Organizational learning, innovation types and sustainability performance: Testing a multiple-mediator model

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Abstract

Existing studies attest to the mediating role of innovation, but less is known about which specific type of innovation matters in the manufacturing context of a developing country. This study unpacks the construct of innovation and tests the mediating effect of product, process, and management system innovation types in the relationship between organizational learning and sustainability performance. A structured questionnaire was used to collect cross-sectional survey data from the managerial staff of 256 medium and large manufacturing firms in Uganda. Hayes's PROCESS macro (Version 4.0) through Model 4 was used to carry out a multiple-mediation analysis. Findings revealed that organizational learning, product innovation, and process innovation have a positive direct effect on sustainability performance. Only product and process innovations partially mediate the relationship between organizational learning and sustainability performance. The findings of this study validated the dynamic capability theory by demonstrating that the effect of organizational learning on sustainability performance can be partially conveyed through product and process innovation. Drawing on this empirical evidence, industry policymakers and managers of medium and large manufacturing firms seeking to improve sustainability performance need to adopt strategies that simultaneously support organizational learning and innovations in products and processes.

Keywords: Sustainability Performance, Organisational Learning Process, Product Innovation, Process Innovation, Uganda Manufacturing Firms

Introduction

In the wake of corporate sustainability scandals, stakeholders are increasingly becoming more troubled about the social and environmental impacts arising out of manufacturing activities. Manufacturing firms particularly in developing countries continue to use ancient production technologies that are energy-intensive and consume a significant amount of natural resources, have ineffective pollution and waste management infrastructure, bring to the market environmentally unfriendly products, as well as fail to integrate green practices in their supply chain (Abdul-Rashid *et al.,* 2017). Consequently, this affects not only the ecosystem, through global warming but also the quality of life. As such, manufacturing firms are obliged to adopt strategies that aim to achieve shareholders' economic interests alongside stakeholders' social and

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environmental interests. Firms that are sustainably conscious in their operations benefit from improved stakeholder trust, employee morale, legitimacy, and market success (Horak *et al.,* 2018).

Recent studies indicate that manufacturing firms on the African continent are more detrimental to human health and the environment than those on other continents (World Meteorological Organisation, 2019; Ozili, 2022). In the sub-Saharan Africa region, manufacturing firms by nature of their operations contribute greatly to land degradation, pollution, waste mismanagement, illegal discharges, and other adverse climate change effects (Asongu *et al.,* 2021; UNCTAD, 2021; Emberson *et al.,* 2020; Omisore, 2018). Such business practices are reported to cause unexpected strong rains and droughts, reduced water levels, drying of wetlands, and the eventual outbreak of waterborne infections, all of which adversely affect the environment and human life (Sendawula *et al.,* 2020; Josephat, 2018). In Uganda, it is estimated that about 39.3% out of every 7,989 registered death or illness is related to the consequences of social and/or environmental degradation (World Health Organisation, 2019; National Environment Management Authority (NEMA) Annual Corporate Report, 2018). Moreover, the Global Sustainability Competitiveness Index (2021) places Uganda at 37.6% in terms of embracing sustainability initiatives, which is below the minimum threshold of 50% and lower than any other East African country. By and large, the manufacturing sector accounts greatly for Uganda's sustainability development challenge (Mugerwa, 2015; NEMA Annual Corporate Report, 2018).

Amidst such social and environmental disasters, the manufacturing sector is credited for its significant contribution to both global and national socio-economic development. Thus, an understanding of the factors that drive manufacturing firms toward becoming more socially and environmentally responsive would be of great importance to corporate sustainability researchers and policymakers (UNCTAD, 2021). This is particularly important in developing countries where the enforcement of social and environmental protection laws, policies, and programmes is less effective, necessitating voluntary action on the part of business owners and management (Muchaendepi *et al.,* 2019; Namagembe *et al.,* 2016). This raises the key question of what management strategies could be embraced to improve the sustainability performance of manufacturing firms in developing countries such as Uganda. Prior studies provide for a stream of corporate sustainability performance drivers. For instance, Zaid et al. (2020) argue that board nationality and gender have a direct positive effect on corporate sustainability performance. Similarly, external demographic pressure was found to positively relate to corporate sustainability performance in a global study conducted by Ledje and Asmelash (2020). Other studies indicate that; financial independence (Miragaia *et al.,* 2016), corporate governance (Crifo *et al.,* 2019), intellectual capital (Massaro *et al.,* 2018), social connectedness (Moldavanova & Goerdel, 2018), and legal enforcement (Bananuka *et al.*, 2021) are equally important direct determinants of firm sustainability performance. There is an emerging research stream linking organizational learning, and innovation to organizational sustainability performance. For instance, Vihari et al. (2018) and Opuku and Fortune (2011) indicate that organizational learning has a direct positive effect on organizational sustainability. Accordingly, organizations that engage in systematic learning processes can interact with both the internal and external environment, from which information is obtained concerning the changing stakeholder needs. This information is then used in designing strategies aimed to address present and future stakeholders' needs (Vihari *et al.,* 2018; Opuku & Fortune, 2011). On the other hand, studies by

Vihari (2019), Pedersen et al. (2018), and Globocnik et al. (2019) found that innovation has a direct significant positive effect on sustainability performance. The authors indicate that innovations in firm products, processes, and management systems enable business firms to address changing stakeholder economic, social, and environmental demands.

