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Sustainable Production Strategy and Product Availability: A Study of Unilever Nigeria PLC

Stanley Akpevwe Onobrakpeya[1], Ovie Emakpor Asagba[2], Brilliant Aforkoghene Ughovero[3] & Christopher Tuni Ijoyah[4]
[1]&[2]Department of Marketing, University of Nigeria, Enugu Campus
[3]Department of Marketing, Delta State University, Abraka
[4]Department of Business Administration, Delta State University, Abraka
Corresponding Email: akpevwestanley@gmail.com

Abstract
Sustainable production is regarded as all industrial activities that focused on the manufacturing of goods using systems and processes that are non-polluting to the environment. The main purpose of the study is to examine the effect of sustainable production strategy on product availability of Unilever Nigeria Plc. The study was conducted using a cross-sectional survey research design. In order to select the sample respondents, stratified random sampling method was used. Out of the 1252 employees of Unilever Nigeria Plc 291 employees were chosen as the sample size. A 16 item structured questionnaire was the instrument used to collect data. To ascertain the reliability of the research instrument, a test-retest method was used. Both descriptive and multiple regressions analysis were used to analyze the collected data. Findings showed that industry 4.0, sustainable living plan and collaboration with channel intermediaries have positive significant effect on product availability. The study concluded that sustainable production has positive significant effect on product availability of Unilever Nigeria Plc. It was recommended amongst others that Unilever's current production facilities should adopt industry 4.0 based manufacturing and promote the digital technologies such as Cyber-physical systems, AI, 3D printing, Robots and Digital manufacturing for the manufacturing of their products.
Keywords: Collaboration, Industry 4.0, Sustainable Living Plan, Sustainable Production
JEL Classification: M1, M11, M3, M30, M31

1. Introduction

Sustainable production is a resource-saving form of manufacturing of goods that preserves the environment's ability to regenerate. Sustainable manufacturing is the major driver behind succeeding manufacturing's innovative solutions, operations, and systems. Managers in many businesses

strive to increase sustainability performance by combining, managing, and assessing the elements and enabling structures that allow it (Wagner & Svensson, 2014; Høgevold, Svensson & Klopper, 2015). In the most recent decade, Industry 4.0 has appeared as a new pattern related with sustainable production, which lay emphasis on the creation of industrial value (Antonio, Roberto, Ana & Alberto, 2020). This new epoch corresponds to the third industrial revolution, which began in the early 1970s and was characterized by the advancement of large-scale production aided by mechanization and industrial engineering, as well as the information technology (IT) industry, to achieve the desired level of automation in product manufacturing. Liere-Netheler, Vogelsang, Hoppe and Steinhüser (2017) asserted that certain manufacturing companies have begun to implement industry 4.0, which has resulted in various benefits.

Juma, Stephen, Peterson, Michael and James (2019) opined that in recent years, industry 4.0 technology and applications have become a relevant factor in companies' operational efficiency. Unilever, for instance, can use the cloud system to protect personal massive amounts of data and use the data to support management systems and decisions. It is on record that 2.5 billion individuals use Unilever brand to feel better, look great and get more out of life (Manjurul, 2020). Günther (2016) posited that over 400 Unilever brands are trusted in the 190 countries where they are sold, and as a result, the company has risen into one of the world's most successful consumer goods company. Unilever has been put through a series of stress tests by the COVID-19. At every stage of the company's worldwide supply chain, from manufacturing to delivery, national lockdowns have had an impact (Unilever Annual Report, 2021). The burden was exacerbated by plant workers unavailability and a scarcity of couriers. When demand shifted from business to consumer products, the capacity to predict what will happen next became less relevant in making judgments at the present time.

Customers' perceptions changed, and they spent more time at home, thus they promoted hygienic products to prevent the spread of Covid-19. This ongoing emergent epidemic has opened up new directions for people and manufacturing company social sustainability (Aalok, Sunil, Sachin & Yiğit, 2020). The United Nations (UN) has released the 2030 Sustainable Development Agenda, which addresses various ongoing issues such as zero hunger, environmental degradation, climate change, and other negative consequences of various manufacturing processes (Marco, Di Baker, Daszak, de Barro, Eskew, Godde, Harwood, Mejıas, Paz & Pardo, 2020). The first environmental study in sustainable manufacturing and production was done, resulting in the development of the discipline of Environmentally Conscious Manufacturing (ECM) (Owen, 1999). Environmental Management Systems

(EMS) is becoming increasingly accepted among producers as an approach for enhancing productivity (Antonio, et al 2020). The main advantages of this approach are that it allows businesses to examine and control their critical environmental impacts, reduce the risk of pollution incidents, ensure compliance with considerable environmental legislation, and continuously improve their processes and operations (Tourais & Videira, 2016).

