JTS

Journal of Techno-Social

http://penerbit.uthm.edu.my/ojs/index.php/jts
ISSN : 2229-8940 e-ISSN : 2600-7940

Internet of Things and Supply Chain Management: An Empirical Analysis of Nigeria Perspective

Olota O. Omotayo[1]*, Aun I. Iortimbir[1], Balogun E. Oluwadamilare[1]

[1]Department of Business Administration,
University of Ilorin, Ilorin, NIGERIA

*Corresponding Author

DOI: https://doi.org/10.30880/jts.2023.15.01.005
Received 15 October 2022; Accepted 1 June 2023; Available online 27 June 2023

Abstract: Information Tecnology (IT) developments is a paradigm shift in various domains, including supply chain management (SCM). This study examines internet of thing (IoT) and SCM; an empirical analysis of Nigeria perspective. The study examined IoT factors and its effect on SCM, with a specific focus on Jumia Nigeria. The survey research design was used in this study. The study's sample size is comprised of 265 members of Jumia employees who were randomly selected with 253 valid responses retrieved. SmartPLS3 was used for the analysis, and hypotheses were tested using structural equation model at a significance threshold of 0.05 to see whether they were correct. Results demonstrated that IoT has a standardized beta value and P value of 0.948 and 0.000 on SCM which its r2 indicates 89.9% on SCM. In conclusion, IoT factors integration will lead to continuous improvement as it helps to enhanced its supply chain management.

Keywords: Internet of Things, supply chain management, e-purchasing, e-based order processing, e-customer service

1. Introduction

In recent years, the internet has evolved as a viable medium for facilitating virtual transactions between customers and businesses. As a new powerful medium for supply chain, the World Wide Web has made many middlemen obsolete and completely redesigned the value chain. Firms' supply chains are being disrupted by the internet, which is changing the way products and services are distributed. A unique approach that makes sure that all supply chain interactions are essentially online is also being forced by this trend to force companies to reconsider their value proposition to clients as well as to address the challenges of more nimble competitors (Zillur, 2003).

The remarkable rise of the internet has led to a similar increase in online business. While some companies have embraced this new rivalry paradigm quickly, others have been slow to adapt. In part, this has been owing to structural causes, but also because of entrenched players' incompetence and reluctance to grasp the size and rapid advances enforced by competition in such a networked economy in supply chain functions, such as procurement, inventory control, and shipping, these changes have been most pronounced (Soloner & Spence, 2002). Supply chain management (SCM) has gone from a low-profile, peripheral concern to a recognized strategic component with a direct influence on the bottom line in the recent decade. Today's supply chains aren't just about reducing costs and improving customer service; they're about focusing on core skills, leveraging the strengths of vendors, and making the supply chain more responsive to customers. With the introduction of the Internet and the World Wide Web, these objectives would be supplanted by a single super objective: competing on the strength of your supply chain management (Lancioni, 2000).

Simultaneously, another fundamental revolution is sweeping across all industries worldwide: the advent of the genuinely global marketplace in the post-net economy (which, in many cases, is upending traditional knowledge in supply chain management SCM) (Fisher, Hammod, Obermeyer, & Raman, 1994). Long-term partnerships with vendors, where the firm and the supplier collaborate to enhance design, increase quality, lower costs, and share the

*Corresponding author: olotaoluwayomi@gmail.com

advantages, were formerly the hallmark of a successful supply chain. Labor-intensive countries with cheap industrial bases have been the go-to destinations for good supply chain managers. However, online shopping has made it easier, faster, and more cost-effective than ever before (Harvey & Richey, 2001). The supplier may change each time, as pricing for Internet-based transactions becomes increasingly flexible, decided more by demand and supply at the moment you wish to make your purchase than by any fixed-price strategy on the seller's part (Poirier & Bauer, 2002).