The contribution of existing direct effect studies withstanding, Hayes (2017) and Smith (2012) suggest future researchers go beyond testing direct effect relationships to include other third variables that could account for greater variation in firm sustainability performance, particularly in a developing economy context. In response, Vihari et al. (2018) conducted a study among pharmaceutical companies in India and established that institutional pressure dimensions significantly moderated the link between organizational learning and organizational sustainability dimensions. Similarly, Vihari (2019) found out that organizational learning and strategic flexibility respectively mediated and moderated the link between business model innovation and corporate sustainability among pharmaceutical companies in India. However, less understanding exists about the mediating role of innovation in the relationship between organizational learning and sustainability performance among medium and large manufacturing firms in a developing country such as Uganda. Besides, sustainability-related studies conducted in Uganda mainly focus on small manufacturing enterprises (e.g Namagembe *et al.,* 2016; Sendawula *et al.,* 2020) yet social and environmental damage is predominantly associated with medium and large manufacturing firms (NEMA Annual Corporate Report, 2018; Bananuka *et al.,* 2021).

Drawing on the dynamic capabilities theory (Teece *et al.,* 1997) and the conceptual work of Mohamed et al. (2009), this paper hypothesized that organizational learning can increase innovation, which in turn improves firm sustainability performance. Further, Damanpour and Aravid (2012) recommend an in-depth analysis to establish which type(s) of innovation is more important, rather than the conventional combinative effect. Moreover, few scholars have tested the mediating mechanisms of innovation types between latent constructs (e.g. Durmuş-Özdemir and Abdukhoshimov, 2018; Al-Sa'di *et al.,* 2017). The three innovation types commonly examined within the industrial sector; product, process, and management system innovation were examined in this study (Wang & Ahmed, 2004; Christensen, 2000). Accordingly, this study makes a two-fold contribution; firstly, the study examined the direct effect of organizational learning and innovation types on sustainability performance. Secondly, the study examined the mediating effect of innovation types on the relationship between the organizational learning process and sustainability performance. The subsequent sections of this paper cover; the literature review, the study model, methodology, results, discussion, conclusion, implications, and limitations of the study.

Literature review

Organizational learning and sustainability performance

The dynamics of today's fast-changing knowledge economy necessitate organizations to continue learning to gain knowledge relevant to addressing market needs. Learning involves the creation, acquisition, distribution, integration, and storage of organizational knowledge (López *et al.,* 2005). Knowledge is an intangible organizational resource embedded within human resources, and therefore organizations need to motivate their human resources to develop a sense of empowerment that energizes them to continuously explore and exploit learning opportunities.

Worth noting, that organizational learning goes beyond periodic training sessions, due to organizational learning being continuous and with a long-term organizational-wide focus (Nonaka *et al.,* 2000). Consistent with the resource-based view theory, the process of learning facilitates the accumulation of knowledge as an organizational intangible resource that is used to deliver sustainable superior customer value in turbulent market environments (Marsick, 2009). Empirical studies show that knowledge accumulated through organizational learning can increase innovation (López *et al*., 2005), competitiveness (Hernaus *et al.,* 2008), and performance (Murray, 2003). With the advent of the corporate sustainability agenda, there is an emerging research stream that suggests organizational learning to potentially improve business sustainability; which concerns the attainment of economic, social, and environmental objectives simultaneously. For instance, Bull and Fokuhl (2020) study established various organizational learning factors that enabled sustainability transitions in a public service agency in Scandinavia. Similarly, Vihari et al. (2018) found that organizational learning had a direct positive effect on organizational sustainability.

From a critical review of extant literature linking organizational learning and sustainability performance, we observed that while the dimensions and measures of sustainability performance have principally and consistently remained uniform across theoretical and empirical studies, there are evident substantial inconsistencies in the dimensions and measures of organizational learning as a predictor variable. For instance, Vihari et al. (2018) used social learning, market learning, and technological learning as dimensions of organizational learning. Smith (2012) used the dimensions of single and double-loop learning while Marsick and Watkins (2003) used system problem solving, experimentation, shared learning, personal mastery, and knowledge transfer. Generally, organizational learning is explored following capabilities and/or typology viewpoint, and little is known about the process of organizational learning and how this process is associated with sustainability performance (Van-Mierlo & Beers, 2020). This paper fills this gap in the literature by examining the construct of organizational learning following a process perspective emphasized by Huber (1991). Accordingly, organizations that engage in a continuous process of knowledge generation, acquisition, distribution, interpretation, utilization, and storage do interact with both the internal and external stakeholders on an ongoing basis. Through such interactions, information about the dynamic nature of stakeholders' needs is generated, acquired, and distributed among organizational members, providing a common understanding of such needs. Equipped with this information, members are able to review the present performance framework and adopt a more inclusive framework that simultaneously addresses stakeholders' economic, social and ecological demands. In light of this view, we hypothesized that;

H1. Organizational learning is positively related to sustainability performance.

