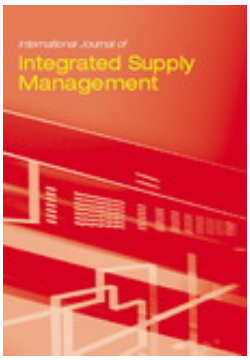

International Journal of Integrated Supply Management

ISSN online: 1741-8097 - ISSN print: 1477-5360
https://www.inderscience.com/ijism

Lean and circular economy relevance in post-harvest loss prevention: Nigerian retailers' perceptions

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DOI: 10.1504/IJISM.2023.10049683

Article History:

Received:	09 November 2021
Accepted:	19 June 2022
Published online:	13 December 2022

Lean and circular economy relevance in post-harvest loss prevention: Nigerian retailers' perceptions

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Abstract: This paper examined the extent to which application of lean management helped in the prevention of post-harvest loss (PHL) among grocery retailers. It also filled the gap on how socioeconomic situations (SES) of retailers in vegetable supply chain (VSC) influenced the adoption of circular economy (CE) as an inimitable tool against PHL. A survey of 337 retailers was undertaken in Akinyele grocery market Ibadan, the result showed that retailers believed the adoption of the LM principle statistically predicted the reduction in the volume of PHL of studied vegetables. Similarly, SES variables of gender and literacy significantly predicted the adoption of principles of CE in the management of PHL based on retailers' perceptions. Findings suggest that forging of inter-organisational relationship is critical for successful performance of lean in VSC; likewise, knowledge management (KM) tool of literacy is an important consideration in adopting a novel strategy to guide against PHL among members of VSC.

Keywords: vegetable supply chain; VSC; post harvest loss; PHL; lean management; LM; circular economy; CE; grocery retailers.

Reference to this paper should be made as follows: Ajayi, A.P. (2023) 'Lean and circular economy relevance in post-harvest loss prevention: Nigerian retailers' perceptions', *Int. J. Integrated Supply Management*, Vol. 16, No. 1, pp.82–105.

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1 Introduction

It is no longer newsy that the Sub-Saharan Africa (SSA) region has for long been bedevilled with an enervative food shortage debacle. As of 2018, verified statistics have it that the region was home to more than half of the global total of acutely food-insecure people, estimated at 65 million people (Reid, 2021). Analysts observed that before the advent of the present economic and health impacts occasioned by the COVID-19 pandemic (which has further driven millions deeper into poverty in SSA) (Ivanov and Das, 2020); the region in past decades has suffered a compressed cycle of disturbing climatic change, debilitating armed conflicts and huge population growth – all of which has deepened the vicious grip of famine in it (Reid, 2021; Food and Agriculture Organisation of the United Nations et al., 2021).

SSA disturbing reality of food shortages problem are accentuated by the disheartening fact that it surpasses that of 'lack of natural endowments' studies indicated that the region has around 600 million hectares of uncultivated arable land, and is also blessed with 70% of its over a billion population engaged in the agricultural sector (FAO, 2018). Apart from having a chunk of its vast arable landmass uncultivated, farmers in SSA unlike their counterparts in the developed world deploys outdated technologies and techniques in virtually every node of the food supply chain, which translated to low productivity (both in actual farming output and management of harvested yields) (Obasanjo, 2012; Sherzad, 2015; Razaei and Liu, 2017; FAO, 2018). The problem of food shortages in the region is further exacerbated by the lethargic responses of different stakeholders in embracing novel food sustainability projects and the employment of strategic supply chain management (SCM) techniques in the management of the food chain from 'farms to homes' (Obasanjo, 2012; Folinasa et al., 2013; Velasco-Munoz et al., 2021).

It is believed that the global food chain averaged 14% post-harvest loses (PHL) per annum in the last decade (FAO, 2019). The picture for SSA as should be expected, is gloomier, available statistics on the discourse showed that the estimated monetary value of all grain PHL in the region for over a decade has been around a staggering USD 4 billion per year (Sheahan and Barrett, 2017; FAO, 2019). Expectedly, food items like vegetables, fruits and groceries rank relatively high amongst farm produce with the highest rate of spoilage: a 2016 FAO statistics showed that an annual average of 20% of these farm products were lost to PHL in the last one decade globally mainly due to the employments of poor supply chain (SC) and preservation techniques (FAO, 2019).

Nigeria is the largest producer of tomatoes in SSA with an annual estimated production of 1.5 million tonnes. Tomatoes as a popular part of the Nigerian diet and is widely consumed fresh and cooked. Sadly, the annual PHL of tomatoes in Nigeria is estimated at a whopping 60% of the total production (Nassarawa and Sulaiman, 2019). Onion, just like tomato, is a vegetal bulb that is utilised as a flavoring and taste-enhancer with very attractive sensorial appeal when used as spice and condiments in foods. The annual productions estimate for Nigeria is over 700,000 tonnes and it is reported that annual PHL from this figure can be as high as 35% (Nasssarawa and Sulaiman, 2019; FAO, 2021). Bell or sweet peppers are culinary vegetables, which are consumed as fresh, dried, grounded or processed condiments. Nigeria, with annual production figure of 753 tonnes is the seventh highest producer in the world and the second highest producer in Africa (FAO, 2021). These three vegetables are by far the most popular in Nigeria,

with some 90% of the country's population affirming their consumption above any other types of vegetables (Nassarawa and Sulaiman, 2019; Sodeeq et al., 2021).

Several studies have investigated different aspects of PHL of farm produce, some contributory factors to their occurrences and their effects on the achievement of food security globally. An FAO study established two main causes of PHL, the study conceptualised these causes as being either direct or indirect (FAO, 2019). The direct cause is rooted in some critical factors, often beyond the control of farmers and consumers: chief among which are problems relating to pest attacks and climate change. The indirect drivers are more complex in nature as they include the amalgamation of the forces of market prices, poor storage system, quality of public services, existing legal framework, the subsisting culture of a place and the willingness to adopt novel technological development in the management of the food chain.

Different studies that examined incidences of PHL, their causes, their spatial and temporal patterns globally, established that PHL occurs at three strategic levels on the food chain (Pawerz, 2014; Razaei and Liu, 2017; Dome and Prusty, 2017; Dora et al., 2020; FAO, 2019; Nassarawa and Sulaiman, 2019). The three levels are: the activities of food producers/farmers at the upstream segment, the midstream actions of food processors/distributors/marketers and the downstream activities of consumers as characterised in their behavioural disposition towards food wastages (Razaei and Liu, 2017; Dome and Prusty, 2017; Dora et al., 2020; FAO, 2019; Nassarawa and Sulaiman, 2019; FAO, 2021; Sugri et al., 2021). Literature search overtime revealed that all the three levels have received the attention of the academic community. However, there is a conspicuous dearth of research that provide an empirical assessment on how the implementation of SC technique of lean management and the impact of cohesiveness of SC collaboration among midstream chain members (wholesalers and retailers) have on the mitigation of PHL for some vegetable produce (Razaei and Liu, 2017; Dome and Prusty, 2017; Dora et al., 2020).

Dome and Prusty (2017) provided an empirical analysis among members of Vegetable supply chain (VSC) in Ethiopia which quantify the amount of PHL of some selected vegetables. Although the study gave a veritable insight on the extent/cost of PHL suffered by wholesalers and retailers as members of VSC in the study area, it failed to provide an empirical assessment which years of experience as members of VSC, the influence of SC interrelationship (as evident in the willingness to share knowledge on of the adoption of lean management technique) and adoption of lean principle has on the possibility of achieving a reduction in the volume PHL suffered among members of VSC. This study, therefore, fills a gap by providing an objective insight into how SC relationships can aid personal learning and the adoption of novel management technique which in turn can be a harbinger of much-desired reduction of PHL in the value chain for vegetable products. Results from some earlier researches have shown that the development of a strong interpersonal relationships among organisational workers do not only aid personal learning of new innovations among employees but also leads to an overall improvement in organisational performance (Lankau and Scandura, 2002; Opengart, 2015; Bodjrenou et al., 2019).

Another gap that this research filled is to provide an empirical assessment on the recognition and adoption of the concept of circular economy (CE) as an inimitable tool for closing PHL loops and designing out wastes for the selected vegetal produce among midstream members in the food chain (Boon and Anuga, 2020). CE is based on three main principles: controlling finite stock of natural resources, closing loops, and designing

out waste. There are only few studies emphasising roles which key social economic situation (SES) of midstream SC members add to the understanding and adoption of CE concept as means of militating against PHL in VSC. Research findings of late indicated that SES attribute of gender influences respondents' disposition to issues of CE and sustainable management of resources (Atlason et al., 2017; Bulut et al., 2017; Nainggolan et al., 2019; Zinecker et al., 2020). Findings have revealed that "women at the household level are more likely to recycle, minimise waste, buy organic food and eco-labeled products, and engage in water and energy savings initiatives" (Atlason, et al., 2017; Bulut et al., 2017; Nainggolan et al., 2019; Zinecker et al., 2020). However, there are scanty evidences of empirical research which utilises the SES variables (of gender and educational attainment) to examined dispositions of midstream SC members to the adoption of the concept of CE as tool in the reduction of PHL of vegetables. This study aimed to fill these identified research gaps using the case of VSC in Nigeria.

