

https://dspace.org/

Circular procurement implementation barriersin the construction industry of developing economies a quantitative analysis

U Onyia; B Awuzie; Matthew Ikuabe; LI Obi

https://hdl.handle.net/10539/46806
SCOPUS

Downloaded from a DSpace repository. https://dspace.org/

Engineering, Construction and Architectural Management

319

Circular procurement implementation barriers in the construction industry of developing economies: a quantitative analysis

Uzor Onyia
Department of Civil Engineering, University of Nigeria, Enugu, Nigeria
Bankole Awuzie
Department of Construction Management and Quantity Surveying, University of Johannesburg, Johannesburg, South Africa
Matthew Ikuabe
School of Construction Economics and Management, University of Witwatersrand, Johannesburg, South Africa, and
Lovelin Ifeoma Obi
Faculty of Business, Computing and Digital Industries, Leeds Trinity University, Leeds, UK

Received 15 February 2025
Revised 18 May 2025
Accepted 23 June 2025

Abstract

Purpose – The procurement phase of the construction project lifecycle remains critical for facilitating successful project outcomes, mainly as it concerns sustainability performance. Therefore, integrating circular economy principles into procurement functions (circular procurement-CP) has become imperative. However, the implementation of CP remains under-researched in the context of the construction industry. This study addresses this knowledge gap by identifying and assessing the inhibitors to optimal CP implementation in a developing economy context.

Design/methodology/approach – The study adopted a survey strategy wherein quantitative data were collected from a population of a randomly selected sample of construction professionals using questionnaires. The responses were subsequently analysed using descriptive and multivariate statistics. These include mean scores, Kruskal-Wallis H-test (K-W), Student-Newman-Keuls (SNK) post hoc technique, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). The CFA was employed to affirm the derived constructs from the EFA.

Findings – The study's results indicate that lack of support from top management, lack of financial resources and perceived high implementation costs ranked as the top three barriers negating effective CP implementation in construction organisations. Furthermore, the barriers were classified into five clusters: inadequacy of government policies and initiatives, stakeholder-related challenges, procurement-related bottlenecks, organisational culture and financial impediments categories, respectively.

Practical implications – The study's results will increase CP implementation awareness among relevant Nigerian construction industry stakeholders. Also, the study outlines best practice guides for stakeholders in the construction delivery value chain to drive sustainable procurement.

Originality/value – Besides enabling an elicitation of the critical barriers to CP implementation in the Nigerian construction industry, the study's results are expected to contribute towards bridging the extant knowledge-practice gap.

Keywords Circular economy, Construction, Procurement, Developing economy, Quantitative study

Paper type Research article

Introduction

The construction industry significantly enables economic development and citizens' well-being globally (Otasowie *et al.*, 2023; Ikuabe *et al.*, 2023a, b). The industry achieves this feat

© Uzor Onyia, Bankole Awuzie, Matthew Ikuabe and Lovelin Ifeoma Obi. Published by Emerald Publishing Limited. This article is published under the Creative Commons Attribution (CC BY 4.0) licence. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this licence may be seen at Link to the terms of the CC BY 4.0 licence.

Engineering, Construction and Architectural Management
Vol. 32 No. 13, 2025
pp. 319-335
Emerald Publishing Limited
e-ISSN: 1365-232X
p-ISSN: 0969-9988
DOI 10.1108/ECAM-02-2025-0249

Downloaded from http://www.emerald.com/ecam/article-pdf/32/13/319/10075157/ecam-02-2025-0249en.pdf by University of the Witwatersrand user on 09 September 2025

by procuring and delivering critical infrastructure and providing employment to a significant proportion of the populace, whether unskilled, semi-skilled or skilled. According to the World Economic Forum (2024), the construction industry contributes about 13% to the global GDP, whilst being responsible for the direct and indirect employment of a significant proportion of the worldwide population. Despite these critical contributions towards advancing society's economic and social growth aspirations, the negative impact of a plethora of anthropogenic activities inherent in the industry's project delivery ecosystem on attaining sustainable futures remains a growing concern. The proclivity of these activities towards the linear economy model of production and consumption, otherwise referred to as the take-make-dispose model, has been blamed for the industry's unsustainable utilisation of natural raw materials and disposal of construction and demolition waste (Adekunle *et al*., 2023; Ikuabe *et al*., 2024; Ramakrishna *et al*., 2020). Due to the preponderance of these anthropogenic activities within the construction projects, the construction industry is responsible for using three billion tonnes of raw materials whilst generating waste in like sum (Ramakrishna *et al*., 2020). Also, the industry is known for emitting significant amounts of carbon and greenhouse gases, further undermining society's carbon neutrality ambitions and exacerbating global warming (Stephen *et al*., 2025). Admittedly, these negative impacts are exacerbated by the growing population and rapidly urbanising cities, which have heightened the demand for buildings and infrastructure, which would, in turn, culminate in the increased use of the earth's resources and greenhouse gas emissions. This reality has necessitated the adoption of various interventions by relevant stakeholders within the context of the construction industry to ameliorate these challenges. Adopting circular economy (CE) principles across the construction project lifecycle has been identified as a veritable pathway for achieving sustainable performance in such projects. Although defying a widely accepted definition, the CE concept remains synonymous with processes associated with eliminating waste (Ogunmakinde *et al*., 2022). The CE concept relies on the 10 Rs principle to minimise the reliance on virgin materials during production. It provides a closed-loop system wherein materials and assets are used for longer intervals and, upon decommissioning, deployed to alternative uses as inputs into another production system (Ramakrishna *et al*., 2020). The growing population and associated rapidly urbanising cities-construction industry has adopted several initiatives to improve its sustainability performance. This gives the premise for circular procurement (CP) for construction project delivery. CP is a strategic approach to purchasing that supports the transition to a CE (Neessen *et al*., 2021). It is a system that prioritizes key concepts such as repair, reuse, recycling, refurbishment and sustainability, instead of employing the traditional linear procurement model. Based on this background, this study is motivated to explore the barriers to implementing CP in the construction industry from a developing economy perspective.

Review of related literature

Highlighted in existing literature, CE has been identified as contributing to construction sustainability through significant changes in the industry's supply chains and procurement processes (EMF, 2017). In literature, the integration of CE and procurement is known as CP (Sönnichsen and Clement, 2020), which holds immense potential for the construction industry. Construction CP is regarded as the procurement strategy that public and private organisations adopt to pursue CE actively (Neessen *et al*., 2021). The United Nations Environment Programme (UNEP) defines "circular procurement as when the buyer purchases products or services that follow CE principles, supporting the assessment of designing, making, selling, reusing and recycling products to determine how to get the maximum value from them, both in use and at the end of their life" (UNEP, 2021). The current economic production and consumption model satisfies procurement activities' needs while compromising future needs. Geissdoerfer *et al*. (2017) argue that this economic model results in enormous quantities of rare resources ending up in landfills, as most materials are discarded after the product's lifetime. In

Downloaded from http://www.emerald.com/ecam/article-pdf/32/13/319/10075157/ecam-02-2025-0249en.pdf by University of the Witwatersrand user on 09 September 2025

addition, procurement teams typically favour using new rather than recycled resources to meet the requirements of this conventional linear procurement system. An alternative to this model is CP, which aims to keep materials in the supply chain longer (Kirchherr *et al.*, 2017). Thus, materials are kept in circulation for an extended period for continuous value extraction. CP aims towards a zero-wastage concept even after the product's end of life through forward and reverse supply chains (Antikainen and Valkokari, 2016) and further suggests cross-sector collaboration to maximise the value of products and services (Qazi and Appolloni, 2022). CP also significantly contributes to the industry's compliance with some international regulations such as Sustainable Development Goals 11 and 12 – (*"sustainable cities and communities" and "responsible consumption and production")*. This is achieved through the development of sustainable urban infrastructure by prioritizing materials and systems that are reusable, durable and resource-efficient. In addition, it directly fosters responsible consumption and production by embedding life cycle thinking into purchasing decisions.