Innovation types and sustainability performance

Today's highly volatile business environment characterized by rapid technological changes and uncertainty necessitates organizations across different industries to become more innovative to survive and stay ahead of the competition (Danneels & Vestal, 2020). Firm innovation involves the generation, acceptance, dissemination, and implementation of creative ideas that improve company products, services, systems, procedures, structures, behavior, competencies, markets, and strategies (Wang & Ahmed, 2004). The dynamic capability theory postulates that

organizations operating in a highly dynamic and complex environment need to proactively re-think their present business models and management practices based on accurate market information (Teece *et al.,* 1997). Otherwise, organizations may be forced to respond to external market pressure to avert decay. Prior research has shown that innovation as a dynamic capability ably improves the firm's sustainability performance (e.g. Vihari, 2019; Globocnik *et al.,* 2019). Through innovation, firms are able to re-think and effect incremental and/or radical changes in existing products, processes, and systems to meet the social, environmental, and economic needs of the various stakeholder groups. Within the manufacturing setting, innovation for sustainability performance may take form of changes in product design, use of energy-saving production methods, reduction in pollution, and improvements in waste recycling infrastructure (Vanclay, 2004).

From the practitioners' perspective, there could be concern that the investment in sustainability-related innovation could compromise the primary economic objectives of the firm. However, empirical studies present evidence supporting the positive influence of innovation capability not only for economic benefit but also for social and environmental benefits. For instance, a study by Persaud (2014) revealed that organizations that institutionalize a dynamic learning culture indirectly promote innovation capability which in turn improves social, economic, and environmental sustainability. Similarly, Pedersen et al. (2018) study concluded that companies with innovative business models possess the resources and capabilities that facilitate the adoption of proactive corporate sustainability strategies. Likewise, Globocnik et al. (2019) stress that innovation improves the three triple bottom line dimensions of sustainability. Such literature supports the view that innovation is a foundation upon which firms increase their engagement in sustainability activities. Thus, firms aspiring to attain higher levels of sustainability performance need to invest heavily in research and development to build knowledge resources relevant to steering continuous transformations in product or service design, process efficiency, and management systems that not only address the social and environmental needs of stakeholders but also serve the economic interests of the minority shareholders. In light of this literature review, we hypothesized that;

H2a. Product innovation is positively related to sustainability performance.
H2b. Process innovation is positively related to sustainability performance.
H2c. Management system innovation is positively related to sustainability performance.

Organizational learning and innovation types

Reflecting on the dynamic capabilities theory, organizational learning is understood to improve organizational innovation (Rezaei *et al.,* 2018). Organizations committed to learning can explore and exploit knowledge resources from both the internal and external environment relevant to improving processes, products, structures, competencies, and technology. The continued interaction with the environment generates information relevant to understanding changing market needs, technological breakthroughs, competitor actions, and public expectations. Managers use this information to spearhead changes in existing products or services, strategies, markets, systems, and processes to meet customer value (Wang & Ahmed, 2004). Thus, organizational learning is a process through which new ideas are obtained, shared, and configured into innovations. Empirical studies conducted in various contexts provide evidence that supports the above theoretical view. For instance, Dell'era and Verganti (2009) assert that

the interaction with designers from different nations on production approaches and work methods (knowledge resources) increased Italian furniture companies' capability to innovate and propose creative solutions. Similarly, Calantone et al. (2002) study recognize learning orientation as an important antecedent of firm innovation. In addition, Hsiao and Chang (2011) and Lee et al., (2008) affirm that organizational learning improves organisational innovation. Another study by Persaud (2014) shows that healthcare organizations that cultivate a culture of learning profit from innovative processes, products, and services.

The contribution of prior studies withstanding, extant literature linking the construct of organizational learning and organizational innovation reveals two major gaps; firstly, organizational learning is explored based on its facilitating factors as well as types. Less understanding exists concerning the process of organizational learning and its effect on firm outputs (Chiva e*t al.,* 2010; Calantone *et al.,* 2002). Secondly, some scholars consider innovation as an integral component of learning (Mahat *et al.,* 2018) yet other scholars suggest innovation to be an outcome of learning (Calantone *et al*., 2002). This paper aimed to generate empirical evidence that clarifies the gaps observed in existing learning and innovation literature by examining the association between organizational learning (as a single process construct) and firm innovation types. We suggested that organizational learning as a process of; knowledge acquisition, distribution, application, and storage has the potential to increase the firm's innovation capacity in products, processes, and management systems. Hence the hypotheses;

H3a. Organizational learning is positively related to product innovation.
H3b. Organizational learning is positively related to process innovation.
H3c. Organizational learning is positively related to management innovation.

The mediating mechanism of innovation types

Scholars have examined the direct effect of organizational learning on sustainability performance in different contexts (e.g. Vihari *et al*., 2018; Opuku & Fortune, 2011), but their results remain inconclusive to provide a full understanding of the corporate sustainability debate. Smith (2012) asserts that organizational learning as a single variable is insufficient to explain entirely variations in organizational sustainability performance, calling future researchers to examine other possible pathways including third variables. Existing studies recognize innovation as a third variable that ably mediates relationships between latent constructs. For instance, Mafabi et al.'s (2012) study of parastatals in Uganda reports the full mediating effect of organizational innovation between knowledge management and organizational resilience. Similarly, Zehir et al. (2015) in their study among SMEs in Turkey report that innovation capacity has a partial mediator effect on market orientation dimensions and export performance.