2 Literature review

2.1 Lean management, supply chain collaboration and enhancement of supply performance

The reality behind the fulfilment of the simplest modern-day customer's order is hinged on the inevitability of supply chain collaboration (SCC) just as much as that of the availability of a viable value chain for such product (Kampstra et al., 2006; Ramanathan and Gunasekaran, 2012; Ajayi, 2016; Essuman et al., 2021; Pires et al., 2021). A review of extant works on the performance or agility of the contemporary SC system posited that the achievement of a sustainable SCC is built on the strength of formed strategic alliances/joint ventures with the overarching influence of shared collaborative planning, forecasting, and replenishment framework (CPRF) among all partners (VICS, 2002; Bahinipati and Deshmukh, 2012; Ajayi, 2016; Essuman et al., 2021). Many scholars equally argued that the incorporation of lean practices into the modern-day SC architecture could be traced to the singularity of the desire of its proponents "to improve the performance of an enterprise by developing all of its production factors" (Rizzardo and Brooks, 2003; Vlachos, 2015; Levinson, 2016).

Even the most excoriating critic of lean and SCC will be convinced by the positive impact that the adoption of the two philosophical viewpoints have on SCM. Pieces of evidence have shown that lean thinking If well implemented, usually assist management teams to identify the ideal conditions under which personnel, material resources, and the entire SC network (including external SC partners) can work together to add value to the organisation with as little waste as possible (Rizzardo and Brooks, 2003; Levinson, 2016). It has also been discovered that, unlike some novel management concepts that operate in silos, the lean management concept offers a pragmatic and robust architecture that makes it to be readily compatible with other SCM concepts in the pursuit of a desired SC performance (SCP) (Anand and Kodali, 2008; Kisperska-Moron and De Haan, 2011; Tortorella et al., 2018, 2019; Vanichchinchai, 2019a). Various scholars posited that the attraction behind lean management appeal to the global business community also lies it ability to provide proven constructs that usually results not only in the elimination of waste for the enterprise but also guarantee the fulfilment of values to customers' purchases/orders (Womack and Jones, 2003; Tsasis and Bruce-Barrett, 2008; Flynn et al.,

2010). Lean thinking was originally conceptualised and employed as a construct in the Toyota production system (TPS).

Doubtlessly, its roles in augmenting the agile production system in the automotive industry led to an upsurge in it utilisation as a tool for just-in-time (JIT) achievement at tactical and operational stages of SCM, particularly within actual production systems in many industrial plants (Flynn et al., 2010; Vanichchinchai, 2019b). Lean operates on five distinctly defined goals, these are;

1 specification of value

2 identification of the value stream

3 the avoidance of interruptions in value flow

4 establishment of medium for customers to pull value

5 continuous pursuit of perfection.

By the end of the 20th century, lean arguably has crystallised itself as a holy grail in the achievement of consistent JIT, elimination of wastes, and unnecessary overheads in the manufacturing sector, however, its successes as a tool in the building of strategic collaborative relationships with the aim of achieving consistent optimal SCP among SC partners in the agro-allied sector of VCS remained unclear. Available pieces of evidence have shown that the optimisation of the adoption of a viable SCR built on the pragmatic architecture of efficient lean has the ability to cut down the operating costs in automotive supply chain (ASC) (Tortorella et al., 2018; Qamar et al., 2018; Vanichchinchai, 2019a). It is observable that some of the readily available studies often focused on manufactured products with a relatively long shelf life or products with technical life cycle rather than biological life cycle as conceptualised by some scholars in the Cradle 2 Cradle design (Braungart et al., 2006; Ellen MacArthur Foundation, 2017; Wautelet, 2018). For example, Tortorella et al. (2018) and Vanichchinchai (2019b) both provided empirical pieces of evidence that there is a possible causality between lean, SCR, and SP in ASC in Brazil and Thailand respectively.

There is, therefore, the need to examine if similar results as obtained in these earlier researches can be replicated in VSC given the relatively higher rate of the product decomposition experienced in VSC, particularly in a developing economy like Nigeria where several studies have indicated that the pattern and functionality of SC processes greatly differ from observed practices in the developed economies (Ajayi, 2016; Dome and Prusty, 2017; Essuman et al., 2021). Similarly, it has also been observed that there is limited evidence of available empirical literature that examined the interrelationship between lean, SCC and how the combination of the two predicted the achievement of SCP by focusing on other attributes of SCP that are not directly cost-related (information sharing and proliferation of novel knowledge) among SC partners who are united in their desire to achieve a significant reduction in waste (Anand and Kodali, 2008; Kisperska-Moron and De Haan, 2011; Tortorella et al., 2018; Vanichchinchai, 2019b).

This study, therefore, contributed to the body of extant research on the discourse by providing empirical evidence of how the adoption of lean among SC partners which operate under a cohesive SCR has impacted SP (particularly as it relates to the reduction of PHL of vegetable products) in a developing economy like Nigeria.

3 Influence of SES attributes of gender and educational attainment on the adoption of CE as a tool to address PHL of VCS

Towards the end of the twentieth century, it became obvious to global business leaders and environmentalists that the one-way model of the utilisation of resources in which goods are manufactured from raw materials, sold, used, and then incinerated or discarded as waste was no longer sustainable (Boulding, 1966; Pearce and Turner, 1990; Turner et al., 1993). Various scholars posited that with the quantum rise in the global population beginning from the post Second World War baby boom era, the strong influence of such steep population increment on the consumption of earth's finite natural resources and the consequential effects of both on the negative exploitative means of harnessing environmental resources – it is imperative that a shift from the traditional linear economy model is not a mere choice but a commonsensical decision (Boulding, 1966; Pearce and Turner, 1990; Turner et al., 1996; Braungart et al., 2006; van Buren et al., 2016; Korhonen et al., 2018; Wautelet, 2018; Hysa et al., 2020).

Ellen MacArthur Foundations' (2017) conceptualisation of CE shared some similarities with the position of earlier scholars, although it emphasised the ability of CE to build capital at three distinctive but analogous levels (natural, economic, and social). They posited that CE is a clear departure from the 'take-make-dispose' extractive system found in the traditional linear economy model, CE they observed, prioritises 'restorative' and regenerative designs and advanced a sustainable framework that is capable of redefining products and services to design out waste, minimising negative (environmental) impacts underpinned by a conscious transition to renewable resources (Ellen MacArthur Foundation, 2017; Boon and Anuga, 2020).

Available evidence has shown that the application of the CE model in the management of environmental resources has been met with great successes in the achievement/restoration of natural, economic, and social capitals in different parts of the world (Braungart et al., 2006; van Buren et al., 2016; McKinsey and Company, 2016; Korhonen et al., 2018; Wautelet, 2018; Ellen MacArthur Foundation, 2017; Boon and Anuga, 2020; Hysa et al., 2020). For example, findings indicated that the adoption of CE alongside other eco-friendly concepts by EU chemical manufacturing industries significantly helped in the achievement of key environmentally benefitting goals of carbon reduction and resource efficiency (Glavic et al., 2021). Similarly, it was discovered that the integration of the CE concept into the financial valuation system has the capability of extending the lifespan of an asset by making it pass through the '4R asset circularity framework' (reuse, refurbish, remanufacture and recycle), thereby achieving the overall goal of sustainable management of earth's resources (Rodrigo-González et al., 2021).

Apart from the desirable economic benefits that a meticulous implementation of CE offers countries and regions; it is also helping in the decoupling global economic growth from the traditional linear economic model that has been identified as a major harbinger of global warming/environmental degradation (Glavic et al., 2021). Scholars generally affirmed that the increasing waves of adverse environmental conditions ravaging various locations globally (evidenced in incessant cases of flooding, hurricane, tsunamis, heatwave, drought, and desertification) is sounding a death knell to the non-eco-friendly traditional linear model of utilisation of earth's natural resources (McKinsey, 2016; Ajayi, 2020a; Glavic et al., 2021; Rodrigo-Gonzalez et al., 2021).