IT has been and continues to be a critical facilitator of successful supply chain management (SCM) (Ross 2016). In the face of an ever-changing environment and a variety of hazards at all levels, supply chain management plays an important role. Because of its ability to integrate internal and external activities, IT has had a significant impact on supply chains' structure, as well as their nature. Improved communication, acquisition and transmission of data, as well as improved supply chain performance, have all contributed to this success. IoT, one of the most recent IT developments, is a paradigm shift in various domains, including SCM. Human-to-thing communication and autonomous coordination among 'things' while being kept or transported through supply chain entities are now possible because to the IoT. SCM may now take advantage of these powerful new tools in today's digital age.

IoT enables unprecedented levels of supply chain visibility, agility, and adaptability to address a variety of supply chain management concerns (Ellis, Morris, & Santagate 2015). It is possible to gain unprecedented insight into the whole supply chain by utilizing the data released by smart things and then successfully collecting, analyzing and transforming it into actionable information. It is possible to achieve new levels of supply chain efficiency by responding to these indications in a timely manner. Rather than a scarcity of information, what has been lacking is the ability to acquire and handle large amounts of it quickly enough. As a result of the IoT, supply chains will be able to respond to changes in real time, offering levels of agility and reactivity never previously seen in the industry (Ellis, Morris, & Santagate 2015). The IoT will also make it possible to remotely control supply chain operations, improve cooperation with partners, and deliver more precise information for improved decision-making.

2. Literature Review

2.1 Internet of Things

The phrase "Internet-of-Things" (IoT) is adopted as a catch-all term to mean different features relating to the extension of internet as well as the Web into the real world via the broad adoption of devices which are distributed spatially with integrated signifier, sensing, and/or capabilities to actuate. People who believe in IoT want to see a future that integrates the real world with digital networks together, using the right information and communication technologies (ICT), to develop innovated services as well as applications possible (Miorandi, Sicari, De Pellegrini, & Chlamtac 2012). Sensors as well as actuators are linked through a common operating image, allowing information sharing between platforms and actuating innovated applications. Through cutting edge computing by cloud as well as omnipresent sensor technology, this can be done easily and fast (Gubbi, Buyya, Marusic, & Palaniswami 2013).

A smart object (SO) is a self-contained, self-configuring, self-managing physical digital item. Self-organizing systems (SOs) have the ability to collect, process, store, communicate, collaborate with, and exchange data with different kinds of electronic equipment and human users both within and outside of their immediate environment. Fortino and Trunfio (2014) argues that changing world wide network architecture that has the capability to configure itself based on open and interoperable protocols for communication in which real life and virtual 'Things' have personalities, real life properties, and virtual identities, and interact intelligently with the network of information. This group of infrastructures allows the management, data mining, and access to the generated data of linked objects (Xu, He, & Li 2014). It means any sensor or actuator that can interface with other equipment and perform a certain purpose. Data generated by users or other systems can be transported, stored and processed via this infrastructure (Gourlier, Kheir & Urien; Wary; Wary & Dorsemaine 2015).

The IoT is a network of physical things which are digitally integrated to sense, monitor, and interact within a business and amongst the business and its supply chain. It enables agility, visibility, tracking, and sharing of information just to promote timely planning, administration, and coordination of supply chain processes. This definition has four crucial characteristics: To begin, digital connectivity of physical items in the supply chain is needed, and this connectivity is to be proactive, allowing the storage, analysis, and sharing of data. To add to this, communication occurs both within an organization and across organizations, encompassing all major supply chain processes (Mohamed, Hassini & Bahroun 2019).