Further, literature shows that organizational learning, innovation, and sustainability performance are interrelated. For instance, Vihari (2019) examined the indirect effect of organizational learning between business model innovation and corporate sustainability. Persaud's (2014) meta-study proposed a framework that enhances learning, innovation, adaptation, and sustainability. Despite the inherent interrelationships, little is known about the mediating role of innovation between organizational learning and sustainability, particularly in a developing country such as Uganda. To address this gap, we suggest that firm sustainability performance could be built on organizational learning via innovation. Essentially, firms that embrace a culture of continued

learning build knowledge resources critical for advancing innovations in products or services, processes, and management systems. Such innovations in turn drive the firm towards attaining greater sustainability performance (Globocnik *et al.,* 2019).

More specifically, practitioners are interested in understanding which specific type(s) of innovation is of critical importance in a given business context (Damanpour & Aravid, 2012). For instance, Durmuş-Özdemir and Abdukhoshimov (2018) in their study within the Turkish telecommunication industry established that product, process, and marketing innovations significantly mediated the link between knowledge management process and performance. In the same vein, Al-Sa'di et al. (2017) study identified process innovation as the only significant mediator between knowledge management and operational performance among manufacturing companies operating in Amman. Thus, contemporary researchers and policymakers desire to understand which type(s) of innovation matter most between organizational learning and sustainability performance of manufacturing firms.

Moreover, existing literature shows that organizational learning improves product innovation (Saban *et al.,* 2000), and product innovation improves organizational sustainability (Globocnik *et al.,* 2019). Learning enables organizations to obtain knowledge about changing customer needs and competitors' strategic actions, which is then utilized in developing new product offers, improving existing product features as well as resulting in new market opportunities. In another study among manufacturing companies in Malaysia, Lee et al. (2013) established that organizational knowledge obtained through learning has a positive and significant effect on process innovation. Within the manufacturing setting, process innovations involve adapting energy-saving production techniques that are more efficient and less pollutant, making improvements in existing waste management infrastructure as well as improvements in delivering inputs and distribution of finished products (Vanclay, 2004). Globocnik et al. *(*2019) found such innovations in manufacturing processes to increase firm sustainability performance. Additionally, Christensen (2000) asserts that learning facilitates changes in management systems, which in turn enhance firm performance. Changes in management systems may take the form of job redesign, leadership development, improvements in staff motivation, performance management, and financial management, among other management systems. Consequently, innovations in products, processes, and management systems not only improve the competitive-economic performance of the firm but also the socio-environmental welfare of the majority stakeholders (Globocnik *et al.,* 2019). Deriving from the aforementioned literature, we hypothesized that;

H4a. Product innovation mediates the relationship between organizational learning and sustainability performance.

H4b. Process innovation mediates the relationship between organizational learning and sustainability performance.

H4c. Management system innovation mediates the relationship between organizational learning and sustainability performance.

In light of the reviewed literature, we developed a model presented in Figure 1 to guide this study.