At present, most of the manufacturing companies are under pressure to foresee the negative impact of COVID-19. Most markets in the world are been affected, and industrial managers are looking for new resources and process techniques to maintain production (Cohen, 2020). The current COVID-19 outbreak in Nigeria has a large impact on production systems and trade. Numerous vital commodities, such as food, groceries, and medicinal supplies, are seeing significant reductions in output, resulting in a massive supply-demand imbalance (Aalok, et al 2020).

The Unilever's exposure to supply chain risks are continuously being reviewed as events unfold. The company always addresses arising issues such as supply shortages, requests for advance payments by suppliers, commodity price increases, increase logistics prices and related delays to ensure very minimal impact on operations. The company constantly source for raw materials or partner with key stakeholders to ensure that raw materials stock-outs are avoided. Unilever also ensured the restructuring of existing payment terms, development of alternative suppliers and leveraging on global procurement. Unilever's had to depend on dynamic marketing as customer preferences and isolation laws changed.

Given that production processes are essential for the procurement of basic necessities that improve the living standards of the people and the world's economy, it is important to examine them from a long-term perspective (Mohamed, Adel, Italo, Mahmoud, Monis & Hussien, 2020). Because the production phase is a part of the product's supply chain, which uses more effort and materials, following the design of production method is critical to achieving sustainability goals. Within the subject of sustainability, the notion of sustainable production (SP) is garnering increasing attention of researchers and has progressed to widespread acceptance in business, notably in industries. The management of sustainable production and utilization of the fundamental and unimportant merchandise and services is an intricate choice predicament for organization directors and policymakers during the pandemic circumstance (Aalok, et al 2020).

Despite the relevance of sustainable production to companies, limited studies have been done on how it can affect a company's product. Therefore the study aims to fill this gap in literature by examining the effect of sustainable production on product availability in Unilever Nigeria Plc.

Carbon and material complicated economic advancement, expanding social and environmental inequities, and an increasingly volatile climate are weakening varied companies' ability to deliver economic stability - and providing an opportunity to reassess and restructure tomorrow's economies. New strategies for encouraging innovation will be required to transform today's and tomorrow's economies.

Despite all of the benefits of industry 4.0 technologies, there is still a long way to go, and most firms have not placed enough attention on implementing them. Businesses can attain their goals at a reduced cost by cultivating logical flaws and increasing sustainable consumption and production practice. Additionally, when it comes to sustainable production, hence the need to create an enabling environment for both practitioners and academics, and producers appear to be unaware of the potential benefits of this mechanism. Therefore, there is need to examine the effect of sustainable production strategy on product availability of Unilever Nigeria Plc. The specific objectives of the study are to: determine the effect of industry 4.0 on product availability; ascertain the effect of sustainable living plan on product availability, determine the extent to which collaboration with channel intermediaries affect product availability.

2. Literature Review

2.1 Conceptual Review

2.1.1 Concept of Sustainable Production Strategy (SPS)

Sustainable production is the manufacture of products and services utilizing non-polluting, energy and natural resource-saving, commercially sustainable, secure, and healthy methods and systems for employees, societies, and customers (Lowell Center for Sustainable Production, 2021). All industrial operations from the production to the buyer, along with all steps in the process (i.e., resources and services linked with the production chain), are included in sustainable production (Mohamed, et al 2020).

Sustainable production or manufacturing is based on the 6R (reduce, redesign, reuse, recover, remanufacture and recycle) instead of the 3R structure (i.e., reduce, reuse, and recycle) (Jayal, Badurdeen, Dillon & Jawahir, 2010). In the 6R strategy, the term "reduce" refers to lowering the effort required to use resources and improve energy efficiency during manufacturing, leading to reduced waste during this phase.