2.2 Supply Chain Management

Literature about supply chain management is available online. SCM emphasizes the importance of collaboration across successive actors, from the primary producer to the ultimate consumer, in order to better meet consumer demand while keeping prices down. An important motivation for supply chain management is the recognition that sub-optimization happens when individual firms in a supply chain tries to maximize its own outcome rather than connecting its objectives and focus with those of other firms just to optimize the supply chain outcome. SCM has to do with skillful handling of interpersonal interactions. Systematic planning, coordination, and control of all business processes and supply chain tasks to deliver superior consumer value at lower value to the entire supply chain, while also satisfying the needs of other supply chain stakeholders (e.g., government and non-governmental organizations). SCM is the integration of activities that include but not limited to transportation, location, delivery, inventory, production just to have the optimal combination of efficiency and effectiveness for the served supply chain market.

2.3 Relevance of IoT in Supply Chain Management

In a study conducted by Zillur (2003) on "Internet-based supply chain management: using the internet to revolutionize your business", the study revealed the following as major aspects of relevance of IoT in supply chain management.

- Purchasing and the internet: Vendor communication, price quotes from suppliers, and catalog purchasing are all examples of procurement applications where the internet is used. The usage of the internet has also made it easier to negotiate with vendors. When it comes to business talks, the internet has largely replaced the need for face-to-face meetings. The negotiation, renegotiation, price, and term agreements are all included in this.
- Internet-Based Inventory Management: Inventory management is one of the most expensive components of supply networks. This is the most common use of the internet in this area, with customers contacting vendors or companies notifying customers of stock-outs. Companies can now implement EDI information systems with their customers more swiftly thanks to the internet. Companies' ability to be proactive in managing inventory systems has been significantly impacted by the internet. Order-shipping delays and inventory crises are two examples where this is evident. Inventory managers now have better access to more data than ever before thanks to internet-based reporting solutions. When it comes to keeping an eye on stock levels in field depots through the internet, managers have a lot of options. Internet-based supply chain inventory management allows businesses to keep inventory levels low, lower overall holding costs, and maintain high customer service standards (Zillur 2003).
- Internet Enhances Transportation: Transport management is the most common application of the internet in supply chains. Transportation is often the second most expensive component of a supply chain, after manufacturing. One of the most common uses of the internet in this industry is to keep track of truck pick-ups at regional distribution hubs. Using this method, transportation managers can verify that the motor carriers they rely on arrive on time as promised. It also gives management the information they need to immediately notify carriers of shipment delays and take corrective action without waiting days for the information to become accessible (Zillur, 2003).
- Internet-Based Order Processing: Order processing apps are the internet's second most prevalent use in supply chains. Order placing and tracking are two of the most common uses of the internet around here. The internet is used by more than half of businesses for this purpose. Prior to the internet, order processing accounted for around 18–20 percent of the overall cost of administering a supply chain system. Because of the internet, traditional order processing systems have seen a significant drop in paperwork. A customer's order cycle time has been cut in half, resulting in a decrease in costs of half a million dollars. Order processing relies heavily on pricing accuracy, and the internet makes it possible for businesses to check vendor prices online before placing an order (Zillur 2003).
- Customer Service and the internet: The internet has given businesses the ability to provide their customers with an additional method of contacting the company in the event of a service issue. Furthermore, clients have access to a company's service department 24 hours a day, seven days a week through the internet, allowing them to tell companies instantly of any service faults or problems that may emerge. The overall result has been a reduction in response times as well as the resolution of customer care complaints. The ability of the internet to communicate in both directions can have a significant impact on the development of customer–firm interactions. It has been demonstrated via experience with internet service systems that customers who have service issues resolved quickly and satisfactorily are more likely to wish to purchase the firm's products again in the future. When used effectively in the customer service arena, the internet can help companies establish strong product and service loyalty (Zillur, 2003).
- The Internet and Business Relationships with Vendors: The internet has proven to be a valuable communication channel between companies and their customers. Vendors and their consumers can also undertake these functions on a seven-day-a-week, twenty-four-hour basis through the use of the internet.
- The Internet and the Scheduling of Production: Businesses can reduce the difficulty of their production scheduling by enhancing communication between vendors, enterprises, and customers, thanks to the advancement of internet technology. Moreover, this communication is carried out not only domestically but also worldwide, with more than 16.4 percent of the companies coordinating their production schedules with various abroad locations (Zillur 2003).