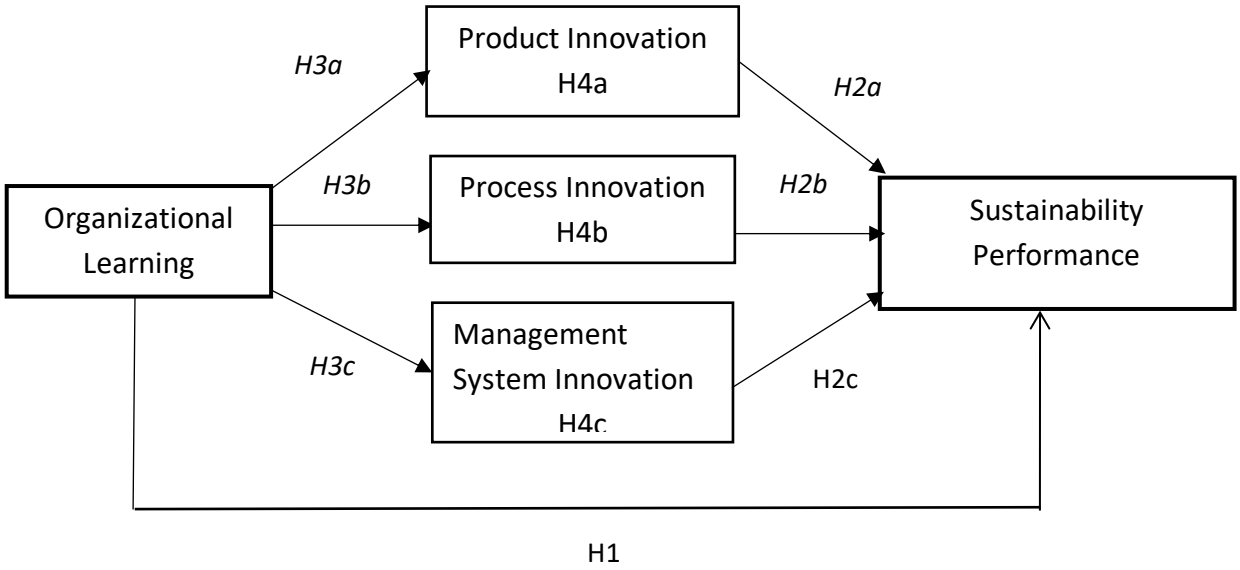

Figure 1: Research model

Methodology

Research design, population, and sampling

The study adopted an explanatory design that facilitated testing hypotheses using quantitative cross-sectional data. Using Yamane's (1967) formula, a sample of 301 large and medium manufacturing firms (as defined under the Uganda MSME policy, 2015) was considered adequate to represent the 1,221 firms registered under the Uganda Manufacturers Association (UMA) as of July 2019. Accordingly, we employed a multi-stage sampling procedure to randomly select the firms that participated in the study. A structured questionnaire was designed and physically delivered by the research team to the target manufacturing firms from February-August, 2020. Managerial staff was selected to respond to the questionnaire on the assumption that they are in a better position to provide more accurate and consistent data about firm-wide variables as recommeded by Baer and Frese (2003). To allow for variability in results and control for the effect of social desirability bias, the authors further recommend researchers to target about five to seven managers per firm. However, a minimum of three managers per firm is acceptable to facilitate final data analysis where the unit of analysis is a firm (Mafabi *et al.,* 2012; Baer & Frese, 2003)

Validity and reliability of measurements

For content validity, the measurement scales used were adapted from past studies. Organizational learning as a single process variable was measured using the scales advanced in the literature of López et al. (2005) and Huber (1991). Product, process, and management system innovations were measured using the scales advanced by Wang and Ahmed (2004) and Tsai et al. (2001). Sustainability performance was measured using the scales advanced by Chow and Chen (2012), and Pedersen et al. (2018). All items were measured on a seven-point Likert scale ranging from Very Strongly Disagree to Very Strongly Agree. To ensure face validity, the draft questionnaire was pilot tested on six research experts and 52 practicing managers in the manufacturing sector. Following their guidance, adjustments were made that enhanced item clarity and relevance. Final

data collected using the revised questionnaire was further explored to ensure construct validity and reliability. Through running Exploratory Factor Analysis (EFA), results showed that the items used to measure each construct loaded above .5 generated total variance explained > 60%, had eigenvalues > 1, and Cronbach (α) <.7. Due to items coded KA5, KD1, KD2, and ENV3 having Corrected item-total Correlations below the threshold of .3 (Nunnally & Bernstein, 1994). The factor structure obtained through EFA was further verified through Confirmatory Factor Analysis (CFA). In CFA, items with non-significant loadings, low loadings (< .40), and high measurement errors were deleted to improve the measurement model. The final measurement model for each construct showed; average variance extracted > .5, Normed Fit Index >.90, CFI>.95, RMSEA<.08, and composite reliability >.70 confirming convergent validity, discriminant validity, and reliability of indicator variables extracted (Hair *et al.,* 2010). Firm age and size were considered relevant control variables that could affect sustainability performance (Pedersen *et al.,* 2018; Vihari *et al.,* 2018). These were measured as nominal variables taking on different codes.

Preliminary analysis

The final data collected was checked for completeness and missing values. Indeed, 17 out of 755 collected questionnaires were largely incomplete, hence discarded. Further analysis of the 738 usable questionnaires revealed 05 cases with missing values. Little's MCAR test results showed that data were missing completely at random (X^2=419.719, DF=429, p=0.617). The missing values were replaced using the linear interpolation method (Noor *et al.,* 2015). Thereafter, the 738 complete cases were aggregated into 256 firms which formed the unit of analysis. Common method bias was statistically checked using Harman's one-factor test (Podsakoff *et al.*, 2003) and the results showed limited method variance since the first factor accounted for 18.9% of the variance, which is below the threshold of 50% (Hair *et al.,* 2010). Further parametric test results showed; probabilities of Mahalanobis distance scores above .001, non-significant Shapiro-Wilk (p>.05), tolerance values of .796, and variance inflation factor values of 1.256. These results confirmed that data was multivariate normally distributed and free from multicollinearity (Hair *et al.,* 2010).

Results

Respondent and firm profile

Findings on the respondent profiles showed that managers who participated in this study were at least 25 years old, with the majority ranging from 36-40 (32.9%). They had attained at least a diploma qualification, with a majority holding a master's degree (61.8%). Managers at all levels were contacted, although middle-level managers formed the majority of the respondents (59.5%). All key departments were involved, although the production (24.3%) and the research and development departments (22.1%) stood out. Respondents had served in their present managerial positions for at least a period of 3 years, with the majority serving for 7-9 years (63.6%). Further, results showed that 68.5% of the sampled firms were drawn from the central region and 31.5% from the eastern. 54.9% were engaged in non-food processing while 45.1% were engaged in food processing. 74.7% of these firms were privately owned, 19.5% were under some form of partnership and only 5.8% were state-owned. By origin, 57.6% were domestic and 42.4% foreign. 45.1% had been in existence for 16 years and above, with young firms (5-10 years) forming 12.1%. Regarding firm size, 66.1% were medium and 33.9% were large.