Table 1 Analysis on how variables used in the study are derived and employed

S/N	*Name of concept*	*Nature of utilisation of concept as a variable in the present research*	*How variables are developed/used in extant studies*	*References*
1	Lean management /grocery retail	Predictor (Independent variable)	Lean management in performance/internal lean practices (ILP) in manufacturing and development of grocery retail lean scale (GRLS)	Shah and Ward (2007), Flynn et al. (2010), Behrouzi and Wong (2011), Alfonso and Cabrita (2015), Vanichchinchai (2019a), Moyano-Fuentes et al. (2019), Garcia-Buendia et al. (2021) Lukic (2012), Negi and Anand (2015, 2016, 2017), Madhani (2020)
2	Supply performance (SP)	Dependent variable	key performance Indicators (KPI) of the leanness of a supply chain in five key areas (profitability, customer retention, quality, delivery, and reduction in the volume of waste)	Shah and Ward (2007), Alfonso and Cabrita (2015), Vanichchinchai (2019b), Moyano-Fuentes et al. (2019), Garcia-Buendia et al. (2021), Buer et al. (2021)
3	Supply chain relationship (SCR)	Control variable	Metrics of supply chain relationship and supply performance	Kampstra et al. (2006), Ramanathan and Gunasekaran (2012); Ajayi (2016), Essuman et al. (2021)
4	Circular economy	Dependent variables	Constructs of circular economy impact on PHL of selected vegetables	Ellen MacArthur Foundation (2017), Boon and Anuga (2020), Hysa et al. (2020), Glavic et al. (2021), Rodrigo-Gonzalez et al. (2021)

Source: Author's analysis 2022

While it is irrefutable that the implementation of CE has brought tremendous socio-economic and environmental benefits to economies in the developed world, such an averment about its benefits in developing countries might not totally be true given some startling economic facts. There are disturbing knowledge and technological gaps in the application of the circularity economic model as against the familiar linear model in most developing countries (Boon and Anuga, 2020). This study filled a noticeable gap in the body of available literature by analysing influences that key SES variables of gender and level of educational attainment have on the adoption of principles of CE in the management of PHL of selected vegetables among midstream actors in Nigeria. Available pieces of evidence from developed economies have shown that empowered or educated women are major drivers of circularity economic change, either as consumers or

as decision-makers, whether in homes or workplaces (Atlason et al., 2017; Bulut et al., 2017; Nainggolan et al., 2019).

Similarly, it has also been argued that employing an integrative gender equality policy is essential for the successful implementation of a CE strategy (Melnyk et al., 2019; Zinecker et al., 2020). In South Western Nigeria and in Ibadan metropolis particularly where this study was conducted, the female gender constituted the bulk of the population that made up the mid-stream node of VSC, as they are mostly retailers of the selected vegetables. This research, therefore, amongst other objectives provided an empirical analysis of influences that gender and literacy level has on the understanding and utilisation of CE model in the management of PHL of the studied vegetables in Ibadan metropolis, Nigeria.

To achieve the study objectives, the following derived hypotheses from the reviewed literature are tested:

H1 Years of working experience as members of VSC, activeness of retailers in SC collaborative relationship and the extent of the adoption of the lean management principle based on the perceptions of respondents do not have significant impact on the reduction in the volume of PHL of studied vegetables.

H2 SES variables of gender and level of educational attainment do not have significant influence on the adoption of principles of CE in the management of PHL of selected vegetables among midstream actors.

4 Research method

In order to achieve the set objectives of this study, a positivist approach was chosen. The ethical approval for the research was obtained from the ethical committee of Redeemer's University. In line with the dictate of the ethical approval, all respondents were individually informed of their ethical rights before being sampled. The Multistage and random sampling techniques are used in selecting participants for this study. Arguably, Ibadan metropolis housed three of the biggest fresh vegetable markets in the South Western part of Nigeria. These three markets are located in Sasa, Onigaari, and Akinyele, it has been noted these suburbs of the metropolis performed food basket functions for Ibadan metropolitan area amongst other ancillary functions (Sodeeq et al., 2021).

The three markets are also among the main break-of-bulk – points in the South Western part of Nigeria for fresh vegetables that are produced mainly in the savannah region of Northern Nigeria. At the first stage of sampling, the Akinyele market was chosen as the study site for the study. Akinyele market is located in a site owned and managed by the federal ministry of agriculture and rural development (FMARD). The market which is lies to the north of the metropolis is situated some 15 kilometres away from the centre of Ibadan and presently occupies an enclosed site with a size of a rough estimate of 0.025 hectares (200 square metres). Due to its geographical position (as it lies to the north of the metropolis) Akinyele grocery market is the first break-of-bulk point for haulage trucks and tankers used in the conveyance of groceries from the northern farmlands to Ibadan metropolis.

The organisation of the market is under a unionised structure (or a loosely defined economic guild). Although, the site of the market is owned by the federal government (FG), the management of its internal structure (allotment of market stall/space,

maintenance of the facility, brokerage, and arbitration) is carried out by the leadership of the guild or union. Records of the Union showed that there are 958 registered retailers who operate in the market at the time when this research was carried out. These retailers are generally of two types, the first group consists of those who operate both as brokers and retailers.

This set, who are mainly of Hausa stock (of northern Nigeria extraction) are familiar with various farmlands in the northern region where these vegetables are grown and so act as brokers to southern co-retailers who rely upon them for regular procurement of fresh stocks. However, they also own and operate retail stalls from where they also merchandise their wares. The second category of retailers are those who are mainly of Yoruba ethnic nationality – they are solely involved in the retailing of groceries, this category of retailers does not perform 'brokers function' alongside their retailing activity. As earlier observed the market operates under a loose form of guild economy. Main bulk procurement by retailers is done from wholesalers, who also act as in-between for farmers and retailers.

The wholesalers also provide the transporting functions of moving the product from various farms scattered in different states of the north, some as far as 700km away from Ibadan. Available literature underscored the relevance of guilds as associations formed by people who have mutual business interests that leverage on the economic power which such union confers on them to exert some measure of socioeconomic and political control on a particular trading concern within a state (Ogilvie, 2014; Prak, 2018; Hoogenboom et al., 2018). According to Ogilvie (2014), guilds over time have created 'a cloak of invincibility' around them that has led to their survival over many millennia and in many cultures. Generally, their functionality revolves around the ability to regulate practices by:

1 moderating competition and market structure

2 ensuring security and contract enforcement

3 provision of information asymmetries and quality standards

4 contributing to human capacity development

5 encouraging technological innovation (Ogilvie, 2014; Prak, 2018; Hoogenboom et al., 2018).

Conceivably, the grocery production in Nigeria is structured as a not 'well-defined economic guild' system. The chain members engaged in the production process (farmers, wholesalers, and retailers) exhibits variants' of all identified traits listed above and through it exercises a vice grip dominion on the market of grocery in the country. Using records of the union as a basis, the effort was made to randomise the sampling of the population; every even-numbered member on the record was tracked down to their stall and subsequently sampled. In all, 497 respondents were sampled from which 337 questionnaires were retrieved (70% of the sampled population) and it was the information garnered from these research instruments that are used for the analysis. The research exercise was carried out between April and July 2021.

Arising from this, a structured questionnaire was developed as the research instrument, the questionnaire contained pre-tested items which provided a measurement for the objectives of the study. The questionnaire was subdivided into four sections:

1 the first section was the socio-economic characteristics of the respondents

2 the second section provided the measurement of respondents perceptions' on the possibility of causality the adoption of lean, SCR, and the achievement of SP

3 the third section was devoted to respondents' perceptions on how their SES variables of gender and level of educational attainment have influenced their adoption of principles of CE in the management of PHL of selected vegetables

4 the fourth section gathered information on the operationalisation and applicability of the five stages of GRLS in the achievement of set objectives based on the perceptions of respondents.

Table 2 Development of constructs and scales from previous works

S/N	*Concepts applied in the study*	*How previous measurements/constructs are developed/used*	*References*
1	Lean management	Lean management in performance /internal lean practices (ILP) in manufacturing	Shah and Ward (2007), Flynn et al. (2010), Behrouzi and Wong (2011), Alfonso and Cabrita (2015), Vanichchinchai (2019), Moyano-Fuentes et al. (2019), Garcia-Buendia et al. (2021)
2	Supply performance (SP)	Key performance indicators (KPI) of the leanness of a supply chain in five key areas (profitability, customer retention, quality, delivery, and reduction in the volume of waste)	Shah and Ward (2007), Alfonso and Cabrita (2015), Vanichchinchai (2019b), Moyano-Fuentes et al. (2019), Garcia-Buendia et al. (2021), Buer et al. (2021)
3	Supply chain relationship (SCR)	Metrics of supply chain relationship and supply performance	Kampstra et al. (2006), Ramanathan and Gunasekaran (2012), Ajayi (2016), Essuman et al. (2021)
4	Grocery retail lean scale (GRLS)	Construct of lean management scales in grocery retail	Lukic, 2012, Negi and Anand (2015), Negi and Anand (2016), Negi and Anand (2017), Madhani (2020)
5	Circular economy (CE)	Constructs of circular economy impact on resource management	Ellen MacArthur Foundation (2017), Boon and Anuga (2020), Hysa et al. (2020), Glavic et al. (2021), Rodrigo-Gonzalez et al. (2021)

Source: Author's Analysis 2022

A pre-field exercise was undertaken in order to ensure their validity and reliability to researches in the service sector or among retailers to be specific. The Cronbach alpha test was carried out on each of the constructed multi items instruments. A Cronbach's alpha lower than 0.60 indicates poor reliability, values between 0.6 and 0.7 are acceptable and values equal to or higher than 0.70 indicate good scale reliability (Churchhill 1979; Simchi-Levi et al. 2003; Quesada et al. 2012; Ajayi 2016, 2020b; Ajayi and Mazinyo,

2020). Respondents perceptions' on the possibility of causality between the adoption of lean, SCR and the achievement of SCP subscale with 12 items had a Cronbach alpha of 0.91 ($\alpha = 0.91$), The respondents' views on how influential has been SES variables of gender and level of educational attainment on their adoption of principles of CE in the management of PHL of selected vegetables subscale which contained 9 items has a Cronbach alpha of 0.89 ($\alpha = 0.89$), while for the GRLS applicability with a subscale of 21 has Cronbach alpha of 0.81 ($\alpha = 0.81$). Subsequently, the information gotten from these questionnaires were processed by codifying them into a Microsoft Excel 2014 workbook sheet for database management operations. These processed data were later migrated to an IBM statistical package for social sciences (SPSS) version 23 environment for statistical analyses.