In addition, implementing CP practices can be complex as it involves tangible and intangible process activities for transforming traditional methods. However, three levels of adoption of CP have been found in the research studies. First and foremost, at the "system level", the focus is on encouraging contractual servitisation rather than owning. It stresses the benefits of renting or leasing methods and collaborating with other organisations to share. Secondly, "the supplier level" explains suppliers' roles in integrating circularity into resources and processes. The system supports the design for disassembly, supplier trackback mechanism and other features. The final level pertains to the product and the re-utilisation of materials or components after their initial use (European Union, 2017). Construction CP encompasses more than just providing construction products and services. It considers the broader and intricate network of stakeholders and supply chain activities, considering the entire lifespan of a project (Ababio and Lu, 2023). Tender design, a vital part of the construction process, is also crucial in CP implementation. CP incorporates circularity and environmental effectiveness principles into client specifications throughout the tendering process, post-award contract administration, and organisational and government procurement policies (Alhola *et al.*, 2019). Implementing CP within industrial processes holds great potential by fostering extensive and continuous stakeholder engagements, creating new business models and allocating efficient roles to improve the regeneration and restoration of material stock within systems (Marrucci *et al.*, 2019). Again, CP relies on desirable components of conventional procurement processes, such as value-for-money prioritisation, quality concerns and environmental consequences, to create a circulation system of energy and materials flow in a closed loop while staying within sustainability boundaries (van Oppen *et al.*, 2018). Over the past few years, the use of CP in public procurement for construction has increased significantly, with developed countries accounting for a larger share of its implementation than developing countries (Kristensen *et al.*, 2021). Table 1 summarises a list of barriers to adopting CP within the construction industry.

Research methodology

The study assessed the inhibitors to implementing CP by construction organisations in Nigeria. This was actualised using a deductive approach hinged on a post-positivism philosophical viewpoint aided by quantitative data elicited from construction professionals using a questionnaire survey. The use of a questionnaire is due to its ability to elicit responses from a large pool of respondents and allow the quantifiability and objectiveness of the study (Tan, 2011). The research area of the study was Lagos and Abuja, Nigeria. The choice of both locations stems from their commercial and administrative attributes. Lagos serves as the commercial capital, while Abuja is the country's seat of power, with both cities boasting many construction professionals and attributed to numerous construction projects of varying sizes. The target respondents of the study were construction professionals, namely builders, architects, quantity surveyors, engineers and project managers. The sample size employed for the study was derived using the formula given by Yamane (1967) – $n = N/1 + N$ (e) 2

Downloaded from http://www.emerald.com/ecam/article-pdf/32/13/319/10075157/ecam-02-2025-0249en.pdf by University of the Witwatersrand user on 09 September 2025

Table 1. Barriers to adopting circular procurement

Barriers	Description	Source(s)
Unwillingness to implement CP	Reluctance to integrate CP due to concerns such as increased cost and complexity to organisations present obstacles to CP implementation	Munaro and Tavares (2023)
Knowledge of return mechanism	Many industrial players lack the awareness of return channels for returning goods	Aslam *et al.* (2020)
Lack of political will for implementation	Insufficient political will impedes the essential commitment to overcoming CP implementation barriers	Munaro and Tavares (2023), Tura *et al.* (2019)
Lack of legislation	The lack of circular-specific laws or regulations hinders implementing CP strategies within the industry	Munaro and Tavares (2023), Kumar Mangla *et al.* (2021)
Divergent procurement priorities	Differences in procurement objectives or preferences of involved stakeholders obstruct CP implementation	Ahmed *et al.* (2024)
No commitment from top management	Lack of dedication from organisational senior leadership poses obstacles to effectively adopting CP practices	Farooque *et al.* (2019), Qazi and Appolloni (2022), Mangla *et al.* (2018), Haselsteiner *et al.* (2021)
Perceived high cost associated with circular products and services	The perception that circular products and services are more expensive than traditional procurement hinders adoption and implementation	Lahane and Kant (2021)
Culture of risk avoidance	Organisational risk aversion culture impedes the adoption and implementation of CP strategies and practices	Kristensen *et al.* (2021), Munaro and Tavares (2023)
Unclear strategic goal among project team members	Lack of well-defined strategic direction for CP implementation among project team members impedes meeting effective CP practices, initiatives, and targets	Munaro and Tavares (2023)
Unclear integration plan among SC partners	The lack of clarity on strategic planning for integrating supply chain partners hinders CP implementation within the industry	van Keulen and Kirchherr (2021)
Non-conformance with environmental laws	Some CP strategies may not satisfy environmental regulations and requirements. Those strategies hinder CP adoption and implementation	Ababio and Lu (2023)
Lack of government support	The lack of robust government assistance and intervention, such as research, innovation, and investment funding, impedes the promotion of CP implementation	Kumar *et al.* (2019)
Incapacity of suppliers	Suppliers' inability to meet CP's requirements presents significant barriers to its implementation	Qazi and Appolloni (2022)
Non-involvement of suppliers at early stages	Late suppliers' involvement in CP processes may not reflect circular product and service selection criteria for achieving CP targets	Ahmed *et al.* (2024), De Angelis *et al.* (2018)
Conflicting existing policies	Existing policies create barriers that hinder the harmonisation and operationalisation of CP practices	Kristensen *et al.* (2021), Lahane and Kant (2021)

(*continued*)

Downloaded from http://www.emerald.com/ecam/article-pdf/32/13/319/10075157/ecam-02-2025-0249en.pdf by University of the Witwatersrand user on 09 September 2025

Table 1. Continued

Barriers	Description	Source(s)
Lack of awareness	Deficiency in organisational and industrial awareness of CP hinders its adoption and implementation	Ababio and Lu (2023), Munaro and Tavares (2023), Mangla *et al.* (2018), Haselsteiner *et al.* (2021)
Bureaucratic organisational system	Organisational systems prioritising cost and quality metrics over environmental and social considerations present obstacles to CP implementation	Ababio and Lu (2023), Leal Filho *et al.* (2019), Qazi and Appolloni (2022)
Unclear pathway to supply chain integration	The lack of well-defined routes or methods for achieving CP supply chains hinders its implementation	Kristensen *et al.* (2021), Qazi and Appolloni (2022), Haselsteiner *et al.* (2021)
Lack of financial resources	The insufficiency of an organisation's financial means and resources to support CP practices impedes its implementation	Farooque *et al.* (2019), Haselsteiner *et al.* (2021)
Inadequate training	Insufficient training protocols present formidable obstacles to successful CP implementation within organisations	Ahmed *et al.* (2024), Mangla *et al.* (2018)
Sourcing not intended for return of materials	The complexity of reverse SC poses challenges to procurement processes, thereby encouraging firms to source for non-returnable materials	Ahmed *et al.* (2024), Qazi and Appolloni (2022)
High cost associated with returned materials	The cost of processing returned materials to meet quality standards for reuse or recycling is a barrier to organisations' widespread adoption of CP	Mont *et al.* (2017), Lahane and Kant (2021)
Lack of return pathway	Existing infrastructure, regulations and economic incentives are not conducive to facilitating reverse supply chains	Lahane and Kant (2021)