Descriptive statistics and correlation analysis

Results in Table I present the means and standard deviations (SD) for organizational learning, innovation types, and sustainability performance. All the mean scores are above 3.5 on a Likert scale of 1-7 indicating that the sampled manufacturing firms were performing above average in terms of learning, innovation, and sustainability performance. Nonetheless, the minimum score of 3.62 below the mean of 4.91 confirms that some medium and large manufacturing firms in Uganda are not performing sustainably. The standard deviation values relatively close to zero show that data was less skewed and close to the mean. Further zero-order correlation results show that all the main study variables were positively and significantly related; with process innovation and sustainability performance emerging the highest *(r*=.509**) and the correlation between product innovation and sustainability performance scoring the lowest (*r*=.260**). The moderate correlation coefficients (*r*<.60) further symbolize non-multicollinearity.

Table 1: Descriptive statistics and correlation analysis

Variables	Min.	Max	Mean	SD	1	2	3	4	5
Organizational learning (1)	4.15	6.15	5.08	.40	**1**				
Product innovation (2)	3.52	6.32	4.88	.58	.260**	**1**			
Process innovation (3)	3.60	6.76	5.22	.6	.306**	.384**	**1**		
Management system innovation (4)	2.89	6.82	4.87	.74	.467**	.188**	.207**	**1**	
Sustainability performance (5)	3.62	6.20	4.91	.48	.506**	.457**	.509**	.317**	**1**

Notes: *N=256, **p<.01*

Hierarchical regression analysis

The first objective of this study sought to establish the direct effect of organizational learning, and innovation types on sustainability performance. Using hierarchical regression analysis, the results in Table 2 show the unique effect of each predictor variable on the dependent variable. In Model 1, we entered firm age and size as control variables and the results show that both firm age (*β*=.024) and firm size (*β*=-.038) had a non-significant effect on sustainability performance. Model 1 had a weak explanatory power of .2 % of the variance in sustainability performance. In Model 2, we entered organizational learning and the results show that organizational learning has a significant positive effect on sustainability performance (*β*=.508***). The Model accounts for 25.4% of the variance in sustainability performance. Based on Model 2 results, *H1* is supported. Next, we tested the effect of each innovation type (product, process, and management system) on sustainability performance. Results in Models 3, 4, and 5 show that only product (*β*=.354***) and process(*β*=.311***) innovation positively and significantly affect sustainability performance. Management system innovation had a non-significant positive effect (*β*=.056). Model 3, 4, and 5 respectively explain 11.5%, 7.7%, and .2% of the variance in sustainable performance. Based on these results, *H2a* and *H2b* were supported while *H2c* was not supported. Overall, the direct effect model explained about 45.2% of the variance in sustainability performance.

Table 2: Hierarchical regression analysis

	Dependent Variable: Sustainability Performance									
	Model 1		Model 2		Model 3		Model 4		Model 5	
Variable	*β*	*t*	*β*	*t*	*β*	*t*	*β*	*t*	*β*	*t*
Firm age	.024	.385	-.009	-.0172	-.045	-.877	-.058	-1.210	-.0056	-1.178
Firm size	-.038	-.600	.010	.176	.010	.201	-.008	-.166	-.008	-.175
Org. learning			.508***	9.285	.419***	8.044	.349***	6.944	.325***	5.856
Pdt innovation					.354***	6.787	.253***	4.900	.250***	4.830
Proc innovation							.311***	5.928	.308***	5.864
Mgt innovation									.056	1.046
F	.29		28.998***		37.154***		40.794***		34.19***	
R^2	.002		.257		.372		.449		.452	
ΔR^2	.002		.254		.115		.077		.002	

Notes: *N=256, ***p<.001, Org: organizational, Pdt: product, Proc: process, Mgt: management system*

Multiple-mediation analysis

The second objective of this study sought to examine the mediating effect of each innovation type in the relationship between organizational learning and sustainability performance. Using Hayes's SPSS multiple-mediator PROCESS macro (Version 4.0), we first tested the mediation conditions suggested by MacKinnon (2012). Standardized path coefficients were checked to determine the strength, direction, and significance level of the relationship. Results in Table 3 show under a_1, a_2, *and* a_3 paths that organizational learning had a significant positive direct effect on product innovation (β=.252***), process innovation (β=.306***), and management system innovation (β=.469***). These results also provide support for *H3a*, *H3b*, and *H3c*. Under the *b* paths, only product innovation (β=.250***) and process innovation (β=.307***) had a positive and significant effect on sustainability performance, whereas management system innovation did not (β=.056).