The "Reuse" concept refers to the repurposing of products or earlier produced parts after their first lifecycle, which helps to save resources. The act of repurposing existing resources that would otherwise be considered rubbish to create new materials or goods is referred to as "Recycle." When it comes to "Recover," it happens when fragments are gathered at the end of

one lifespan and then removed, cleaned, and rebuilt for the next. A demonstration of "Redesign" is the use of approaches such as Design for Environment (DFE) to modify or redesign a product to make it more practical (Hauschild, Jeswiet & Alting, 2004). In terms of "Remanufacture," it entails repurposing a previously used product and restoring it to its original state by reusing as many elements as possible without sacrificing functionality (Schau, Traverso & Finkbeiner, 2012; Schau, Traverso, Lehmann & Finkbeiner, 2011).

Production is linked to all human activities in today's society, and it is a source of products and services that are essential for human health, well-being, and safety (Gunasekaran & Spalanzani, 2012). Sarkis (1995) proposed the well-known 'RS' approach: Reduction, Remanufacturing, Recycling, and Reuse to identify product, process, and technology as the key three components of ECM strategies. Environmentally Conscious Manufacturing and Product Recovery was offered by Gungor and Gupta (1999) as an enhanced approach (ECMPRO). According to this perspective, the environmental basis encompasses not only the process of generating new products, including design, manufacture, and distribution to consumers, but also the product's end-of-life management after its useful life. O'Brien (1999) focused on cost-cutting options for companies that are proactive in improving their operations' environmental performance.

Jayal, et al. (2010) asserted that a holistic approach to sustainable manufacturing or production is required, addressing product, process, and system challenges in an integrated framework. Jawahir and Bradley (2016) asserted that the first 'Rs' method, which is supported by three principles: reduce, reuse, and recycle, must be extended to a broad vision of sustainable manufacturing. Advancement in process planning is required to reduce materials and energy consumption, overstocks, emissions, and waste, among other things, in order to improve manufacturing technology (Klassen, 2000; Jawahir, Dillon & Rouch, 2006).

Sustainable manufacturing varies from traditional manufacturing concepts in that it focuses on the triple bottom line (TBL) evaluation standards, which consider the economic, environmental, and social aspects all at the same time (Mohamed, et al 2020). The TBL is a rating system proposed by John Elkington in the early 1900s as the major criterion for assessing the degree to which sustainability viewpoints are accepted, which was deemed impossible by conventional tactics at the time. The economic pillar is not the only point of view that needs to be improved in a sustainable production process; the environment and social aspects are also taken into account (Mohamed, et al 2020).The variant of this strategy shifts the plan

and evaluation metric from an economically based cycle to a more complete procedure.

Because such integration necessitates a compatible assessment perspective, the traditional Life Cycle Analysis (LCA) is revised with the TBL standard to include the ecological, social, and economic perspectives. LCA is a concept that tracks a product's environmental impact from its raw material state to its final disposal (Heijungs, Huppes & Guinée, 2010). The life cycle cost (LCC) and the Social Life Cycle Assessment (LCSA) have been presented in this fashion (Klöpffer, 2008). The LCC focuses on the product's economic characteristics. LCC can be classified into three categories: traditional (internal costs), environmental, and social. But at the other end, the LCSA evaluates a product's effect on workers, consumers, community groups, and society. Despite the fact that the LCSA can assess all three features of the TBL, it lacks specific definition for the TBL markers. This is notably evident in social and economic perspectives, which demonstrate a lower level of development as compared to the natural world (Chang, Neugebauer, Lehmann, Scheumann & Finkbeiner, 2017).

2. Conceptual Framework and Hypotheses

The conceptual framework is an illustration showing the connection between the dimensions of sustainable production strategy (SPS) and product availability. These dimensions are industry 4.0, Sustainable living plan and collaboration with channel intermediaries.

Dimensions of SPS

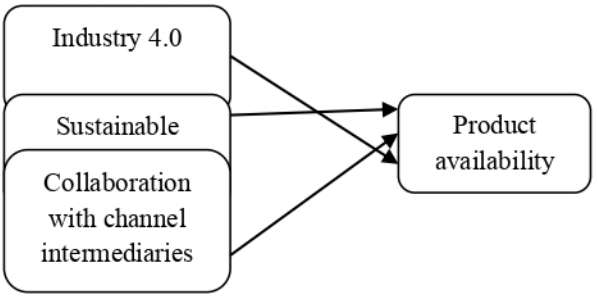

Figure 1: Conceptual Framework
Source: Researchers Conceptual Model for the Study Variables (2022)