Source(s): Authors' own work

The data was used after the derivation of the number of registered professionals, which made up the sample frame of the study. Thereafter, one hundred and seventy-four questionnaires were distributed, while one hundred and sixty-three were returned, and all were filled out correctly. The sampling technique used in the study was the cluster probability sampling technique. The chosen technique was achieved by getting hold of the various registered professionals of the professional bodies in Lagos and Abuja, Nigeria. The researcher distributed the questionnaire electronically, which expedited the process of data acquisition from the target respondents. Before collecting data from the target respondents, a pilot study was conducted, which helped frame the needed components for the research instrument. Also, the validity and reliability of the research instrument were ascertained using Cronbach's alpha test. The test gave an alpha value of 0.912, which affirms the validity and reliability of the survey instrument (Tavakol and Dennick, 2011).

The review of extant literature identified twenty-three inhibiting factors to implementing CP by construction organisations in Nigeria. The data retrieved from the respondents of the study were analysed using the following methods of data analysis: mean item score (MIS), Kruskal-Wallis *h*-test (*K-W*), Student Newman-Keuls (SNK) post hoc technique, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). The MIS was used to rank the identified inhibitors based on the opinions of the study's respondents. Kruskal-Wallis *h*-test (*K-W*) was employed to ascertain if there is a statistical difference in the views presented by the respondents based on their professional affiliation. *K-W* is a non-parametric test used in evaluating the significant difference in the opinions of more than two groups (Pallant, 2005). The outcome of the *K-W* test provides the chi-square and *p*-value. When the given *p*-value >0.05, it is deemed that there is no significant difference in the opinions of the group of

Downloaded from http://www.emerald.com/ecam/article-pdf/32/13/319/10075157/ecam-02-2025-0249en.pdf by University of the Witwatersrand user on 09 September 2025

respondents. In contrast, when the given *p*-value <0.05, it is deemed that there is a significant difference in the views of the group of respondents. In addition, the SNK post hoc test was deployed to differentiate the mean responses of the respondents' classification based on their professional designation. Furthermore, the study used principal component analysis (PCA) as the extraction method in the conduct of EFA. This aided in determining the unidimensionality and factor analysisability of the identified inhibitors, as suggested by Oke *et al.* (2021) and Ikuabe *et al.* (2022). The idea of using EFA is driven by providing insights and clarity into structured patterns, giving a more detailed understanding of the connection patterns of the variables (Young and Pearce, 2013). Using the EQation software (EQS) version 6.4, the obtained constructs from the EFA were subjected to further analysis to affirm their equivalency. This was executed with the aid of CFA. The study used a multi-dimensional technique to assess the model. This was situated within the purview of the following fit indices: Satorra–Bentler scaled Chi-square ($S - B\chi^2$), root mean square error of approximation (RMSEA), standardised root mean square residual (SRMR) and root mean square error of approximation with 95% or 90% confidence interval (RMSEA @ 95% or 90% CI), goodness-of-fit index (GFI) and Bentler comparative fit index (CFI). According to Kaplan (2009), these indices outline a comparative absolute fit index and incremental fit indices. Furthermore, these indices exhibit a thorough and detailed assessment of the suitability of the derived constructs with the data sample. Moreover, further evaluation conducted by the analysis includes the *z*-statistics, construct validity and internal consistency.

Findings and discussion

Demographic information of respondents

The information on the respondents of the study shows that architects and quantity surveyors made 33.7% and 27.9% of the respondents, respectively. In contrast, builders and engineers comprised of 15.5% and 12% of the respondents, respectively. Also, 10.9% of the respondents were project managers. In terms of the years of professional experience of the respondents, 27.4% attained 11–15 years of experience, 19.4% attained 6–10 years of experience, 18.7% attained 1–5 years of experience and 22.8% of the respondents have above 15 years of professional experience, while 11.7% have less than 1 year of professional experience.

Inhibiting factors to the implementation of circular procurement

The review of related literature highlighted twenty-three inhibiting factors to implementing CP. These were presented to the target respondents of the study for rating based on their significance. The result of the analysis conducted on the retrieved data is presented in Table 2. The results show the ranking of the inhibiting factors and the *K-W* test. The result indicates that the most ranked factor is no commitment from top management, with a mean score of 4.68. The next ranked factors are lack of financial resources and perceived high cost associated with CP, with mean scores of 4.55 and 4.51, respectively. This is closely followed by divergent procurement priorities and lack of legislation, with mean scores of 4.43 and 4.40, respectively. The least ranked factors are non-conformance with environmental laws and lack of return pathway, with mean scores of 3.38 and 3.44, respectively. All the inhibiting factors are observed above 3.00, which portrays their significance. Furthermore, the outcome of the *K-W* test showed no significant difference in the opinions of the respondents based on their professional affiliation with nineteen factors. These nineteen factors have a *p*-value above 0.05, which implies a convergence in the views of the group of professionals. Conversely, there is a divergent stance in the opinions of the group of professionals on four factors. These factors are divergent procurement priorities, unclear strategic goals among project team members, inadequate training, and non-involvement of suppliers at an early stage. These factors have a *p*-value of less than 0.05.

Table 3 outlines the result of the SNK post-hoc test conducted in the study. The outcome of the *K-W* test indicates that there are divergent opinions on four factors serving as inhibitors to

Downloaded from http://www.emerald.com/ecam/article-pdf/32/13/319/10075157/ecam-02-2025-0249en.pdf by University of the Witwatersrand user on 09 September 2025

Table 2. Factors inhibiting the implementation of circular procurement

Inhibitors	$\overline{X}$	*R*	*K-W* X^2	Sig.
No commitment from top management	4.68	1	3.671	0.621
Lack of financial resources	4.55	2	4.629	0.795
Perceived high cost associated with circular products and services	4.51	3	6.338	0.087
Divergent procurement priorities	4.43	4	7.865	0.004**
Lack of legislation	4.40	5	9.117	0.068
Conflicting existing policies	4.32	6	2.638	0.517
Lack of awareness	4.28	7	3.047	0.116
Unwillingness to implement CP	4.19	8	4.719	0.373
Culture of risk avoidance	4.11	9	5.522	0.266
Knowledge of return mechanism	4.09	10	3.135	0.053
Incapacity of suppliers	4.04	11	1.176	0.384
Unclear strategic goal among project team members	3.97	12	3.794	0.031**
Lack of political will for implementation	3.85	13	7.472	0.426
Bureaucratic organisational system	3.79	14	6.725	0.725
Unclear integration plan among supply chain partners	3.72	15	4.523	0.338
Inadequate training	3.67	16	5.096	0.017**
Lack of government support	3.65	17	3.337	0.286
High cost associated with returned materials	3.6	18	7.648	0.199
Unclear pathway to SC integration	3.56	19	4.194	0.423
Non-involvement of suppliers at early stage	3.51	20	5.283	0.029**
Sourcing not intended for return of material	3.49	21	6.658	0.578
Lack of return pathway	3.44	22	7.405	0.082
Non-conformance with environmental laws	3.38	23	2.994	0.165