Having satisfied the conditions suggested by MacKinnon (2012) under *paths* a_1, a_2, b_1, *and* b_2, we moved on to test the mediation effect of the product, and process innovation. Preacher and Hayes's bootstrapping technique, with a bias-corrected 95% confidence interval (5000 bootstrap resamples requested) was used to determine the significance level of the mediation effect (Preacher & Hayes, 2004). Specifically, the lower and upper bounds of confidence intervals were checked to establish whether the mediating effect was statistically significant or not. Accordingly, results in Table 3 under indirect effects show that product innovation is a significant mediator, where; a_1 x b_1 standardized *Coeff.=.063, SE=.020, p<.001, 95% Boot CI= [.030, .104].* Also, product innovation emerged as a significant mediator, where; a_1 x b_1 standardized *Coeff. =.094, SE=.025, p<.001, 95% Boot CI= [.050, .145].* The upper and lower confidence interval (CI) values not containing a zero indicates that both product and process innovations are significant mediators in the relationship between organizational learning and sustainability performance, hence providing support for *H4a* and *H4b*. Results further reveal a partial mediating effect since the direct effect of organizational learning on sustainability performance reduced from β=.508 to β=.325, upon introducing product and process innovations as mediators in the model, although path c_1 remained significant. The non-significant result obtained for the b_3 path implied that we could not test the mediating effect of management system innovation, since this violated one of the key mediation conditions (significant *b* paths) suggested by MacKinnon (2012). Nonetheless, Muele (2019) encourages researchers to proceed with mediation analysis despite obtaining non-significant results for either path *a, b* or *c*. Based

on this view, we further tested the mediating effect of management system innovation, and the results confirmed that management system innovation is not a significant mediator, where; a_1 x b_1 standardized *Coeff. =.026, SE=.026, p>.05, 95% Boot CI= [-.025, .079]*. This is because zero lies along the upper and lower confidence intervals. Therefore, *H4c* is not supported.

Table 3: Mediating effect of product, process and management system innovation

				Bias correlated bootstrap 95% Confidence Interval	
Models	**R^2**	**Stand. Coeff.**	**SE**	**Lower**	**Upper**
IV on mediators (a paths)					
OL-Pdt Innov	.078	.252***	.088	.191	.539
OL-Process Innov	.102	.306***	.089	.278	.628
OL-Mgt Innov	.218	.469***	.102	.654	1.057
Mediators on DV (b paths)	.452				
Pdt Innov-SP		.250***	.043	.123	.292
Process Innov-SP		.307***	.043	.166	.334
Sys Innov-SP		0.056	.035	-.032	.106
Total effect (c' path)	.257	.508***	.066	.480	.739
Direct effect (c_1 paths)		.325***	.067	.258	.520
Indirect effects					
Total		.184***	.042	.104	.267
Pdt Innov		.063***	.020	.030	.104
Process Innov		.094***	.025	.050	.145
Mgt Innov		.026	.026	-.025	.079

Notes: *Based on 5,000 bootstrap samples, N=256, ***p<.001, OL: organizational Learning, Pdt: Product, Mgt: Management System, Innov: Innovation*

Discussion of Findings

Overall, the results of this study confirm that organizational learning, innovation types, firm age, and size contribute to positive variances in the sustainability performance of medium and large manufacturing firms in Uganda. However, firm age and size as control variables account for a trivial non-significant contribution to changes in sustainability performance. This means that the age and size of a manufacturing firm have little to do with its ability to perform sustainably, especially where the firm is oriented toward greater learning and innovation. This result is in line with the stakeholder theory which assumes that all firms irrespective of their unique differences can identify, analyze and address their stakeholders' interests. The non-significant contributing power of firm age and size could further be explained from a legal perspective whereby social and environmental protection laws apply to all business firms regardless of their age and/or size. A related study conducted in Uganda by Bananuka et al. (2021) also found no significant association between firm characteristics and environmental sustainability performance.

Results further revealed that organizational learning significantly contributes to sustainability performance. This suggests that manufacturing firms that engage in continuous learning by way of interacting with both the external and internal environment generate information relevant to understanding the changing stakeholder expectations. Consistent with the results of Van Mierlo and Beers (2020), the survival and continuity of business organizations in the contemporary knowledge economy hinges on the extent to which they engage in a continuous process of learning. The learning process equips internal organizational members with knowledge of the

changes occurring within the marketplace. The knowledge resources obtained through learning enable organizational members to collectively understand and appreciate sustainability management as a voluntary commitment that goes beyond regulatory pressure. With such changed mental models, relevant strategic decisions are deliberately put forward to ensure that business activities safeguard the economic, social, and environmental interests of the present and future stakeholders.

The study further indicates that product and process innovations significantly affect sustainability performance. This result suggests that firms with higher innovative capacity (in products and processes) are more likely to engage in sustainability management practices relative to their competitors. Manufacturing firms that can periodically develop new products, alongside improving existing ones, adopt modern production techniques, make reforms in their waste management infrastructure, maximize the reuse of waste materials, improve distribution channels, and supply chain mechanisms are more likely to operate sustainably. This result resonates with Globocnik et al. (2019) argument that improvements in product design and process efficiency are important pathways toward becoming more socially and environmentally friendly, without compromising the economic objectives of the business.