5 Results

The demographical attributes of respondents are in Table 2. 337 respondents participated in the study including 144 (42.73%) males and 193 (52.27%) females. Grocery retailing in the South-Western part of Nigeria is traditionally seen more as a 'female vocation', although there is a growing population of males making an incursion into the trade in recent times. The educational distribution of the population indicated that 80 (23.47%) of the population had no formal or 'Western education'. 189 (56.08%) of the population had primary school leaving certificate (PSLC) or six years of formal education, 42 (12.46%) had secondary school certificate examination (SSCE) or twelve years of formal training, 14 (4.16%) had National Diploma or fourteen years of scholarly training while 12 (3.56%) are first degree holders.

The educational distribution of the respondents indicated that 269 (79.82%) of the sampled respondents had between PSLC and no formal training at all. This fact definitely undermined the understanding of novel approaches in managing PHL. Low literacy level among respondents also made the administration of the research instrument to this category of respondents a bit burdensome as an interpretation of some of the prepared questions had to be done from English to Yoruba and Hausa languages in different instances.

The first hypothesis which stated that years of working experience, activeness of retailers in SC collaborative relationship, and the adoption of the lean management principle do not have a significant impact on the reduction in the volume of PHL of studied vegetables was tested by the use of hierarchical linear regression (HLR) model.

Table 1, provided the details of the result from the tested hypothesis. Six-step hierarchical regression analyses were conducted and in step 1 factors that could affect the outcome of the expected results were placed under control by adding them to the model. Years of work experience and level of participation as a member of a structured SC were added in step 1 and the result revealed that both variables were significant predictors of the adoption of the principles of lean management as a means of reducing PHL of the selected studied vegetables. They jointly contributed 6% to the total variance observed in the willingness of VSC midstream members (retailers) to adopt lean management and subsequent reduction in the volume of PHL observed in the VSC [$R = 0.24$, $R^2 = 0.06$, $F(2, 334) = 9.96$, $p < 0.01$]. Independently, years of work experience predicted reduction in PHL of studied vegetables in the sense that midstream members avowed that with lengthier years of working experiences comes significant increment in volume of produce

saved from PHL ($\beta = 0.14$, $t = 2.56$, $p < 0.05$). On the contrary, the prediction of a reduction in the volume of PHL by the membership of a structured SC was negative ($\beta = -0.18$, $t = -3.31$, $p < 0.01$). Impliedly, this means that respondents do not believe that being an active member of the studied VCS decreases PHL along the chain.

In step 2 of the model, a definition of value was added to the model and the variables predicted reduction in PHL of the studied vegetables (on the basis of the perception of respondents) jointly contributing a significant variance of 8% [$R = 0.27$, $R^2 = 0.08$, $F(3, 333) = 9.02$, $p < 0.01$]. This implied that definition of value accounted for additional 2% significant variance to the observed differences ($\Delta R^2 = 0.02$, $\beta = 0.14$, $t = 2.61$, $p < 0.01$). Mapping of value stream was added in step 3 of the model. The result revealed that mapping of value stream did not significantly predict the reduction in PHL of the studied vegetables (based on the perceptions of respondents) ($\beta = 0.04$, $t = 0.58$, $p > 0.05$). However, the joint prediction of the variables in step 3 was significant [$R = 0.28$, $R^2 = 0.08$, $F(4, 332) = 6.84$, $p < 0.01$].

Creation of product flow was added in step 4 and it was observed that the achievement of a reduction in the volume of PHL improved with a significant increase in the creation of product flow ($\beta = 0.39$, $t = 6.87$, $p < 0.01$). Jointly, a significant variance of 19% was observed in the reduction in the volume of PHL of studied vegetables based on perceptions of respondents [$R = 0.44$, $R^2 = 0.19$, $F(5, 331) = 15.67$, $p < 0.01$]. This account for 11% significant variance attributed to the creation of product flow ($\Delta R^2 = 0.11$, $\Delta F = 47.18$, $p < 0.01$).

In step 5, establishing pull factors was added to the model, however, it did not significantly predict the achievement of a reduction in the volume of PHL ($\beta = 0.01$, $t = 0.24$, $p > 0.05$). The joint prediction with other earlier variables were still significant with 19% observed variance [$F(6, 330) = 13.03$, $p < 0.01$]. Lastly in step 6, the pursuit of SC perfection was added to the model and the result shows that the achievement of a reduction in the volume of PHL by respondents increases significantly ($\beta = 0.14$, $t = 2.55$, $p < 0.01$). Also, there was a significant joint variance as 21% observed in the achievement of a reduction in the volume of PHL of the studied vegetables based on the adoption of lean management principle [$R = 0.46$, $R^2 = 0.21$, $F(7, 329) = 12.28$, $p < 0.01$]. This means that the pursuit of a consistent reduction in the volume of PHL accounted for the additional 2% variance observed in step 6 of the model ($\Delta R^2 = 0.02$, $\Delta F = 6.48$, $p < 0.05$). Based on the significant joint prediction of the adoption of lean management principle on the achievement of a reduction in the volume of PHL, hypothesis one was rejected. The second hypothesis which stated that socioeconomic situation (SES) variables of gender and level of educational attainment do not have significant influence on the adoption of principles of CE in the management of PHL of selected vegetables among midstream actors was tested. The second hypothesis was tested through analysis of variance (ANOVA). First, a table of mean and standard deviation (SD) that showed the variance in SES variables of gender and educational attainment on the implementation of Circular economic (CE) as a tool to mitigate against PHL was made. This was followed by the ANOVA table which showed the summary of the influence of gender and educational attainment on the adoption of principles of CE in the management of PHL respondents. Lastly, a Sheffe post HOC test was conducted which showed the mean difference (MD) in SES variables of educational attainment and gender and their influence on the adoption of CE in the management of PHL for the selected vegetables.

Table 3 Hierarchical regression model on how work experience, SCR and LM impact on PHL

Variables	*B*	*T*	*P*	*R*	*R2*	*ΔR2*	*Df*	*F*	*ΔF*
Step 1				*0.24*	*0.06*	-	*2.33*	*9.96*	-
Years of work experience	0.14	2.56	< 0.05						
Activeness of retailer as a member of structured supply chain	–0.18	–3.31	< 0.01						
Step 2				*0.27*	*0.08*	*0.02*	*3.33*	*9.02***	*6.81***
Years of work experience	0.13	2.49	< 0.05						
Activeness of retailer as a member of structured supply chain	–0.21	–0.379	< 0.01						
Definition of value	0.14	2.61	< 0.01						
Step 3				*0.28*	*0.08*	*0.00*	*4.33*	*6.8***	*0.34*
Years of work experience	0.14	2.55	< 0.05						
Activeness of retailer as a member of structured supply chain	–0.22	–3.81	< 0.01						
Definition of value	0.13	2.32	< 0.05						
Mapping of value	0.04	0.58	> 0.05						
Step 4				*0.44*	*0.19*	*0.00*	*6.33*	*13.08***	*0.06*
Years of work experience	0.18	3.43	< 0.01						
Activeness of retailer as a member of structured supply chain	–0.22	–0.404	< 0.01						
Definition of value	–0.05	–0.91	> 0.05						
Mapping of value stream	0.62	0.43	> 0.05						
Creation of product flow	0.39	6.79	< 0.01						
Establishing pull factors	0.61	0.24	> 0.05						

Note: **P < 0.01, N = 337.