Note(s): ** significant at 0.05; R = Rank; K-W = Kruskal-Wallis *h*-test

Source(s): Authors' own work

Table 3. SNK post hoc test

Groups	*N*	Subset for alpha = 0.05 1	2	3
Builders	23	2.8117		
Engineers	23	2.6834		
Quantity surveyors	23		2.7295	
Project managers	23		2.5052	
Architects	23			2.5263
Sig.		1.000	0.241	

Source(s): Authors' own work

the implementation of CP by construction organisations in Nigeria. Hence, it becomes imperative to provide details about the different viewpoints. The SNK post hoc test (multiple comparisons) outlines the mean difference between the various groups of respondents; in this case, it is a professional designation. The findings show a difference in opinion among the three classifications of the professional designation. The first group comprises builders and engineers with values of 2.8117 and 2.6834, respectively. The second group includes quantity surveyors and project managers with values of 2.7295 and 2.5052, respectively. The third group is made of architects with a value of 2.5263.

Downloaded from http://www.emerald.com/ecam/article-pdf/32/13/319/10075157/ecam-02-2025-0249en.pdf by University of the Witwatersrand user on 09 September 2025

Exploratory factor analysis

EFA was employed to cluster the identified factors inhibiting the implementation of CP by construction organisations into more manageable constructs. This was achieved using PCA with varimax rotation. According to Tabachnick and Fidell (2007), this extraction technique aids in reducing large numbers of variables into coherent components or clusters. Hair *et al.* (2006) affirmed that EFA's conduct requires a large sample size for reasonable results; therefore, the study used one hundred and sixty-three as the sample size. To ascertain the factorability of the dataset, the Kaiser–Meyer–Olkin (KMO) of sampling adequacy and Bartlett's test of sphericity were employed. The result of the KMO sampling adequacy and Bartlett's test of sphericity is presented in Table 4. It is revealed that the KMO value given is 0.965, above the threshold of 0.6 used by previous studies (Aghimien *et al*., 2021; Ikuabe *et al.*, 2021). Also, Bartlett's test of sphericity gave a value of 1137.142 and a *p*-value of 0.000, thus implying that it is significant (Pallant, 2005). The results affirm the suitability and factorability of the study's dataset for EFA.

Table 4 also presents the results of the factor loadings emanating from the EFA. It is revealed that the identified twenty-three factors are loaded into five components, which are achieved through PCA and the adoption of varimax rotation as the extraction technique. The rotated component matrix's outcome shows that the factor loading values are all above the 50% threshold as adopted by previous studies (Aghimien *et al*., 2021; Ikuabe *et al.*, 2022). These results, in combination with the extracted communalities, show a good correlation between the formed components yielded by the analysis. Five components from the analysis are extracted, as shown in the table. The first component exhibits five variables whose factor loadings range from 0.927 to 0.635 and are named inadequacy of government policies and initiatives, while the second component has six variables with factor loadings that range from 0.851 to 0.551 and are named stakeholder-related challenges. The third component is attributed to five variables having factor loadings from a range of 0.728 to 0.524, named procurement bottlenecks. In comparison, the fourth component has four variables with a factor loading ranging from 0.708 to 0.517 and is named organisational culture. The fifth component comprises three variables with factor loadings ranging from 0.672 to 0.506 and is named financial impediments. The derived components' names emanate from the intrinsic attributes of the variables that formed the various components. Also, the percentage of the variance explained by the individual components is presented in Table 4. It is revealed that components one, two and three have 34.18%, 17.22% and 9.92, respectively. Meanwhile, components four and five have 5.06% and 3.84% respectively. The cumulative sum of the percentage variance explained for all components is 70.22%.

Confirmatory factor analysis

The findings of the EFA were further subjected to assessing the validity of the resulting components using CFA. The study's dataset is attributed to non-normality. Hence, the study employed the robust maximum likelihood estimation technique. This estimation method caters to the non-normality of the dataset (Field, 2009). The standardised coefficient ((λ), the z-statistics, the coefficient of determination (R^2) and the validity of the derived components are presented in Table 5. Also, the Rho alpha and Cronbach alpha were employed to assess the model's internal consistency. Cepeda-Carrion *et al*. (2019) noted that using both tests is advised in determining the model reliability when evaluating the internal consistency for attaining a robust output. The result shows that the standardised coefficient of the variables ranges from 0.927 to 0.634. This portrays a good construct validity as all the variables are well above 0.5 (50%) of the variance, which is the threshold. Furthermore, it is indicated that Cronbach's alpha and Rho's alpha tests gave a resulting coefficient of 0.881 and 0.874, respectively. Hair *et al*. (2019) noted that it is recommended for the coefficients to be above 0.7 and closer to 1.00, hence indicating good reliability from the derived constructs. The outcome of the z-statistics shows that all the variables have a value greater than 1.96. This reinforces the

Downloaded from http://www.emerald.com/ecam/article-pdf/32/13/319/10075157/ecam-02-2025-0249en.pdf by University of the Witwatersrand user on 09 September 2025

Table 4. Rotated component matrix and total variance explained

Label	Inhibitors	Component 1	2	3	4	5	Extracted communalities	% Of variance
Inadequacy of government policies and initiatives								
INH 1	Lack of legislation	0.927					0.675	34.18
INH 2	Lack of government support	0.831					0.559	
INH 3	Non-conformance with environmental laws	0.774					0.824	
INH 4	Conflicting existing policies	0.709					0.791	
INH 5	Lack of political will for implementation	0.635					0.633	
Stakeholders-related challenges								
INH 6	Lack of awareness		0.851				0.669	17.22
INH 7	Inadequate training		0.767				0.528	
INH 8	Unwillingness to implement CP		0.692				0.771	
INH 9	Incapacity of suppliers		0.638				0.906	
INH 10	Unclear strategic goal among project team members		0.584				0.592	
INH 11	Unclear integration plan among supply chain partners		0.551				0.647	
Procurement bottlenecks								
INH 12	Divergent procurement priorities			0.728			0.504	9.92
INH 13	Non-involvement of suppliers at early stage			0.665			0.817	
INH 14	Lack of return pathway			0.613			0.888	
INH 15	Knowledge of return mechanism			0.588			0.628	
INH 16	Sourcing not intended for return of material			0.524			0.712	
Organisational culture								
INH 17	No commitment from top management				0.708		0.609	5.06
INH 18	Bureaucratic organisational system				0.611		0.836	
INH 19	Unclear pathway to SC integration				0.534		0.772	
INH 20	Culture of risk avoidance				0.517		0.935	
Financial impediments								
INH 21	Lack of financial resources					0.672	0.585	3.84
INH 22	High cost associated with returned materials					0.522	0.793	
INH 23	Perceived high cost associated with Circular Products and Services					0.506	0.812	

(*continued*)

Downloaded from http://www.emerald.com/ecam/article-pdf/32/13/319/10075157/ecam-02-2025-0249en.pdf by University of the Witwatersrand user on 09 September 2025

Table 4. Continued

Label	Inhibitors	Component 1	2	3	4	5	Extracted communalities	% Of variance
Kaiser-Meyer-Olkin measure of sampling adequacy							0.965	
Bartlett's test of sphericity		Approx. Chi-Square					1137.142	
		df					152	
		Sig.					0.000	

Source(s): Authors' own work

significance of the identified variables as inhibiting factors to implementing CE construction organisations. Moreover, the results of the R^2 show that the values range from 0.871 to 0.591. This affirms the potent predictive accuracy of the variables. Henseler *et al*. (2009) noted that R^2 values closer to 1.0 indicate a substantial predictive accuracy. Also, the group R^2 of the derived constructs shows that the most potent predictive accuracy constructs are procurement bottlenecks, the inadequacy of government policies and initiatives, and financial impediments with values of 0.826, 0.793 and 0.784, respectively. This is followed by stakeholder-related challenges and organisational culture with values of 0.771 and 0.707, respectively.