Additionally, organizational learning as a process construct emerged as a significant predictor of product, process, and management system innovations. This result adds to existing literature that suggests that innovation is an outcome of learning rather than an integral part of learning. Learning enables organizations to interact with both the internal and external environment. From such interactions, organizations obtain information relevant to understanding emerging market opportunities and threats. The information acquired and internally shared among organizational members, facilitates the introduction and implementation of changes in products, processes, and management systems needed to cope with market complexities. Consistent with the research work of Rezaei et al. (2018), knowledge-based firms oriented towards greater learning processes are more likely to register greater technological innovations (in form of product and process changes) as well as administrative reforms. Thus, organizational learning as a process of knowledge acquisition, sharing, interpretation, and storage is critical for increasing firm innovations in products, processes, and management systems.

Our study results on mediation analysis provide new insight into existing corporate sustainability literature by affirming that both product and process innovations play a significant partial mediating role in the relationship between organizational learning and sustainability performance. This suggests that the contribution of organizational learning to sustainability performance is greater through both product and process innovations. Manufacturing firms that engage in continuous learning processes build knowledge resources that enable them to develop new products, make improvements in existing product quality and features, adopt less polluting production methods, use renewable energy resources, develop mechanisms of recycling and maximize the reuse of waste materials and generally adopt green supply chain management practices. Such innovations are predicted not only to improve the quality of social life and minimize environmental harm but also to increase the economic value of the firm. This finding is consistent with Durmuş-Özdemir and Abdukhoshimov (2018) and Ruiz-Jimenez and Fuetes-Fuetes (2013) findings that product and process innovation significantly mediated the relationship between knowledge management capabilities and firm performance. The non-

significant mediating effect of management system innovation reported in this study suggests that changes in organizational leadership, structures, culture, communication, and staff welfare programmes do not necessarily transmit the contribution of learning towards sustainability performance. This result contradicts Slavković and Babić's (2013) study which suggests that administrative innovation (also referred to as management innovation) significantly mediates the relationship between knowledge management and organizational performance. Nonetheless, a similar study by Durmuş-Özdemir and Abdukhoshimov (2018) also found a non-significant mediating effect of management system innovation between knowledge management process and performance. Within the manufacturing setting, innovations related to management systems seem to be more associated with improvements in internal administrative efficiency, staff motivation as well as working relationships but may contribute less directly, towards improving the quality of social life and the ecosystem in the outside communities, which factors are critical in sustainability performance.

Conclusions and implications

Sustainability performance has become a central debate on every manufacturing firm's agenda. In the present study, a theoretical framework examining the interrelationship between organizational learning, innovation types, and sustainability performance was developed and empirically tested among medium and large manufacturing firms in Uganda.

Results revealed that the organizational learning as a single process construct has a direct positive effect on product innovation, process innovation, management system innovation, and sustainability performance. Additionally, product and process innovation are positively related to sustainability performance. Most importantly, the study uncovers the outstanding role of product and process innovation by demonstrating their partial mediating effect in the relationship between organizational learning and sustainability performance. This study confirms that higher levels of manufacturing sustainability performance in Uganda cannot be premised solely on the continuous process of learning. The indirect effect of innovation in firm products and processes also plays a critical role. Impliedly, the knowledge resources acquired, distributed, interpreted, and stored through the learning process should facilitate; new product developments, improvements in existing product features, adoption of green production methods, improvements in waste management, as well as maximize reuse of waste materials. With such changes, medium and large manufacturing firms not only benefit economically but also contribute to the social and environmental well-being of their host communities.

Theoretically, the results of this study validated the importance of integrating the stakeholder theory with the dynamic capabilities theory to explain how learning and innovation can increase firm sustainability performance. Furthermore, the results of this study add to the body of existing empirical literature that supports the significant interrelationship among organizational learning, product innovation, process innovation, and sustainability performance. Specifically, the study brings to knowledge the mediating role of product and process innovations in the relationship between the organizational learning process and sustainability performance.

To the practitioners, the results of this study inform managers of medium and large manufacturing firms to institutionalize a culture that supports continuous learning processes and innovations in products and processes as a strategic path to attaining higher levels of

sustainability performance. A learning culture can be realized through management's continued investment in staff training and development programs, teamwork, reinforced through rewards, partnering with external technical experts and knowledge-creating institutions, use of external consultants and professionals, as well as participation in external business shows, exhibitions, conferences, and professional dialogue. To increase the firm's innovative potential, managers need to put in place vibrant research and development departments that use the knowledge resources generated through learning to steer both radical and incremental changes in products and processes. Otherwise, the firm may fall into the dark side of organizational learning where the knowledge resources generated are not put to something that translates into organizational value.

To the policymakers working towards attaining global sustainable goals, and more specifically climate change, incentives (such as awards) could be offered to manufacturing firms that adopt sustainability-oriented business management models which not only strengthen their competitive-economic performance but also safeguard the quality of life as well as protect the environment. Manufacturing firms should generate evidence showing the extent to which they engage in continuous learning and innovations geared towards sustainability as a requirement to benefit from the proposed incentives. For instance, sustainability-oriented values could be embedded within the company's strategic goals and objectives, sufficient resources allocated to learning and innovation in the annual budgetary framework, as well as ensure that management annual performance review reports highlight with evidence the extent to which their firm is oriented towards sustainability based learning and innovation.

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