2.1 Industry 4.0 (I4.0)

The key principles of Industry 4.0 were described by Kagermann, Lukas and Wahlster (2011), who attributed the emergence of the Internet of Things (IoT) and Internet of Services into manufacturing to this new

approach. Smart factories with horizontally and vertically integrated manufacturing systems benefit from the Internet of Services (Gerrikagoitia, Unamuno, Urkia & Serna, 2019). Production processes have gained flexibility as a result of large data exchange between intelligent manufacturing stations and cells with embedded mechatronics and sensors (Thoben, Wiesner & Wuest, 2017; Gausemeier, Czaja & Du¨ lme, 2015). Nagy, Oláh, Erdei, Máté and Popp (2018) opined that the cognitive connectivity of industrial product or process is known as industry 4.0. Big data analytics, automated robotic systems, and real-time activity modeling, as well as cybersecurity and virtual worlds, are all on the horizon. Among the technologies connected with Industry 4.0 include additive manufacturing, interoperability, and the Internet of Things (Juma, Stephen, Peterson, Michael & James, 2019). Nagy et al., (2018) posited that IoT connects all IT resources in a firm, allowing them to speak with one another and enable enterprises to respond to industrial events in real time.

Jadhav, Mantha, and Rane (2015) asserted that they've been incorporated into every part of a manufacturing company's business activities, including transportation, sourcing, operational processes, and reseller relationship management. Autonomous robots are a key component of Industry 4.0, which is reshaping the industrial industry. Juma, et al. (2019) posited that robots have long been an important part of industrial organizations for performing normal and repetitive operations, while big data connotes the huge and complex data sets gathered by industrial firms.

The benefits of autonomous robots, according to Deloitte (2019), include faster product creation, higher productivity, less errors, and better human-machine relationship. As a result, Unilever's use of autonomous robots could be critical to increasing its operational performance. Erboz (2017) opined that the benefits of employing big data analytics include speedier decision making, innovative product development, and lower operational costs. Furthermore, big data analytics contributes to the creation of new competitive advantages, which increases performance. In Industry 4.0, augmented reality is a key technology. Augmented Reality (AR) is an interactive technology that uses a computer-generated display to simulate the actual world, enhancing the user's experience and knowledge of their surroundings.

To portray genuine images, AR uses computerized simulations. Google Glasses, which captures visual and auditory information in the environment, is one of the most widely used AR gadgets in the world. However, because AR is utilized to establish Horizontal and Vertical System Integration at Unilever, it has a wide range of applications. Unilever's development of smart manufacturing is aided by horizontal and vertical

system combination. Vertical combination is the coupling of physical infrastructure and information technologies at several organizational levels to enhance production agility. Horizontal integration, on the other hand, refers to the interconnectedness of supply chain players. The Cyber-Physical Systems enable vertical integration.

Cloud computing (CC) is one of the most well-known Industry 4.0 technologies. Organizations can use CC to refer to subscription information storage resources. Juma et al. (2019) posited that CC allows for data storage and access from anywhere at any time. Platform as a Service, which allow different users to get relevant information in the internet; Software as a Service, which requires consumers to key in to internet services; and Infrastructure as a Service, which provides information storage capabilities (Erboz, 2017). Alcácer and Cruz-Machado (2019) added lower information storage costs, effective data administration, adaptability, and increased efficiency. Simulation software is a key component of Industry 4.0. Juma et al. (2019) opined that simulation tools are utilized to tackle production difficulties through extensive analysis methods. Rodi (2017) opined that simulations are conducted utilizing real-life data acquired from many sections of a corporation, resulting in the development of successful solutions.

Radio frequency identification and barcode scanners are critical IT resources in the industrial business (Gerrikagoitia, et al 2019). Unilever deployed RFID (radio frequency identification) technology to gather, store, and process data in order to boost manufacturing efficiency. RFID comprises three pieces, according to Gengel, et al (2016): a tag, which is a chip with a transmitter; a reader, which sends out radio waves to indicate an item's location; and middleware, which controls the entire system. Juma et al (2019) added that production, which tracks equipment and raw materials on the production line; supply chain, which delivers real-time data on production inputs or outputs in transit; and stock management, which tracks the flow of raw materials and equipment in the warehouse, are all RFID system typical applications in manufacturing firms. Industry 4.0 is supported by the Internet and communication capabilities, unlike past industrial trends that focused on improving mechanical processes in businesses. Rghioui and Oumnad (2017) stated that IoT connotes the connection of devices using the Internet and communication software that enables intelligent information sharing inside a company. The Internet of Things enables for real-time data exchange between devices, which boosts a company's efficiency. The following hypothesis was proposed:

$H1_a$: Industry 4.0 has a positive effect on product availability.