Table 3 Hierarchical regression model on how work experience, SCR and LM impact on PHL (continued)

Variables	*B*	*T*	*P*	*R*	*R2*	*ΔR2*	*Df*	*F*	*ΔF*
Step 5				*0.44*	*0.19*	*0.00*	*6.33*	*13.63**	*0.06*
Years of work experience	0.18	3.43	< 0.01						
Activeness of retailer as a member of structured supply chain	–0.22	–4.04	< 0.01						
Definition of value	–0.05	–0.91	> 0.05						
Mapping value stream	0.02	1.43	> 0.05						
Creation of products flow	0.39	6.79	< 0.01						
Step 6				*0.46*	*0.21*	*0.02*	*7.32*	*12.28***	*6.48*
Years of work experience	0.19	3.71	< 0.01						
Activeness of retailer as a member of structured supply chain	–0.21	–4.00	< 0.01						
Definition of value	–0.03	–53	> 0.05						
Mapping value stream	–0.02	–0.30	> 0.05						
Creation of products flow	0.36	6.19	< 0.01						
Establishing pull factors	0.01	0.22	> 0.05						
Pursuit of consistent reduction in volume of PHL	0.14	2.55	< 0.05						

Note: **P < 0.01, N = 337.

Table 4 Mean and standard deviation table showing the variance in social economic situation (SES) variables of gender and educational attainment on the implementation of circular economic (CE) as a tool to mitigate against PHL

Gender	*Educational level*	*Mean*	*Standard deviation*	*N*
Male	Non formal education	2.70	0.483	40
	Primary school certificate	2.67	0.492	57
	SSCE/WAEC	3.24	0.663	25
	OND	3.90	0.304	10
	First degree/HND	3.61	0.559	12
	Total	*3.49*	*0.648*	*144*
Female	Non formal education	2.50	0.577	40
	Primary school certificate	3.65	0.493	132
	SSCE/WAEC	3.72	0.452	17
	OND	3.83	0.419	4
	First degree/HND	-	-	-
	Total	*3.76*	*0.473*	193
The combination of male and female	Non formal education	2.64	0.497	80
	Primary school certificate	2.67	0.492	189
	SSCE/WAEC	3.40	0.627	42
	OND	3.81	0.393	14
	First degree/HND	3.76	0.474	12
	Total	*3.64*	*0.570*	*337*

Table 5 Summary of 4 x 4 ANOVA table showing the influence of gender and educational attainment on the adoption of principles of CE in the management of PHL respondents

Source	*SS*	*Df*	*MS*	*F*	*P*
Gender	0.113	1	0.113	0.515	> 0.05
Educational level	24.642	4	6.161	27.954	< 0.01
Gender *educational level	3.201	3	1.067	4.841	> 0.05
Error	72.285	328	0.220		
Total	109.270	336			

The analysis as presented in Table 2 indicated that males (M = 3.49; SD = 0.65) had a similar measure on the adoption of the concept of CE in the management of PHL for the selected vegetables when compared with their female counterparts (M = 3.76; SD = 0.47). The distribution also revealed that individuals with OND measured highest on the adoption/implementation of the concept of CE in the management of PHL for the selected vegetables (M = 3.81; SD = 0.39). This was followed by those with either HND or first degree (M = 3.76; SD = 0.47). The sequence descended to the lowest with individuals who had no formal education measuring least on SC sustainability (M = 2.64; SD = 0.50). The outcome implied that a higher level of educational attainment enjoys a

strong relationship with the adoption/implementation of the concept of CE in the management of PHL among respondents.

Table 6 Sheffe post HOC test showing the mean difference in SES variables of educational attainment and gender and their influence on the adoption of CE in the management of PHL for the selected vegetables

S/N	*Educational level*	*Non formal*	*PLSC*	*SSCE*	*OND*	*BSc*	*HND*
1	Non formal education	-					
2	Primary school certificate	0.02	-				
3	SSSCE/WAEC	0.76*	0.74*	-			
4	OND	1.17*	1.15*	0.41*	-		
5	First degree/HND	1.12*	1.10*	0.36*	0.05	-	

Note: The mean difference is significant at 0.05.

It is safe to posit, therefore, that the more educated or literate retailers/wholesalers become the higher is their willingness to implement the concept of CE in the management of their PHL in the VSC. The interaction influence from Table 2 revealed that males with OND measured highest on the implementation of the concept of CE in the management of PHL for the selected vegetables (M = 3.90; SD = 0.30) and this was followed by females with OND certificate (M = 3.83; SD = 0.42) while female that are holders of SSCEcame third (M = 3.72, SD = 0.45). It is instructive that females with no formal education and male with primary school education ranked lowest in the adoption/implementation of the concept of CE in the management of PHL [female (M = 2.50; SD = 0.58) while male second lowest (M = 2.67, SD = 0.49)].

Table 5, which is an ANOVA matrix that tested the second hypothesis indicated that gender had no significant influence on the adoption of principles of CE in the management of PHL among the respondents [$F(1, 328)= 0.515$, $p > 0.05$]. This implied that there was no significant difference in the attitudinal dispositions of males when compared with their female counterparts on the adoption or implementation of principles of CE in order to manage PHL among retailers in the study area. The level of educational attainment significantly predicted the adoption/implementation of principles of CE in the management of PHL among respondents [$F(4, 328) = 27.954$, $p < 0.01$]. This implied that the level of education attainment by respondents influences their willingness to adopt or implement the concept of CE in the management of PHL of the selected vegetables. In all, the identified independent variables (gender and level of educational attainment) had a significant interacting influence on the dependent variable (the adoption of CE in the management of PHL of the selected vegetables) [$F(3, 328) = 4.841$, $p < 0.05$]. This negated hypothesis 2. To understand the observed variances and the exact difference in education level that led to the significant influence, sheffe post hoc test was conducted and the result is presented in Table 6.

The result from sheffe post hoc test Table 6 indicated that it was only the variance between no formal education and PSLC(md = 0.02, $p > 0.05$), and the difference between OND and HND (md = 0.05, $p > 0.05$) that were not significant. Other differences were significant, for example, the difference in the observed variance of respondents who are holders of secondary school certificate examination (SSCE) from those with no formal education was significant (md = 0.76, $p < 0.05$), similarly the observed variance among

respondents who had SSCE and OND (md = 0.41, $p < 0.05$). Also, the variance in the observed difference of holders of OND from those with no formal education is significant (md = 1.17, $p < 0.05$), ditto for the variance observed in the difference between holders of OND and those with PSLC (md = 1.15, $p < 0.05$).

6 Discussion

The results from the first hypothesis indicated that while members of the studied VSC significantly affirmed that numbers of years spent as retailers contributed to the adoption of lean management and the subsequent reduction witnessed in the volume of PHL: being members of a structured SC did not. On its own, this result is not a surprise given the fact that one of the observed drawbacks associated with the growth of productive SC collaborative relationships in SSA has been 'distrust' among chain members (Ajayi, 2016; Dome and Prusty, 2017). While findings from earlier works have indicated that the willingness to share knowledge on the adoption of lean management techniques and the development of strong interpersonal relationships among organisational workers leads to an overall improvement in organisational performance (Lankau and Scandura, 2002; Opengart, 2015; Wu et al., 2015; Bodjrenou et al., 2018; Bellasario and Pavlov, 2019), the building of synergistic relationship among chain members often requires agreement on consanguinity of the chosen KPI's among all members in the chain.

As earlier stated, members of VSC in Ibadan are organised in a loosely defined economic guild, ordinarily, such union should provide a platform for better flow of information, innovative ideas and capital, that could help in the holistic adoption of innovative SC techniques (lean or CE) and the achievement of the much-desired reduction of PHL, evidence from this result, however, indicated the contrary. A confirmation that laid credence to the fact that significant numbers of the respondents believed in operating more as 'silos' than as members of SC with similar values is their belief that years of experience of retailers will determine the adoption of lean principle and the achievement of a reduction in PHL. Experience has shown that overly reliance on individual ability always undermines the propensity to share information, adopt new innovation and achieve the common goal from such innovative exploit (Lankau and Scandura, 2002; Opengart, 2015; Bodjrenou et al., 2019; Bellasario and Pavlov, 2019). Relatively low level of literacy among respondents (nearly 80% had just about primary school education) could be another critical drawback to the adoption of a novel technique in the management of PHL of the studied vegetables in the study area, previous findings have indicated that more literate chain members are, the more positively responsive they will be to the adoption of innovations (Ajayi, 2016; Boon and Anuga, 2020).

Results from the hierarchical analysis further indicated that three out of the five measures of lean principle significantly predicted reduction in the volume of PHL based on the perceptions of the respondents (identification of common values, pull factors, and pursuit of a consistent reduction in PHL volume) while two of the principles are not significant (mapping of value and smooth flow of products). From this result it can be surmised that the three variables that the respondents considered as germane to the achievement of the much-desired PHL are returned as significant predictors of the adoption of lean; while the two variables that underline forging sustainable inter-organisational (IORs) alliances are insignificant (Schilke and Cook, 2013; Guo et al., 2017; Oliveira and Lumineau, 2019).