The result of the fit indices and the derivative output estimate is presented in Table 6. It is shown that the CFI and GFI values derived are 0.957 and 0.968, respectively. This informs that both indices attain a good fit, as it is noted that a good fit is achieved when the resulting value is ≥ 0.95, while an acceptable fit is achieved when the resulting value is ≥ 0.90 (Iacobucci, 2010). Furthermore, it is shown that the resulting values of the RMSEA and SRMR are 0.045 and 0.072, respectively. This outcome indicates that the RMSEA attained a good fit while the SRMR attained an acceptable fit. Bentler (2005) recommended a good fit for both indices when the resulting value ≤ 0.05, while an acceptable fit is recommended when the resulting value ≤ 0.08. Also, the resulting analysis value of the model's sample data is an S – Bχ^2 of 5.431 with 2° freedom and an associated *p*-value of 0.000. Due to the high sensitivity associated with chi-square in sample size and the data's normality, it is adjudged less reliable (Zhong and Yuan, 2011). Consequently, it is encouraged that the normed chi-square is employed (Kline, 2005). This is achieved by using the degree of freedom to divide the chi-square. Hence, the normed chi-square from the study is 2.716. Byrne (2006) recommended values ranging from 3.00 to 5.00 for a good fit. Therefore, the resulting normed chi-square of this study affirms the model's adequacy.

Discussion of findings

The analysis indicates that the most significant factors inhibiting the deployment of CP are no commitment from top management, lack of financial resources, perceived high cost associated with Circular Products and Services, and divergent procurement priorities. Also, the result of the CFA conducted using the derived value of R^2 indicates that the inadequacy of government policies and initiatives is the most significant construct that outlines the implementation barriers of CP.

Inadequacy of government policies and initiatives

The study's analysis shows that the inadequacy of government policies and initiatives significantly hinders the implementation of CP. This component comprises lack of legislation, government support, non-conformance with environmental laws, conflicting existing policies and lack of political will for implementation. This finding is in tandem with Tura *et al*. (2019) and Munaro and Tavares (2023), who noted that the lack of circular-specific laws or regulations hinders the implementation of CP strategies in the construction industry. Also, it

Downloaded from http://www.emerald.com/ecam/article-pdf/32/13/319/10075157/ecam-02-2025-0249en.pdf by University of the Witwatersrand user on 09 September 2025

Table 5. Factor loading, *Z*-statistics and internal consistency of the model

Groups	Label	Standardised coefficient (λ)	*Z*-statistics	R^2	Significant at 5% level?	Group R^2	Cronbach's alpha	Rho coefficient
Inadequacy of government policies and initiatives	INH 1	0.813	5.991	0.772	Yes	0.793	0.881	0.874
	INH 2	0.772	9.304	0.618	Yes			
	INH 3	0.634	11.008	0.519	Yes			
	INH 4	0.859	7.922	0.813	Yes			
	INH 5	0.707	6.471	0.868	Yes			
Stakeholders-related challenges	INH 6	0.914	4.446	0.714	Yes	0.771		
	INH 7	0.883	10.537	0.856	Yes			
	INH 8	0.895	9.372	0.658	Yes			
	INH 9	0.729	6.429	0.721	Yes			
	INH 10	0.861	7.835	0.863	Yes			
	INH 11	0.746	9.017	0.665	Yes			
Procurement bottlenecks	INH 12	0.799	11.255	0.594	Yes	0.826		
	INH 13	0.936	9.968	0.817	Yes			
	INH 14	0.758	10.385	0.738	Yes			
	INH 15	0.714	11.773	0.695	Yes			
	INH 16	0.789	8.969	0.762	Yes			
Organisational culture	INH 17	0.927	9.268	0.809	Yes	0.707		
	INH 18	0.770	10.358	0.871	Yes			
	INH 19	0.837	7.564	0.661	Yes			
	INH 20	0.756	8.941	0.586	Yes			
Financial impediments	INH 21	0.837	9.445	0.725	Yes	0.784		
	INH 22	0.741	11.93	0.867	Yes			
	INH 23	0.705	6.795	0.619	Yes			

Source(s): Authors' own work

Downloaded from http://www.emerald.com/ecam/article-pdf/32/13/319/10075157/ecam-02-2025-0249en.pdf by University of the Witwatersrand user on 09 September 2025

Table 6. Robust fit indices

Fit index	Cut-off value	Estimate	Indication
$S - B\chi^2$		5.431	
df	x > 0.00	2	Good fit
CFI	x ≥ 0.90 (acceptable) x ≥ 0.95 (good fit)	0.957	Good fit
GFI	x ≥ 0.90 (acceptable) x ≥ 0.95 (good fit)	0.968	Good fit
RMSEA	x ≤ 0.08 (acceptable) x ≤ 0.05 (good fit)	0.045	Good fit
SRMR	x ≤ 0.08 (acceptable) x ≤ 0.05 (good fit)	0.072	Acceptable
NFI	x ≥ 0.90 (acceptable) x ≥ 0.95 (good fit)	0.959	Good fit
NNFI	x ≥ 0.90 (acceptable) x ≥ 0.95 (good fit)	0.917	Acceptable
RMSEA 90% CI		0.021:0.063	Acceptable range
p-value	x > 0.05	0.00	Acceptable range

Source(s): Authors' own work

has been reported that existing policies create barriers that impede the harmonisation and operationalisation of CP practices (Kristensen *et al.*, 2021; Lahane and Kant, 2021). The lack of government initiatives significantly hampers the drive to implement CP. Without clear policies directing initiatives such as using recycled materials, resource efficiency and waste reduction, the concept of CP would be a mirage in the construction industry. Moreover, the lack of standardised guidelines further generates uncertainty (Kumar Mangla *et al.*, 2021; Munaro and Tavares, 2023), which leads to the hurdle of general acceptance. Furthermore, insufficient political will impedes the commitment to overcoming CP implementation barriers. This is corroborated by Tura *et al.* (2019), who noted that effective policies backed by firm enforcement are important in driving the implementation of CP in the construction industry.