2.2 Sustainable Living Plan (SLP)

Companies are gradually paying more attention to the environmental factor. The environmental management system (EMS) is the most generally utilized method for improving a company's environmental results in the short and medium term (Antonio, et al 2020). It may be thought of as a plan that aids a firm to steadily monitor its primary environmental impacts and reduce impending pollution hazards while adhering to the law and striving for continuous development. The code, ISO 14001 is the most widely recognized worldwide standard for creating, executing, and maintaining an EMS. The standard is focused on organizations and does not create a set of quantitative emission targets or precise methods for assessing such emissions (Haapala, Zhao & Camelio, 2013).

Unilever is bringing its operations under one roof with a network of worldwide Ultra Logistic control towers in order to enhance customer service, reduce CO2 emissions, and save money. Unilever is increasingly relying on hybrid vehicles and rail instead of driving. According to Kalsoom (2013), the Unilever strategy has three main missions: 'increasing health and well-being, minimizing environmental impact,' and 'enhancing livelihoods,' each of which has a set of precise goals. Siddique (2018) opined that Unilever's Sustainable Living Plan aims to divorce commercial growth from environmental effect, reducing the company's total environmental footprint across the value chain as it grows in size.

Manjurul (2020) stated that the Unilever Sustainable Living Plan is directly linked to returns and earnings because it fosters growth, mitigates risks, saves money, and attracts talent. Unilever's sustainability efforts are focused on four important areas: water conservation, waste reduction, ozone-depleting substance emissions, and controllable sourcing. Unilever announced a new goal in 2019: by 2025, they will invest and partner to collect and process more plastic packaging than they sell, reducing any future regulatory costs related with EPR. By 2025, the organization will have to assist in the collection and preparation of around 600,000 tons of plastic. According to the Unilever Code of Business Principles, the company is committed to continual progress in environmental impact management as well as the long-term objective of establishing a sustainable business.

According to the Unilever Code of Business Principles, the company collaborates with others to promote environmental stewardship, create awareness of environmental challenges, and share best practices. By 2025, the firm aimed to have all of its plastic packaging be reusable, recyclable, or compostable, according to a pledge made in January 2017. Unilever announced two new goals in 2019: halving the quantity of virgin plastic used in their packaging and assisting in the collection and processing of more

plastic packaging than they sell. Unilever is changing its approach to plastic packaging by using less plastic.

Unilever asserted that participating in the Carbon Disclosure Project (CDP) program adds value to their suppliers. To achieve zero waste, Unilever employed the "four R strategy," which includes reducing, reusing, re-covering, and recycling. In addition, the organization works on repurposing garbage as a resource, such as transforming industry waste into building materials or composting food waste from employee cafeterias. Unilever has invested much in regional operations centers and is working to improve its product life cycle management. Unilever's efforts to improve the lives of truck drivers and assist efforts to lessen the environmental impact of transportation are also relevant.

Unilever has partnered with a variety of organizations globally, including the United Nations Development Programme, the World Bank, and the World Health Organization, to collect plastic wrapping to aid in the isolation, assembly, and reuse of packaging materials across India. Similarly, Unilever has aided in the establishment of approximately 3,000 waste banks in Indonesia, providing over 400,000 people with the opportunity to repurpose their garbage. Unilever has a long-standing partnership with Brazilian retailer Grupo Po de Açcar to assist with rubbish collection via drop-off sites (Unilever Annual Report, 2021). Unilever planned to meet this promise by investing in and partnering with others to strengthen collection and disposal; acquiring and using sustainable materials in their packaging; and engaging in lengthened manufacturers' commitment initiatives, in which the company pays explicitly for the collection of their packaging. It is proposed that the following hypothesis be tested:

$H2_a$: Sustainable living plan has a positive significant effect on product availability.

