport practices		
Government has improved processes and mechanisms for efficient goods delivery	√	√
Government has established mechanisms for addressing civil society concerns relating to emissions from urban freight transport		√

Source: Authors' own creation

Appendix 7**Table A7.** Government environmental communication and adoption of environmentally friendly urban freight logistics practices

Government environmental communication Items	Adoption of environmentally friendly urban freight logistics practices	
	Remains constant	Improves
We hold public meetings, host workshops and events, and provide opportunities for public input and feedback		✓
We engage with the community to build trust and support for environmental management policies		✓
We use multiple channels of communication when communicating environmental policies		✓
Different members of the public prefer diverse types of communication		✓
We provide education and training to build public understanding and support for environmental management policies		✓

Source: Authors' own creation

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