Stakeholders-related challenges

The second component derived from the analysis is labelled stakeholders-related challenges. It comprises the following variables: lack of awareness, inadequate training, unwillingness to implement CP, incapacity of suppliers, unclear strategic goal among project team members and unclear integration plan among supply chain partners. This finding aligns with the study of Ahmed *et al.* (2024), which affirmed that a deficiency in organisational and industrial awareness of CP hinders its adoption and implementation. The absence of clear communication and shared objectives hinders the drive for CP in construction project delivery. Furthermore, a deficiency in organisational and stakeholders' awareness of CP inhibits its acceptance and implementation (Ababio and Lu, 2023; Munaro and Tavares, 2023). It becomes imperative to outline the need for intensive sensitisation of CP awareness among stakeholders in the construction industry. In addition, weak collaboration between stakeholders results in disjointed decision-making, which leads to ineffectiveness in material recycling and reuse. Moreover, the lack of clarity on strategic planning for integrating supply chain partners hinders CP implementation within the industry (van Keulen and Kirchherr, 2021).

Procurement bottlenecks

The third component, which comprises five variables, is called procurement bottlenecks. The variables are divergent procurement priorities, non-involvement of suppliers at an early stage,

Downloaded from http://www.emerald.com/ecam/article-pdf/32/13/319/10075157/ecam-02-2025-0249en.pdf by University of the Witwatersrand user on 09 September 2025

lack of return pathway, knowledge of return mechanism and sourcing not intended for the return of material. Ahmed *et al.* (2024) noted that differences in procurement objectives or preferences of involved stakeholders obstruct CP implementation. Usually, traditional processes prioritise cost-effectiveness and speedy completion over long-term value and sustainability. Moreover, the late involvement of suppliers in the procurement process tends to hinder service and product selection criteria for the attainment of CP (De Angelis *et al.*, 2018). Furthermore, supply chain limitations outline hurdles associated with a lack of supply of circular materials. Qazi and Appolloni (2022) affirm that the complexity of the reverse supply chain poses challenges to procurement processes, encouraging firms to source non-returnable materials. Many suppliers lack the capacity or incentives to produce and distribute recycled or repurposed construction materials at competitive prices. This is further exacerbated by lengthy approval processes, which serve as a significant challenge for procurement decisions.

Organisational culture

The fourth component, labelled as organisational culture, comprises four variables. The variables are no commitment from top management, bureaucratic organisational system, unclear pathway to sustainable construction integration and culture of risk avoidance. This finding is corroborated by Leal Filho *et al.* (2019), who noted that organisational systems prioritising cost and quality metrics over environmental and social considerations present obstacles to CP implementation. Many construction organisations have a defined operational environment that revolves around cost-driven tenets that place short-term financial gains over attaining long-term sustainable principles. Moreover, the lack of commitment from organisational leadership in steering the drive towards CP is a significant obstacle (Farooque *et al.*, 2019; Qazi and Appolloni, 2022; Mangla *et al.*, 2018; Haselsteiner *et al.*, 2021). When top management in organisations does not actively promote CE principles for procurement activities, there is a great tendency for the organisation not to imbibe the sustainability concepts.

Financial impediments

The last component derived from the analysis comprises three variables labelled as financial impediments. The variables are lack of financial resources, high costs associated with returned materials and perceived high costs related to circular products and services. This finding is in tandem with the study of Farooque *et al.* (2019), who stated that the insufficiency of an organisation's financial means and resources to support CP practices impedes its implementation. Deploying sustainable materials and recycling processes requires substantial initial investment, which might be difficult for many construction organisations to key into. This becomes more challenging in severely competitive markets where cost optimisation is a significant priority. Also, the cost of processing returned materials to meet quality standards for reuse or recycling is a barrier to organisations' widespread adoption of CP (Lahane and Kant, 2021).

Conclusion

The study assessed the factors inhibiting the implementation of CP from a developing economy perspective. Using a quantitative approach, data were elicited from construction professionals and analysed using multiple analysis techniques. The findings showed that the most significant barriers to implementing CP are no commitment from top management, lack of financial resources, and perceived high costs associated with circular products and services. Also, the EFA findings revealed five constructs: inadequacy of government policies and initiatives, stakeholder-related challenges, procurement bottlenecks, organisational culture and financial impediments. The CFA conducted for the study further affirmed these derived constructs using construct validity, reliability and fit indices. With the study's outcome, it is

Downloaded from http://www.emerald.com/ecam/article-pdf/32/13/319/10075157/ecam-02-2025-0249en.pdf by University of the Witwatersrand user on 09 September 2025

essential to state that the drive for implementing CP can be achieved using a multi-faceted approach. The government must commit to establishing regulatory frameworks and policies that clearly support and mandate the deployment of CP. Also, stakeholder engagement is paramount in overcoming resistance to change. This can be actualised through awareness campaigns and constant training programs that help educate and train various stakeholders associated with the delivery of construction projects.

The study's outcome contributes immensely to the growing conversation on sustainable development. Theoretically, it contributes to the body of knowledge by filling the gap in scholarly studies centred on sustainable procurement from a developing economy perspective. This will serve as a solid theoretical foundation for further studies geared towards contributing to the dialogue on sustainable development by implementing viable procurement concepts and techniques. Moreover, from a practical perspective, the study offers valuable insights that can help abate the critical barriers to the implementation of CP in construction project delivery. The outcome of the study can assist relevant stakeholders involved in the procurement of construction projects in making informed decisions that can contribute towards sustainable development from a developing economy context.

It is important to state that the study was conducted in only two cities in Nigeria, Lagos and Abuja. Future studies can be conducted in other cities of the country to get a broader perspective on the barriers to CP implementation. Also, the current study employed a quantitative approach; future studies can employ a qualitative method or mixed methods, as this might bring a different perspective to the assessment of implementation barriers of CP for construction project delivery.

References

Ababio, B.K. and Lu, W. (2023), "Barriers and enablers of circular economy in construction: a multi-system perspective towards the development of a practical framework", *Construction Management and Economics*, Vol. 41 No. 1, pp. 3-21, doi: 10.1080/01446193.2022.2135750.

Adekunle, S., Chauke, N., Ikuabe, M., Aigbavboa, C. and John, B. (2023), "Achieving circular economy adoption in the construction industry: hurdles to cross in a developing country", in Aigbavboa, C., Oke, E. and Thwala, W. (Eds), *Sustainable Construction in the Era of the Fourth Industrial Revolution. AHFE (2023) International Conference. AHFE Open Access*, Vol. 107, AHFE International, USA, doi: 10.54941/ahfe1003097.

Aghimien, D.O., Aigbavboa, C.O., Meno, T. and Ikuabe, M.O. (2021), "Unravelling the risks of construction digitalisation in developing countries", *Construction Innovation*, Vol. 21 No. 3, pp. 456-475, doi: 10.1108/ci-02-2020-0026.

Ahmed, S., Majava, J. and Aaltonen, K. (2024), "Implementation of circular economy in construction projects: a procurement strategy approach", *Construction Innovation*, Vol. 24 No. 7, pp. 204-222, doi: 10.1108/ci-12-2022-0327.

Alhola, K., Ryding, S.-O., Salmenperä, H. and Busch, N.J. (2019), "Exploiting the potential of public procurement: opportunities for circular economy", *Journal of Industrial Ecology*, Vol. 23 No. 1, pp. 96-109, doi: 10.1111/jiec.12770.