2.3 Collaboration with Channel Intermediaries (CCI)

Unilever engaged and collaborated with a wide range of stakeholders to achieve their goal of making sustainable living the norm. Investors, consumers, customers, suppliers, governments, regulators, and lawmakers, as well as NGOs, civic society, and peer corporations, are among them. The company aims to comprehend the issues that concern its stakeholders and to answer to any inquiries raised regarding the company's goods and business practices in a transparent and open manner. Manjurul (2020) posited that Unilever is stepping up its attempts to build on its long-standing local roots in agricultural countries. Due to its well-established distribution network in both advanced and conventional retail stores, and its adaptability globally integrated brand ideas to local market segments, Unilever is well positioned

to capitalize on the region's economic potential. Manjurul (2020) stated that Unilever works with governments, NGOs, and other partners to bring about change that is both good for society and beneficial for business, as well as with supply chain partners to develop new products and packaging. Through the company's Responsible Sourcing Policy and their Responsible Business Partner Policy, they collaborate with farmers and suppliers to drive social and environmental standards in their supply chain.

Unilever is always on the lookout for new ways to influence their wider value chain. Unilever recognizes that working with channel intermediaries is critical to addressing many sustainability difficulties, and its transformational change programs aim to assist in delivering the systems change required to address some of the most complex environmental and social issues. To help Unilever's operations, the business has teamed with Convoy on a multi-year trucking arrangement. As per Slack (2016) stated that Unilever is partnering with Convoy, because of the company's dedication to driver safety, superior service, and the continuous development of cutting-edge technological solutions that expedite procurement, increase on-time delivery, engage drivers, and save money via operational efficiency.

Unilever is likewise in the process of in-sourcing 3PL services in order to cut carbon emissions and expenses. In the field of sustainability, the organization has modified its logistics. Unilever made a concerted effort to guarantee that the vans' load capacity is not compromised. In the view of Marcel-te (2016), Unilever is aggressively engaging with corporations like Nestlé and Procter & Gamble to attain this goal. Unilever has also built a Transport Control Tower in Africa. The Control Tower, situated in South Africa, is in charge of overseeing Africa's logistics operations and processes. The installation of a control tower aided in the improvement of transportation management services. It has the capacity to take use of regional capabilities and scale in order to cut costs and improve customer service. Fani (2015) went on to say that international distribution channels range from direct producer-to-consumer to complex multilevel systems with a variety of intermediaries, each serving a specific purpose. Most multinational corporations would prefer to choose their own sales force to establish a direct channel, but leading to decreased overall sales, high start-up costs, and the lack of host community knowledge, they are forced to use middlemen such as agents or distributors. The following hypothesis was proposed:

$H3_a$: Collaboration with channel intermediaries has a positive effect on product availability.

3. Method

The study adopted the cross-sectional survey research design method, which is usually concerned with the systematic gathering of information from respondents at a particular point in time. This was done in order to better understand or forecast specific aspects of the population of interest's behaviour. The population of this study consists of 1252 employees of Unilever Nigeria Plc (Unilever Annual Report, 2021). The sample size was determined by using Krejcie and Morgan (1970) sample size determination formula. The approximate number of people who made up this subset was two hundred and ninety-one (Sample size: 291). The sampling technique that was used in this study is the stratified random sampling. Each member of the sample has an equal chance of selection. Stratified random sample was used to portray not only the entire sample, but also key subgroups, particularly small minority groups. The population was divided into non-overlapping groups called strata, and a sample was drawn from each stratum according to a set of rules. The employees were categorized into 4 strata based on their job status, including senior, junior, contract, and casual workers. Emphasis was centered on the employees of the company since they are all directly involved in the daily operations of the company.

Primary data was used for the study and data were collected through the structured questionnaire administered to the respondents. The instrument used for this study is a 12-item questionnaire constructed by the researcher using 5-point Likert scale (appendix A). The questionnaire was made up of two sections "A" and "B". Section A contains the personal data of the respondents while section B contains the variables used to measure sustainable production practice such as industry 4.0, sustainable living plan and collaboration with channel intermediaries, and product availability (dependent variable). Hence, for the study a pre-test of the questionnaire was done. This pre-test allowed the researcher to spot some flaws that could have jeopardized the study's validity. The instrument was administered to two groups of experts within the interval of two weeks. A reliability value of 0.7 or higher is considered excellent and acceptable, but a reliability coefficient of 0.6 or lower indicates poor reliability (Sekaran, 2003).