2.4 Case Company Description

Jumia Express serves as the case study for this research. There are three (3) key components to Jumia's business model: the marketplace, Payment as well as logistics. It was established in the years 2012 in Lagos, Nigeria, making it ten years old. The firm was founded by Jérémy Hodara and Sacha Poignonnec. Jumia's system of payment as well as its logistical services work together to make online purchases possible (Hesham, 2018). Konga happens to be a direct rival of Jumia Express in Nigeria. About 110,000 active individuals and sellers have partnered with Jumia Express (Wikipedia, 2020).

The drop-off as well as pick-up locations of Jumia Express is above 1,300, which includes some in outlying locations. This covers 11 African nations (www.bloomberg.com, 2020). In 2020, Jumia announced that its logistics services can be used by third parties for long distance deliveries across the 11 African nations by using its expertise, technology, as well as network capabilities (www.nasdaq.com, 2020).

Supply chain management by Jumia Express follows a set structure. Market needs and operational obstacles are specific to the company's Jumia supply chain; other firms, however, face similar problems. Five aspects of supply chain decision-making are made by Jumia individually and as a group:

- Production/Service Offerings: What products or service does Jumia market want? How much of which products or services should be made available for Jumia Express customers in warehouse and by when? This activity includes the creation of master inventory schedules that take into account market demand, supplier availability, capability and market strength, quality control, warehouse and insurance cost and customers individual rate of demand all these are considered by Jumia Express. These activities are conducted online through IoT. Jumia through IoT has a record on all transactions performed with its agents and on its platform, this enhances its record keeping and help in generating the accurate data on market demand, customers rate of demand for particular service or product, ordering rate, suppliers' availability and market strength.
- Inventory: Jumia Express considers the inventory that should be stocked at each stage in Jumia Express supply chain through IoT, inventory that should be held in its warehouse on each category of products made available by its agent for customers to be able to view as much as possible online and at different price. The primary purpose of why Jumia Express keeps inventory is to act as a buffer against uncertainty such as limited online view of products amongst others in its supply chain. However, holding inventory can be expensive through IoT, in terms of the data consumption through uploading and also on the part of customers while viewing through to place order for the best option they prefer.
- Location: Jumia Express has an online presence location and that is enhanced through the use of IoT. IoT made it possible for Jumia's model to work out as it enables it to connect with verse number of agents and customers while been online. Also, Jumia Express uses third-party logistics for its physical delivery of goods at customers specified location which the communication and connection with the third-party logistics, agents, and customers are all facilitated through IoT.
- Transportation: Jumia Express move its product from one supply chain location to another through IoT especially for goods ordered abroad for tracking and tracing. Jumia Express uses expensive truck delivery and air freight for reliable fast delivery and to enhance its logistics capability. The use of Ships to transport goods through the sea is also used by Jumia Express because it is cheap but takes time before delivery which makes it less efficient. To guide against this, Jumia Express holds large volume of inventory. No matter the means of transportation used by Jumia Express, the need for IoT for communication and connecting with other parties involved is mandatory, likewise the tracking and tracing of the goods via IoT, that is, online.
- Information: Jumia Express uses IoT for data collection and also share information through IoT. Timely and accurate information holds the promise of better coordination and better decision making. With good information, people can make effective decisions about what to sell, buy and how much, about which category to locate goods and how best to transport it. The sum of these decisions defines the capabilities and effectiveness of Jumia Express's supply chain.

2.5 Challenges and Benefits for the Case Company

Jumia supply chain has its own unique set of operating challenges and yet the issues remain essentially the same for other organizations in the same line of business. The following are the challenges faced by Jumia Express in its use of IoT for its supply chain management.