In a similar vein, results from the second hypothesis showed that while gender was not a significant predictor of the adoption of CE technique in the management of VSC among the retailers, educational attainment was. It is observed that CE 3Rs techniques of reduce, reuse, and recycle are popular among the studied retailers. They implemented these techniques by operating real-time demand scheduling through the maintenance of consistent mobile phone contacts with suppliers of groceries from the northern part of the country (this prevents glut in the market), selling off old stocks at lowered prices once there is a delivery of fresh produce, diversion of scraps to animal feeds, decomposition of scraps into manures by farmers who buy them at reduced prices and disposal of waste to landfills. As earlier stated, educated females either at home or in workplaces often display a greater predisposition to the implementation of CE techniques in the management of resources than their male counterpart Atlason et al., 2017; Bulut et al., 2017; Nainggolan et al., 2019; Melynk et al., 2019; Zinecker et al., 2020). The fact that females with no formal education ranked lowest in the adoption and implementation of CE in this study Table 6 further buttressed this assertion.

7 Managerial implication and conclusions

Striking the much-needed balance in the provision of basic societal needs (food, clothing, and shelter) necessary for the optimal functionality of the state in Nigeria has been a nervy issue for economist theorists and policymakers for ages. Successive Nigerian governments have been hovering between the sensitive options of adopting either a welfarist or a capitalist approach in the provision of societal basic needs and necessary infrastructure to ease the production processes of these necessities (Maku et al., 2020). As earlier noted, the production, distribution, storage, and sales of the studied VSC are situated firmly in the control of guild members, who are primarily capitalists. However, the inability of the guild to forge 'a trustful strategic alliance' among chain members is a critical deterrent to the adoption of nascent SC techniques that could make the achievement of reduction PHL easily possible.

Organisation theorists affirmed that IORs thrive on the progression of trust elements across all levels of interrelationships among partners (Schilke and Cook, 2013; Guo et al., 2017; Oliveira and Lumineau, 2019). Another reality bought to the fore from this research is the indispensability of effective knowledge management (KM) in the achievement of efficient IORs (Chiu and Chen, 2016; Sayyadi, 2019; Antunes and Pinheiro, 2019) and the consequential effect of the two on the adoption of lean among chain members (Shah and Ward, 2007; Flynn et al., 2010. Behrouzi and Wong, 2011; Alfonso and Cabrita, 2015; Vanichchinchai, 2019; Moyano-Fuentes et al., 2019; Garcia-Buendia et al., 2021). This work also provides a fresh theoretical insight into earlier works (Lukic, 2012; Negi and Anand, 2015, 2016, 2017; Madhani, 2020) on the application of lean into PHL of VSC and extended earlier theoretical works (Lukic, 2012; Nengi and Anand, 2016, 2017; Madhani, 2020) on the development of GRLS. This is done by showing the inimitable roles of IORs and KM in strengthening the constructs of GRLS. As could be deduced from findings in this study, literacy ability among chain members does have a measure of influence in their willingness to adopt innovative SC techniques that could help in the achievement of better SP and the reduction in the incidence of PHL of VCS.

Similarly, findings from this work extended earlier scholarly activities on the concept of CE as a tool for reducing PHL of VSC (Ellen MacArthur Foundation, 2017; Boon and Anuga, 2020; Hysa et al., 2020; Glavic et al., 2021; Rodrigo-Gonzalez et al., 2021). As evinced from this study the confluence of gender and literacy level among citizens should be important considerations when deploying CE as a tool for PHL. This strengthened the argument of earlier theorists on the importance of these two factors in the understanding and utilisation of CE as a tool for 'closing the loop of PHL' in VSC (Atlason et al., 2017; Bulut et al., 2017; Nainggolan et al., 2019; Melynk et al., 2019; Zinecker et al., 2020). Inconsistent policy thrust on food production between the adoption of the Keynesian regime (where a deliberate attempt is made to redistribute real income in favour of the poor and meeting basic needs of all citizens) and neoliberalism (which favours commercialisation and privatisation of nearly all economic activities) has made the achievement of a desirable standardisation of food production processes in the country an uphill task.

8 Limitations and future research

As should be expected this research is not without some limitations. The first of such is the sampled population, which was made up of grocery retailers in Akinyele market (Ibadan metropolis), while findings indicated that significant relationships exist between the studied variables – making a sweeping generalisation based on this for other grocery retail markets in Nigeria and by extension, SSA can be misleading. On the scope of the study, the focus was on how the adoption of lean and CE techniques influenced the reduction in PHL of the selected vegetables based on the perceptions of sampled retailers. Other variables (like the economic cost of adopting these techniques, level of information and communication technology (ICT) adoption/deployment) were not investigated in this study. These variables most likely can also influence operational performance and might be an area for future research. Lastly, it is germane to declare that whereas the results of the tested hypotheses showed significant relationships among the variables, this should not be necessarily assumed to be causality. As indicated above, some other factors not considered in this study could also be determinants. Finally, future research should endeavour to examine how the adoption of these nascent SCM and environmental sustainability concept (lean and CE) affects other food chain production in Nigeria.

Acknowledgements

The author wishes to acknowledge the assistance of the Redeemer's University Research Grant and Staff Development Committee in the course of this work.

References

Ajayi A.P. (2020a) 'Perceptions of key participants on the influence of green supply chain on production and freighting activities in a developing economy', *Sokoto Journal of the Social Sciences*, Vol. 10, No. 1, SokotoOnline ISSN 2384-7654.

Ajayi A.P. and Mazinyo, S.P. (2020) 'Socio-economic situation and substance use disorder influences on safety practices among truckers', *The Open Transportation Journal*, Vol. 14, pp.78–85, https://doi.org/10.2174/1874447802014010078.

Ajayi, A.P. (2016) 'Analytical study of supply chain collaboration guiding forestry products supply in a developing economy', *Int. J. Business Performance and Supply Chain Modelling*, Vol. 8, No. 4, pp.277–298.

Ajayi. A.P. (2020b) 'Uber: examination of socio-economic situation of its clienteles and security components in Lagos', *Journal of Transportation Security*, Vol. 13, pp.1–17, https://doi.org/10.1007/s12198-020-00216-0.

Alfonso, H. and Cabrita, M. (2015) 'Developing a lean supply chain performance framework in a SME: a perspective based on the balanced scorecard', *Procedia Engineering*, Vol. 131, No. 1, pp.270–279, https://doi.org/10.1016/j.proeng.2015.12.389.

Anand, G. and Kodali, R.A (2008) 'Conceptual framework for lean supply chain and its implementation', *Int. J.Value Chain Manag*., Vol. 3, No. 3, pp.313–357, https://doi.org/10.1504/IJVCM.2008.019517.

Antunes, H. and Pinheiro, G. (2020) 'Linking knowledge management, organizational learning and memory', *Journal of Innovation and Knowledge*, Vol. 5, No. 2, pp.140–149.

Atlason, R., Giacalone, D. and Parajuly, K. (2017) 'Product design in the circular economy: Users' perception of end-of-life scenarios for electrical and electronic appliances', *Journal of Cleaner Production*, Vol. 168, pp.1059–1069, http://dx.doi.org/10.1016/j.jclepro.2017.09.082.

Bahinipati, B.K. and Deshmukh, S.G. (2012) 'E-markets and supply chain collaboration: a literature-based review of contributions with specific reference to the semiconductor industries', *Logistic Research*, Vol. 4, Nos. 1–2, pp.19–38, DOI: 10.1007/s12159012-006.

Behrouzi, F and Wong, K (2011). 'An investigation and identification of lean supply chain performance measures in the automotive SMEs', *Scientific Research and Essays*, Vol. 6, No. 24, pp.5239–5252, DOI: 10.5897/SRE11.1125.

Bellisario, A. and Pavlov, A. (2018) 'Performance management practices in lean manufacturing organizations: a systematic review of research evidence', *Production Planning and Control*, Vol. 29, No. 5, pp.367–385, DOI: 10.1080/09537287.2018.14329.

Bodjrenou, K., Xu, M. and Bomboma, K. (2019) 'Antecedents of organizational commitment: a review of personal and organizational factors', *Open Journal of Social Sciences*, Vol. 7, No. 5, DOI: 10.4236/jss.2019.75024.

Boon, E. and Anuga, S. (2020) 'Circular economy and its relevance for improving food and nutrition security in Sub-Saharan Africa: the case of Ghana', *Materials Circular Economy*, Vol. 2, No. 5, https://doi.org/10.1007/s42824-020-00005-z.

Boulding, K.E. (1966) 'The Economics of the coming spaceship earth', in Jarrett, H. (Ed.): *Environmental Quality in a Growing Economy: Essays from the Sixth RFF Forum*, pp.3–14, RFF Press, New York.

Braungart, M., McDonough, W. and Bollinger, A. (2006) 'Cradle-to-cradle design: creating healthy emissions – a strategy for eco-effective product and system design', *Journal of Cleaner Production*, Vol. 15, Nos.13–14, pp. 1337–1348.