Table 1: Reliability test for all items in the Questionnaire

S/N.	Dimensions of Sustainable Production	Alpha (α) value
1	Industry 4.0	0.712
2	Sustainable living plan	0.713
3	Collaboration with Channel Intermediaries	0.715
4	Product availability	0.711

Source: Researchers Computation, SPSS, 2022

The instrument was credible because all coefficient values in table 1 were larger than 0.6, which is greater than the standard criterion proposed by Seckaran (2003). The 12-item structured copies of questionnaire retrieved from the respondents collected were coded using the 5-point Likert scale, and were analyzed by using descriptive statistics (i.e frequency distributions, percentages), and multiple linear regression analysis. Tables were used to present the findings. Multiple linear regressions were utilized as an inferential statistical tool. The link between two or more independent variables and one dependent variable was estimated using multiple linear regression. They were used with version 23 of the statistical package for social science (SPSS) software.

The following is the general form of the equation for predicting PA:

$PA = f(I4.0, SLP, CC1)$ ……1

$PA = \beta o + \beta 1\, I4.0 + \beta 2 SLP + \beta 3 CCI + \varepsilon$ ……2

Where:

I4.0= Industry 4.0 (Internet of Things, autonomous robots, radio frequency identification technology, and simulation tools).

SLP= Sustainable Living Plan (Reduce, redesign, reuse, and recover)

CCI= Collaboration with Channel Intermediaries (supply chain partners, farmers, agents or distributors, vans' load capacity).

PA = Product Availability (Accessibility)

β_1- β_3= Parameters to be estimated

4. Results and Discussion

This section presents the analysis of data collected through the research instrument (questionnaire) in the field, which is helpful for a good analysis of this data. In addition, the analyses were done concerning the research objectives and hypothesis under the study. 272 of the 291 copies of questionnaire distributed were returned, 3 were not thoroughly filled, and 269 could be used. As a result, the study was based on a sample size of 269 participants. A whopping 92 percent of people responded. The data related to the respondents were presented in terms of gender, age, marital status, and educational qualification of the respondents.

Table 2: Distribution Table Showing Demographical Data of Respondents

S/N.	Demographic Characteristics	Category	Frequency	Percentages
1	Gender	Male Female Total	121 148 269	45% 55% 100
2	Age	18-30 31-43 44 years of age Total	86 121 62 269	32% 45% 23% 100
3	Marital Status	Single Married Divorced Total	94 108 67 269	35% 40% 25% 100
4	Educational background	B.Sc/HND OND/NCE MBA/M.Sc Total	167 67 35 269	62% 25% 13% 100

Source: Researchers Computation, SPSS, 2022

The results in table 2 indicated that 45% of the samples were males while 55% were females. The age bracket of the respondents showed that 32% were within the age bracket of 18-30 years of age; 45% falls within the age bracket of 31-43 years of age; lastly, 23% were above 44 years of age. The marital composition of the respondents indicated that 35% were single, 40% of the respondents were married, while the remaining 25% were divorced. On the educational background of the sample, it was shown that most of the respondents have a high level of those with tertiary background with 62% being B.Sc/HND holders; 25% were OND/NCE holders, while the remaining 13% of the sample size were MBA/M.Sc holders.

Table 3: Model Summary and Fitness Test

R=.837[a] R Square=.701 Adjusted R Square=.697 Std. Error of the Estimate=.7122					
Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	314.576	3	104.859	206.720	.000[b]
Residual	134.421	265	.507		
Total	448.996	268			

a. Dependent Variable: Product availability

b. Predictors: (Constant), Industry 4.0, Sustainable Living Plan, Collaboration with channel intermediaries.

Source: Researchers Computation, SPSS, 2022

Table 3 indicated that change in product availability was brought about by the components of sustainable production strategy by 70% (0.701) as indicated by the R^2 value. The independent variables explained 70% of the variability of the dependent variable. The *F*-ratio showed that the sub variables of sustainable production strategy statistically predicted product availability, $F = 206.720$, $0.000 < 0.05$. This indicates that the regression model is both accurate and significant.

4.2 Test of Hypotheses

Table 4: Multiple Linear Regression Analysis of the Dimensions of Sustainable Production Strategy and Product Availability

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.961	.822		-1.169	.243
	Industry 4.0	.185	.063	.162	2.927	.004
	Sustainable Living Plan	.500	.072	.405	6.919	.000
	Collaboration with channel intermediaries	.361	.046	.365	7.805	.000

a. Dependent Variable: Product availability

Source: Researchers Computation, SPSS, 2022

Table 4 showed that the first variable, Industry 4.0, has a positive effect on product availability (ß =.185, P0.05). $H1_a$ test revealed that industry 4.0 has a significant positive influence on product availability (0.004<0.05). This finding supported Juma *et al* (2019) assertion that industry 4.0 technology and applications have emerged as a dominant force in the operational efficiency of companies around the globe in recent decades. Sustainable living plans has a positive effect on product availability (ß =.500, P0.05). $H2_a$ test revealed that a sustainable living plan had a substantial positive effect on product availability (0.000 0.05). This supports Siddique (2018) assertion that the Unilever Sustainable Living Plan aims to divorce economic growth from environmental impact, reducing the company's total environmental footprint across the value chain as it grows. This is in agreement with Antonio et al (2020) assertion that producers are increasingly recognizing the Environmental Management System as a tool for improving their manufacturing performance.