Antikainen, M. and Valkokari, K. (2016), "A framework for sustainable circular business model innovation", *Technology Innovation Management Review*, Vol. 6 No. 7, pp. 5-12, doi: 10.22215/timreview/1000, available at: http://timreview.ca/article/1000

Aslam, M.S., Huang, B. and Cui, L. (2020), "Review of construction and demolition waste management in China and USA", *Journal of Environmental Management*, Vol. 264, 110445, doi: 10.1016/j.jenvman.2020.110445.

Bentler, P.M. (2005), *EQS 6 Structural Equation Program Manual*, Multivariate Software, Encino, CA.

Byrne, B.M. (2006), *Structural Equation Modelling with EQS- Basic Concepts, Applications and Programming*, 2nd ed., Lawrence Erlbaum Associates, Routledge, Mahwah, New York, doi: 10.4324/9780203726532.

Downloaded from http://www.emerald.com/ecam/article-pdf/32/13/319/10075157/ecam-02-2025-0249en.pdf by University of the Witwatersrand user on 09 September 2025

Cepeda-Carrion, G., Cegarra-Navarro, J.G. and Cillo, V. (2019), "Tips to use partial least squares structural equation modelling (PLS-SEM) in knowledge management", *Journal of Knowledge Management*, Vol. 23 No. 1, pp. 67-89, doi: 10.1108/JKM-05-2018-0322.

De Angelis, R., Howard, M. and Miemczyk, J. (2018), "Supply chain management and the circular economy: towards the circular supply chain", *Production Planning and Control*, Vol. 29 No. 6, pp. 425-437, doi: 10.1080/09537287.2018.1449244.

EMF (2017), "Closed loop", available at: www.ellenmacarthurfoundation.org/ce100/directory/closed-loop

European Union (2017), *Public Procurement for a Cirular Economy: Good Practice and Guidance*, European Union, Brussels.

Farooque, M., Zhang, A. and Liu, Y. (2019), "Barriers to circular food supply chains in China", *Supply Chain Management: An International Journal*, Vol. 24 No. 5, pp. 677-696, doi: 10.1108/scm-10-2018-0345.

Field, A. (2009), *Discovering Statistics Using SPSS for Windows*, 3rd ed., Sage Publications, London.

Geissdoerfer, M., Savaget, P., Bocken, N.M. and Hultink, E.J. (2017), "The Circular Economy–A new sustainability paradigm?", *Journal of Cleaner Production*, Vol. 143, pp. 757-768, doi: 10.1016/j.jclepro.2016.12.048.

Hair, J.F., Black, W., Babin, B., Anderson, R. and Tatham, R. (2006), *Multivariate Data Analysis*, 6th ed., Pearson Prentice Hall, Person Education, Upper Saddle River, NJ, 07458.

Hair, J.F., Risher, J.J., Sarstedt, M. and Ringle, C.M. (2019), "When to use and how to report the results of PLS-SEM", *European Business Review*, Vol. 31 No. 1, pp. 2-24, doi: 10.1108/ebr-11-2018-0203.

Haselsteiner, E., Rizvanolli, B.V., Villoria Sáez, P. and Kontovourkis, O. (2021), "Drivers and barriers leading to a successful paradigm shift toward regenerative neighborhoods", *Sustainability*, Vol. 13 No. 9, p. 5179, doi: 10.3390/su13095179.

Henseler, J., Ringle, C.M. and Sinkovics, R.R. (2009), "The use of partial least squares path modelling in international marketing", *Advances in International Marketing*, Vol. 20, pp. 277-319, doi: 10.1108/S1474-7979(2009)0000020014.

Iacobucci, D. (2010), "Structural equations modeling: fit indices, sample size, and advanced topics", *Journal of Consumer Psychology*, Vol. 20 No. 1, pp. 90-98, doi: 10.1016/j.jcps.2009.09.003.

Ikuabe, M., Aigbavboa, C.O., Anumba, C., Oke, A.E. and Aghimien, L. (2022), "Confirmatory factor analysis of performance measurement indicators determining the uptake of CPS for facilities management", *Buildings*, Vol. 12 No. 4, p. 466, doi: 10.3390/buildings12040466.

Ikuabe, M., Aigbavboa, C. and Ngcobo, N. (2023a), "Private finance initiative as a tool for the infrastructural deficit in developing economies", in Karatas, A., Iranmanesh, A., Gurgun, A., Yazdani, S. and Singh, A. (Eds), *Proceedings of International Structural Engineering and Construction: Innovative Theory and Practices in Structural Engineering and Construction*. Vol. 10 No. 1, doi: 10.14455/ISEC.2023.10(1).CON-36

Ikuabe, M., Aigbavboa, C., Thwala, W., Chiyangwa, D. and Oke, A. (2023b), "Risks of joint venture formation in the South African construction industry", *International Journal of Construction Management*, Vol. 23 No. 14, pp. 2391-2399, doi: 10.1080/15623599.2022.2059913.

Ikuabe, M., Aigbavboa, C. and Oke, E. (2024), "Sustainability assessment practices in the construction industry: the untold story of South Africa", in Papadikis, K., Zhang, C., Tang, S., Liu, E. and Di Sarno, L. (Eds), *Towards a Carbon Neutral Future. ICSBS 2023. Lecture Notes in Civil Engineering*, Springer, Singapore, Vol. 393, pp. 229-235, doi: 10.1007/978-981-99-7965-3_21.

Ikuabe, M., Oke, A.E. and Aigbavboa, C.O. (2021), "Evaluating the influencing factors responsible for construction contractors' opportunism in a developing economy", *African Journal of Science, Technology, Innovation and Development*, Vol. 13 No. 3, pp. 387-393, doi: 10.1080/20421338.2020.1746044.

Kaplan, D. (2009), *Structural Equation Modeling: Foundations and Extensions*, 2nd ed., Sage, Thousand Oaks, CA.

Downloaded from http://www.emerald.com/ecam/article-pdf/32/13/319/10075157/ecam-02-2025-0249en.pdf by University of the Witwatersrand user on 09 September 2025

Kirchherr, J., Reike, D. and Hekkert, M. (2017), "Conceptualizing the circular economy: an analysis of 114 definitions", *Resources, Conservation and Recycling*, Vol. 127, pp. 221-232, doi: 10.1016/j.resconrec.2017.09.005.

Kline, R.B. (2005), *Principles and Practice of Structural Equation Modelling*, 2nd ed., Guilford Press, New York.

Kristensen, H.S., Mosgaard, M.A. and Remmen, A. (2021), "Circular public procurement practices in Danish municipalities", *Journal of Cleaner Production*, Vol. 281, 124962, doi: 10.1016/j.jclepro.2020.124962.

Kumar, V., Sezersan, I., Garza-Reyes, J.A., Gonzalez, E.D.R.S. and Al-Shboul, M.d.A. (2019), "Circular economy in the manufacturing sector: benefits, opportunities and barriers", *Management Decision*, Vol. 57 No. 4, pp. 1067-1086, doi: 10.1108/md-09-2018-1070.

Kumar Mangla, S., Börühan, G., Ersoy, P., Kazancoglu, Y. and Song, M. (2021), "Impact of information hiding on circular food supply chains in business-to-business context", *Journal of Business Research*, Vol. 135, pp. 1-18, doi: 10.1016/j.jbusres.2021.06.013.

Lahane, S. and Kant, R. (2021), "Evaluation and ranking of solutions to mitigate circular supply chain risks", *Sustainable Production and Consumption*, Vol. 27, pp. 753-773, doi: 10.1016/j.spc.2021.01.034.