Buer, S., Semini, M., Strandhagen, J.O. and Sgarbossa, F. (2021). 'The complementary effect of lean manufacturing and digitalisation on operational performance', *International Journal of Production Research*, Vol. 59, No. 7, pp.1976–1992, DOI: 10.1080/00207543.2020.1790684.

Bulut, Z., Kökalan Çımrin, F. and Doğan, O. (2017) 'Gender, generation and sustainable consumption: Exploring the behaviour of consumers from Izmir, Turkey', *International Journal of Consumer Studies*, Vol. 41, No. 6, pp.597–604, http://dx.doi.org/10.1111/ijcs.12371.

Chiu, N and Chen, H. (2016) 'The study of knowledge management capability and organizational effectiveness in Taiwanese public utility: the mediator role of organizational commitment', *SpringerPlus*, Vol. 5, p.1520, DOI 10.1186/s40064-016-3173-6.

Churchhill, G.A. (1979) 'A paradigm for developing better measures of marketing constructs', *Journal of Marketing Research*, Vol. 16, No. 1, pp.64–73.

Dome, M.M. and Prusty, S. (2017) 'Determination of vegetable postharvest loss in the last-mile supply chain in Tanzania: a lean perspective', *Int. Journal of Logistics Systems and Management*, Vol. 27, No. 2, pp.133–150.

Dora, M., Wesana, J., Gellynck, X., Seth, N., Dey, B. and De Steur, H. (2020) 'Importance of sustainable operations in food loss: evidence from the Belgian food processing industry', *Annals of Operations Research*, Vol. 290, pp.47–72, https://doi.org/10.1007/s10479-019-03134-0.

Ellen MacArthur Foundation (2017) 'Cradle to cradle in a circular economy – products and systems [online] https://www.ellenmacarthurfoundation.org/circular-economy/ schools- of-thought/cradle2cradle (accessed 17 July 2021).

Essuman, D., Asamoah, D and Anin, E. (2021) 'How interfirm governance mechanism and capabilities determine supply chain responsiveness in small businesses: evidence from an African market', *Africa Journal of Management*, Vol. 7, No. 3, pp.423–446, DOI: 10.1080/23322373.2021.1927449

FAO, IFAD, UNICEF, WFP and WHO. (2021) 'The state of food security and nutrition in the world 2021', *Transforming Food Systems For Food Security, Improved Nutrition And Affordable Healthy Diets For All*, Rome, FAO, https://doi.org/10.4060/cb4474en (accessed October 4, 2021).

FAO. (2019) 'The State of food and agriculture 2019', *Moving Forward on Food Loss and Waste Reduction,* Rome, Licence: CC BY-NC-SA 3.0 IGO.

Flynn, B., Huo, B. and Zhao, X. (2010) 'The impact of supply chain integration on performance: a contingency and configuration approach', *Journal of Operations Management*, Vol. 28, No. 1, pp.58–71.

Folinasa, D., Aidonisa, D., Triantafilloua, D. and Malindretosb, G. (2013) 'Exploring the greening of the food supply chain with lean thinking techniques', *Procedia Technology*, Vol. 8, pp.416–424.

Food and Agriculture Organization (2018) 'Africa arable land percentage', *Electronic Files and Web Site* [online] https://data.worldbank.org/indicator/AG.LND.ARBL.ZS?locations=ZG (accessed June 3, 2021).

Garcia-Buendia, N., Moyano-Fuentes, J. and Maqueira-Marín, J.M. (2021) 'Lean supply chain management and performance relationships: what has been done and what is left to do', *Journal of Manufacturing Science and Technology*, Vol. 32, No. 1, pp.405–423.

Glavič, P., Pintarič, Z.N. and Bogataj, M. (2021) 'Process design and sustainable development–an european perspective', *Processes*, Vol. 9, p.148, https://doi.org/10.3390/ pr9010148.

Guo. S., Lumineau, F. and Lewicki, R. (2017) 'Revisiting the foundations of organizational distrust', *Foundations and Trends in Management*, Vol. 1, No. 1, pp.1–88.

Hoogenboom, M., Kissane, C., Prak, M., Wallis, P. and Minns, C. (2018) 'Guilds in the transition to modernity: the cases of Germany, United Kingdom, and the Netherlands', *Theoretical Society*, Vol. 47, pp.255–291, https://doi.org/10.1007/s11186-018-9316-8.

Hysa, E., Kruja, A., Rehman, N.U. and Laurenti, R. (2020) 'Circular economy innovation and environmental sustainability impact on economic growth: an integrated model for sustainable development', *Sustainability*, Vol. 12, No. 12, p.4831.

Ivanov, D and Das, A (2020) 'Coronavirus (COVID-19/SARS- CoV2) and supply chain resilience: a research note', *International Journal of Integrated Supply Management*, Vol. 13, No. 1 pp.90–102.

Kampstra, P.R., Ashayeri, J. and Gattorna, J.L. (2006) 'Realities of supply chain collaboration', *The International Journal of Logistics Management*, Vol. 17, No. 3, pp.312–330.

Kisperska-Moron, D. and De Haan, J. (2011) 'Improving supply chain performance to satisfy final customers: 'Leagile' experiences of a polish distributor', *International Journal of Production Economics*, Vol. 133, No. 1, pp.127–134.

Korhonen, J., Honkasalo, A. and Seppälä, J. (2018) 'Circular economy: the concept and its limitations', *Ecological Economics*, Vol. 143, No. C, pp.37–46.

Lankau, M.J. and Scandura, T.A. (2002) 'An investigation of personal learning in mentoring relationships: content, antecedents, and consequences', *Academy of Management Journal*, Vol. 45, pp.779–790, http://dx.doi.org/10.2307/3069311.

Levinson, W.A. (2016) *Lean Management System LMS:2012: A Framework for Continual Lean Improvement*, CRC Press, p.11, ISBN 9781466505384 (accessed 14 June, 2021).

Lukic, R. (2012) 'The effects of application of lean concept in retail', *l Economia. Seria Management*, Vol. 15, No. 1, pp.88–98.

Madhani, P. (2020)'Enhancing retailers' operations performance with lean six sigma approach', *The Journal Contemporary Management Research*, Vol. 14, No. 2, pp.1–25.

Maku, O., Tella, A. and Akinola, C. (2020) 'Alleviating poverty in Nigeria: Keynesian Vs monetary theory of poverty', *Studia Universitasis Vasile Goldis Arad-Economics series, Sciendo*, Vol. 30, No. 1, pp.103–120.

McKinsey and Company (2016) 'Europe's circular-economy opportunity', [online] https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/Sustainability/Our%20Insights/Europes%20circular%20economy%20opportunity/Europes%20circulareconomy%20opportunity.ashx (accessed 9 June 2021).

Melnyk, V., van Herpen, E., Jak, S. and van Trijp, H.C.M. (2019) 'The mechanisms of social norms' influence on consumer decision making: a meta-analysis', *Zeitschrift für Psychologie*, Vol. 227, No. 1, pp.4–17, http://dx.doi.org/10.1027/2151-2604/a000352.

Moyano-Fuentes, J., Bruque-Camara, S. and Maqueira-Marin, J.M. (2019) 'Development and validation of lean supply chain management measurement instrument', *Production Planning and Control,* Vol. 30, No. 1, pp.20–32, doi:10.1080/09537287.2018.1519731.

Nainggolan, D., Pedersen, A., Smed, S., Zemo, K., Hasler, B. and Termansen, M. (2019) 'Consumer in a circular economy: economic analysis of household waste sorting behaviour', *Ecological Economics*, Vol. 166, No. 1, pp.1–10, https://doi.org/10.1016/j.ecolecon.2019.106402.

Nassarawa, S. and Sulaiman, S. (2019) 'Extending the shelf life of tomato and onion in Nigeria: a review', *International Journal of Food Science and Nutrition*, Vol. 4, No. 5, pp.99–111.

Negi, S. and Anand, N. (2015) 'Issues and challenges in the supply chain of fruits and vegetables sector in India: a review', *International Journal of Managing Value and Supply Chains*, Vol. 6, No. 2, pp.47–62 (Indexed in EBSCO, ProQuest, Ulrich's Web etc.), Published by AIRCC Publishing Corp., DOI: https://doi.org/10.5121/ijmvsc.2015.6205.

Negi, S. and Anand, N. (2016) 'An overview of fruits and vegetable's retail supply chain models in India', Kamath, N. and Saurav, S. (Eds.): *Handbook of Research on Strategic Supply Chain Management in the Retail Industry*, IGI Global, Hershey PA, USA, pp.170.187 (SCOPUS Indexed), ISBN: 9781466698949, DOI: https://doi.org/10.4018/978.1.4666.9894.9.ch010.