It was indicated that collaboration with channel intermediaries which is the third variable has positive effect on product availability (ß =.361, P<0.05). Test of $H3_a$ showed that collaboration with channel intermediaries

has a positive significant effect on product availability. This finding is consistent with Manjurul (2020) assertion that Unilever collaborates with governments, NGOs, and other partners to bring about change that benefits society and business, as well as with partners in their supply chain to develop new products and packaging.

4.3 Implications of the Findings

The policy implication showed that the higher the usage of industry 4.0 by companies the higher the level of product availability. Sustainable living plan is a strong determinant of product availability. Manufacturing companies do not operate in a vacuum, it can be sustained when their operations does not affect the environment. The higher the collaboration a company has with channel intermediaries the higher the level of products that will be made availability for customers.

5. Conclusion and Recommendations

Findings showed that 70% of the change in product availability was brought about by the components of sustainable production strategy. The study therefore, concluded that sustainable production strategy has positive significant effect on product availability of Unilever Nigeria Plc. The study result indicated that industry 4.0, sustainable living plan, collaboration with channel intermediaries has positive significant effect on product availability. Based on the study results and conclusion it was recommended that producers should develop realistic operational methods for addressing production losses and improving consumption patterns, which would help the economy grow even more. Current manufacturing facilities should transition to Industry 4.0 technology and encourage new technologies such as Cyber-physical systems, artificial intelligence, 3D printing, robotics, and smart manufacturing. Managers should move away from supply chain networks and toward Digital Supply Networks (DSNs).In order for companies to attain high sustainable production, they should adopt industry sustainable living plan and collaboration with key channel intermediaries.

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APPENDIX A

Section A

Personal Data

Kindly answer the questions in the space provided below

1. Gender: Male [ ] Female [ ]
2. Age: Below 30 [ ] 31-43 [ ] 44 and above [ ]
3. Education: OND/NCE [ ] HND/B.Sc. [ ]
4. Marital status: Single [ ] Married [ ] Divorced [ ]

SECTION B

QUESTIONNAIRE ITEMS:

For each of the following items use the box provided to indicate your answer by ticking the option most acceptable to you.

1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5= strongly agree.

(1) What is the effect of industry 4.0 on product availability?

S/N.	Statement	SA 5	A 4	U 3	D 2	SD 1
1	The use of Internet of Things enables our company to respond to industrial events in real time.					
2	We use simulation tools to tackle production difficulties through extensive analysis methods					
3	The use of autonomous robots is critical to increasing our productivity.					
4	We use radio frequency identification technology to process data to boost manufacturing efficiency.					

(2) How does sustainable living plan affect product availability?

S/N.	Statement	SA 5	A 4	U 3	D 2	SD 1
5	My company lowers the effort required to use resources and improve energy efficiency during manufacturing.					
6	To achieve zero waste, my company repurposes products after their first lifecycle, which helps to save resources.					
7	My company repurposes existing resources that would otherwise be considered rubbish to create new materials.					
8	My company gathers fragments at the end of one lifespan and then removed, cleaned, and rebuilt for the next.					

(3) How collaboration with channel intermediaries does affect product availability?

S/N.	Statement	SA 5	A 4	U 3	D 2	SD 1
9	My company works with supply chain partners to develop new products and packaging.					
10	My company works with farmers to drive social and environmental standards in their supply chain.					
11	My company works with agents or distributors in order to increase overall sales.					
12	My company guarantee that there is no compromised vans' load capacity of distributors.					

(4) What is the effect of product availability on brand reputation?

S/N.	Statement	SA 5	A 4	U 3	D 2	SD 1
13	Out-of-stock works differently and can affect the profit of our company					
14	Retailers can miss out on sales due to product out-of-stock					
15	Products that can be easily accessible by customer's increases repeat purchase.					
16	Products constantly supplied to retailers create brand reputation.					