Leal Filho, W., Skouloudis, A., Brandli, L.L., Salvia, A.L., Avila, L.V. and Rayman-Bacchus, L. (2019), "Sustainability and procurement practices in higher education institutions: barriers and drivers", *Journal of Cleaner Production*, Vol. 231, pp. 1267-1280, doi: 10.1016/j.jclepro.2019.05.202.

Mangla, S.K., Luthra, S., Mishra, N., Singh, A., Rana, N.P., Dora, M. and Dwivedi, Y. (2018), "Barriers to effective circular supply chain management in a developing country context", *Production Planning and Control*, Vol. 29 No. 6, pp. 551-569, doi: 10.1080/09537287.2018.1449265.

Marrucci, L., Daddi, T. and Iraldo, F. (2019), "The integration of circular economy with sustainable consumption and production tools: systematic review and future research agenda", *Journal of Cleaner Production*, Vol. 240, 118268, doi: 10.1016/j.jclepro.2019.118268.

Mont, O., Plepys, A., Whalen, K. and Nußholz, J. (2017), *Business Model Innovation for a Circular Economy: Drivers and Barriers for the Swedish Industry – the Voice of REES Companies*, Mistra REES, Lund.

Munaro, M.R. and Tavares, S.F. (2023), "A review on barriers, drivers, and stakeholders towards the circular economy: the construction sector perspective", *Cleaner and Responsible Consumption*, Vol. 8, 100107, doi: 10.1016/j.clrc.2023.100107.

Neessen, P.C.M., de Jong, J.P., Caniëls, M.C.J. and Vos, B. (2021), "Circular purchasing in Dutch and Belgian organizations: the role of intrapreneurship and organizational citizenship behavior towards the environment", *Journal of Cleaner Production*, Vol. 280, 124978, doi: 10.1016/j.jclepro.2020.124978.

Ogunmakinde, O.E., Egbelakin, T. and Sher, W. (2022), "Contributions of the circular economy to the UN sustainable development goals through sustainable construction", *Resources, Conservation and Recycling*, Vol. 178, 106023, doi: 10.1016/j.resconrec.2021.106023.

Oke, A.E., Kineber, A.F., Albukhari, I., Othman, I. and Kingsley, C. (2021), "Assessment of cloud computing success factors for sustainable construction industry: the case of Nigeria", *Buildings*, Vol. 11 No. 36, pp. 1-15, doi: 10.3390/buildings11020036.

Otasowie, K., Ikuabe, M., Aigbavboa, C. and Oke, A. (2023), "Factors militating against the use of digital technology by sub-contractors in South Africa", in Arai, K. (Ed.), *Proceedings of the Future Technologies Conference (FTC)*, *Lecture Notes in Network and Systems*, Springer, Cham, Vol. 560, pp. 749-757, doi: 10.1007/978-3-031-18458-1_50.

Pallant, J. (2005), *SPSS Survival Manual: A Step-by-step Guide to Data Analysis Using SPSS for Windows (Version 12)*, 2nd ed., Allen & Unwin, Australia, Crows Nest NSW2065.

Qazi, A.A. and Appolloni, A. (2022), "A systematic review on barriers and enablers toward circular procurement management", *Sustainable Production and Consumption*, Vol. 33, pp. 343-359, doi: 10.1016/j.spc.2022.07.013.

Downloaded from http://www.emerald.com/ecam/article-pdf/32/13/319/10075157/ecam-02-2025-0249en.pdf by University of the Witwatersrand user on 09 September 2025

Ramakrishna, S., Ngowi, A., De Jager, H. and Awuzie, B. (2020), "Emerging industrial revolution: symbiosis of industry 4.0 and circular economy: the role of universities", *Science, Technology and Society*, Vol. 25 No. 3, pp. 505-525, doi: 10.1177/0971721820912918.

Sönnichsen, S.D. and Clement, J. (2020), "Review of green and sustainable public procurement: towards circular public procurement", *Journal of Cleaner Production*, Vol. 245, 118901, doi: 10.1016/j.jclepro.2019.118901.

Stephen, S.S., Oke, A.E., Aigbavboa, C.O., Akinradewo, O.I., Adetoro, P.E. and Ikuabe, M. (2025), *Stealth Construction: Integrating Practices for Resilience and Sustainability*, Emerald Publishing, Leeds, doi: 10.1108/978-1-83608-182-120251013.

Tabachnick, B. and Fidell, L. (2007), *Using Multivariate Statistics*, 5th ed., Allyn & Bacon, New York.

Tan, W.C.K. (2011), *Practical Research Methods*, Pearson Custom, Singapore.

Tavakol, M. and Dennick, R. (2011), "Making sense of Cronbach's alpha", *International Journal of Medical Education*, Vol. 2, pp. 53-55, doi: 10.5116/ijme.4dfb.8dfd.

Tura, N., Hanski, J., Ahola, T., Ståhle, M., Piiparinen, S. and Valkokari, P. (2019), "Unlocking circular business: a framework of barriers and drivers", *Journal of Cleaner Production*, Vol. 212, pp. 90-98, doi: 10.1016/j.jclepro.2018.11.202.

UNEP (2021), "Second Edition of UNEP's sustainable public procurement guidelines [WWW document]".

van Keulen, M. and Kirchherr, J. (2021), "The implementation of the Circular Economy: barriers and enablers in the coffee value chain", *Journal of Cleaner Production*, Vol. 281, 125033, doi: 10.1016/j.jclepro.2020.125033.

van Oppen, C., Croon, G. and de Vroe, D.B. (2018), "Circular procurement in 8 steps", Copper8.

World Economic Forum (2024), "Engineering and construction", available at: https://www.weforum.org/communities/engineering-and-construction/ (accessed 5 January 2025).

Yamane, T. (1967), *Statistics: an Introductory Analysis*, 2nd ed., Harper & Row, New York.

Young, A.G. and Pearce, S. (2013), "A beginner's guide to factor analysis: focusing on exploratory factor analysis", *Tutorials in Quantitative Methods for Psychology*, Vol. 9 No. 2, pp. 79-94, doi: 10.20982/tqmp.09.2.p079.

Zhong, X. and Yuan, K.H. (2011), "Bias and efficiency in structural equation modeling: maximum likelihood versus robust methods", *Multivariate Behavioral Research*, Vol. 46 No. 2, pp. 229-265, doi: 10.1080/00273171.2011.558736.

Further reading

Ethirajan, M., Arasu M, T., Kandasamy, J., Kek, V., Nadeem, S.P. and Kumar, A. (2021), "Analysing the risks of adopting circular economy initiatives in manufacturing supply chains", *Business Strategy and the Environment*, Vol. 30 No. 1, pp. 204-236, doi: 10.1002/bse.2617.

Corresponding author

Matthew Ikuabe can be contacted at: ikuabematthew@gmail.com

For instructions on how to order reprints of this article, please visit our website:
www.emeraldgrouppublishing.com/licensing/reprints.htm
Or contact us for further details: **permissions@emeraldinsight.com**

Downloaded from http://www.emerald.com/ecam/article-pdf/32/13/319/10075157/ecam-02-2025-0249en.pdf by University of the Witwatersrand user on 09 September 2025