Negi, S. and Anand, N. (2017) 'Post harvest losses and wastage in Indian fresh agro supply chain industry: a challenge', *The IUP Journal of Supply Chain Management*, Vol. 14, No. 2, pp.7–23 (Indexed in EBSCO, ProQuest and SSRN), Published by ICFAI University Press [online] https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3214396 (accessed 29 April 2021).

Obasanjo.O.(2012) 'Special to CNN: How Africa could feed the world', [online] https://globalpublicsquare.blogs.cnn.com/2012/11/06/how-africa-could-feed-the-world/ (accessed 3 May 2021).

Ogilvie, S. (2014) 'The economics of guilds', *Journal of Economic Perspectives*, Vol. 28, No. 4, pp.169–192.

Oliveira, N and Lumineau, F. (2019) 'The dark side of interorganizational relationships: an integrative review and research agenda', *Journal of Management*, Vol. 45, No. 1, pp.231–261, DOI: 10.1177/0149206318804027.

Opengart, R. (2015) 'Supply chain management and learning organization: a merging of literatures', *International Journal of Commerce and Management*, Vol. 25, No. 2, pp.183–195, https://doi.org/10.1108/IJCoMA-10-2012-0063.

Parwez, S. (2014) 'Food supply chain management in Indian agriculture: issues, opportunities and further research', *African Journal of Business Management*, Vol. 8, No. 4, pp.572–581, DOI: 10. 5897/AJMB2013.7292.

Pearce, D.W. and Turner, R.K. (1990) *Economics of Natural Resources and the Environment*, Harvester Wheatsheaf, New York, London.

Pires C.M., Parreira, R. and Frazzon, E.M. (2021) 'Integrated operational supply chain planning in Industry 4.0', *Int. J. Integrated Supply Management*, Vol. 14, No. 1, pp.17–22.

Prak, M. (2018) 'Citizens without nations', *In Urban Citizenship in Europe and the World*, pp.1000–1789, Cambridge University Press, Cambridge.

Qamar, A., Hall, M. and Collinson, S. (2018) 'Lean versus agile production: flexibility trade-offs within the automotive supply chain', *International Journal of Production Research*, Vol. 56, No. 11, pp.3974–3993, https://doi.org/10.1080/00207543.2018.1463109.

Quesada, H., Gazo, R. and Sanchez, S. (2012) 'Critical factors affecting supply chain management a case study', in Groznik, A. (Ed.): *The US Pallet Industry, Pathways to Supply Chain Excellence*, ISBN: 978- 953-51-0367-7, InTech.

Ramanathan, U. and Gunasekaran, A. (2012) 'Supply chain collaboration: impact of success in long-term partnerships', *International Journal of Production Economics* http://dx.doi.org/10.1016/j.ijpe.2012.06.002 (accessed 5 July 2021).

Razaei, M. and Liu, B. (2017) 'Food loss and waste in the food supply chain', [online] http://www.fao.org/3/bt300e/bt300e.pdf (accessed 14 July 2021).

Reid, K. (2021) 'Africa hunger, famine: Facts, FAQs, and how to help', World Vision Inc. [online] https://www.worldvision.org/hunger-news-stories/africa-hunger-famine-facts (accessed 5 July 2021).

Rizzardo, D. and Brooks. R. (2003) *Understanding Lean Manufacturing,* Maryland Technology Enterprise Institute, USA.

Rodrigo-González, A., Grau-Grau, A. and Bel-Oms, I (2021) 'Circular economy and value creation: sustainable finance with a real options approach', *Sustainability*, Vol. 13, p.7973, https://doi.org/10.3390/su13147973.

Sayyadi, M. (2019) 'How effective leadership of knowledge management impacts organizational performance', *Business Information Review*, Vol. 36, No. 1, pp.30–38.

Schilke, O. and Cook, K. (2013) 'A cross-level process theory of trust development in interorganizational relationships', *Strategic Organization*, Vol. 11, No. 3, pp.281–303.

Shah, R. and Ward, P.T. (2007) 'Defining and developing measures of lean production', *Journal of Operations Management*, Vol. 25, No. 4, pp.785–805.

Sheahan, M. and Barrett, B. (2017) 'Review: food loss and waste in Sub-Saharan Africa', *Food Policy*, Vol. 70, pp.1–12, http://dx.doi.org/10.1016/j.foodpol.2017.03.012.

Sherzad S. (2015) 'Post-harvest losses along value and supply chains in the Pacific Island Countries', *A FAO Brief* [online] http://www.fao.org/fileadmin/user_upload/sap/docs/Post harvest%20losses%20along%20value%20 and%20supply%20chains%20in%20the%20Pacific %20Island%20Countries.pdf) (accessed 1 May 2021).

Simchi-Levi, D., Kaminsky, P. and Simchi-Levi, E. (2003) *Designing and Managing the Supply Chain: Concepts*, *Strategies and Case Studies*, McGraw-Hill, New York.

Sodeeq, A,. Ibrahim,G., Hazat, O., Oguntade, M., Taiwo, O. and Adesanlu, A. (2021) 'Profitability of tomato marketing and determinants in Akinyele local government area, Oyo state, Nigeria', *Greener Journal of Agricultural Sciences*, Vol. 11, No. 1, pp.41–47.

Sugri, I., Abubakari, M., Owusu, R. and Bidzakin, J. (2021) 'Postharvest losses and mitigating technologies: evidence from Upper East Region of Ghana', *Sustainable Futures*, Vol. 3, No. 1, p.100048.

Tortorella, G.L. and Fettermann, D. (2018) 'Implementation of Industry 4.0 and lean production in brazilian manufacturing companies', *International Journal of Production Research*, Vol. 56, No. 8, pp.2975–2987.

Tortorella, G.L., Giglio, R. and van Dun, D.H. (2019) 'Industry 4.0 adoption as a moderator of the impact of lean production practices on operational performance improvement', *International Journal of Operations and Production Management*, Vol. 39, Nos. 6–8, pp.860–886.

Tsasis, P. and Bruce-Barrett, C. (2008) 'Organisational change through lean thinking', *Health Services Management Research*, Vol. 21, No. 3, pp.192–198.

Turner, R.K., Pearce, D.W. and Bateman, I. (1993) *Environmental Economics: an Elementary Introduction*, Johns Hopkins University Pre, Baltimore.

Van Buren, N. et al. (2016). 'Towards a circular economy: the role of dutch logistics industries and governments', *Sustainability*, Vol. 8, No. 7, p.647, DOI: 10.3390/su8070647.

Vanichchinchai, A. (2019a) 'A categorization of quality management and supply chain management frameworks', *Cogent Bus. Manag.*, Vol. 6, No. 1, p.1647594.

Vanichchinchai, A. (2019b) 'The effect of lean manufacturing on a supply chain relationship and performance', *Sustainability*, Vol. 11, p.5751, DOI: 10.3390/su11205751.

Velasco-Munoz, J.F., Mendoza, J.F., Aznar-Sanchez, J.A. and Gllego-Scmid, A. (2021) 'Circular economy implementation in the agricultural sector: definition, strategies and indicators', *Resources, Conservation and Recycling*, Vol. 120, https://doi.org/10.1016/j.resourcec. 2021.105618.

Vlachos, I. (2015) 'Applying lean thinking in the food supply chains: a case study', *Production, Planning and Control*, Vol. 26, No. 16, pp.1351–1367, ISSN 0953-7287.

Voluntary Inter industry Commerce Standards Association (VICS) Association (2002) 'Global commerce initiative recommended guidelines: collaborative planning, forecasting and replenishment, CPFR", version 2.0 [online] http://www.vics.org/docs/committees/cpfr/ CPFR_Tabs_061802.pdf (accessed 31 May 2021).

Wagenberg, C., Plaisier, C,. Dijkxhoorn, Y., Groot, J. and van Gogh, B. (2017) 'CGIAR FS4HD reduce postharvest losses of vegetables for healthier urban consumption deliverable 1: Tomato as selected vegetable for impact assessment of intervention to reduce postharvest losses', [online] https://edepot.wur.nl/446254.

Wautelet, T. (2018) *The Concept of Circular Economy: its Origins and its Evolution*, A working paper, DOI: 10.13140/RG.2.2.17021.87523.

Womack, J. and Jones, D. (2003) *Lean Thinking*, Free Press, New York.

Wu, X., Wen, B. and Du, M. (2015) 'A multi-level research on the antecedents and consequences of group task satisfaction', *American Journal of Industrial and Business Management*, Vol. 5, No. 5, DOI: 10.4236/ajibm.2015.55028.

Zinecker, A., Ibezim-Ohaeri, V., Adeyinka, T. and Merrill, L. (2020) 'Gender and fossil fuel subsidy reform in Nigeria: findings and recommendations GSI REPORT', *Global Subsidies Initiative-IISD, BIDS, IRADe and Spaces for Change* [online] http://www.iisd.org/gsi (accessed 4 September 2021).