- Quality Pre-evaluation: This is commonly referred to as what I ordered versus what I got. This challenge is faced by Jumia Express customers majorly but also affects the goodwill of Jumia Express such that customers are unable to evaluate the quality of the texture of their product before buying it through IoT until they are being delivered to the customer. Also, after delivery, customers then evaluate and provide feedback on the product online which might be favorable or unfavorable for Jumia Express. A slight variance between the expected quality and actual quality makes customer give bad comment in the comment field, thus, hamper the goodwill of Jumia Express and also increase the product return rate.

- Delay in Delivery: Unlike when customers patronize traditional outlets and then obtain their goods and get it home immediately, the use of IoT by Jumia Express makes it difficult for customers to obtain goods immediately. Customers at times wait as much as months to get their goods delivered. This shows how inefficient such supply chain is in terms of transportation and delivery of goods ordered through IoT.
- Shipping Cost: Another thing that pose a challenge to Jumia Express is the expensive shipping cost on mostly foreign goods. Goods ordered through the use of IoT mostly adds shipping cost and delivery cost. The shipping cost at times are more than the cost of the product. This discourages the customers from going for most products that they prefer and thus affects the level of sale of Jumia Express.
- Internet Cost: Jumia Express has online presence which is enhanced by IoT. Most customers consider the cost of data usage in accessing the products displayed in catalogues in Jumia website along with the cost of the product before going online to order. Also, during payment customers are required to enter their banking details for payment of which most customers may not want to due to trust issues and online fraudulent activities.

Jumia supply chain has its own unique set of operating benefits. The following are the benefits derived by Jumia Express in its use of IoT for its supply chain management.

- Conveniency: Jumia Express offers customers conveniency by providing an avenue for them to buy right from anywhere they are through the use of IoT and deliver their products to their door step. This conveniency factor that limits the stress of the customers helps to increase the sales level of Jumia as customers buy even when they are tired at home and they feel like not going anywhere which still affects traditional outlets till today.
- Comparison: Jumia Express allows customers to compare variety of same products online in terms of price and shape, color, look among others. This makes customers patronize its online goods and choose the most preferred after making long term effort to compare as much as possible on its website. Unlike the limited comparison available to traditional outlets. This increases the level of internet access, penetration and patronage of Jumia and also helps to increase is level of sales.
- 24 Hour Service: Jumia Express is an Online shopping outlet that is ever open due to the use of IoT unlike traditional Outlet. This makes customers be sure of getting whatever they need anytime anywhere without stress or making too much effort but by just accessing its online website or application and its supply chain or logistics will get the goods across. This also benefit Jumia Express as it makes it receive orders anytime of the day and thus, increase its order rate unlike that of the traditional outlets.
- Broad Reach: Jumia Express has a broad reach or a wide network coverage with the help of IoT and this makes it have large customer base across major parts of Africa and in some countries outside of Africa. Its supply chain effectiveness enables it to get its goods across to its customers anywhere they are while IoT does the communication during the process.
- 5. Intermediary: Jumia Express also serves as intermediary between its agent and customers as there are some goods not available from Jumia but it allows its agents to upload their goods for sale through IoT which customers assess and then buy from the agent while Jumia takes the commission of connecting the agent and the customers through IoT. Also, Jumia Express uses third party logistics to get the goods across to the customers (Jumia Logistics Services, n.d).

2.6 Theoretical Review

The Technology Acceptance Model TAM is perhaps the most commonly acknowledged paradigm for analyzing a person's choice to use IT. It was first introduced in Davis' (1986) dissertation and later work with his collaborators (Venkatesh and Davis, 1996). According to the TAM's fundamental form, user beliefs that a technology will be helpful in enhancing work quality and views of how simple it is to use will both influence whether or not they intend to adopt it. In other words, people will consider a technology to be more valuable if it is simpler to learn. However, there is some thought put into how perceptual ease affects intents to use the technology, which is mediated by ideas about how beneficial the technology is (Gefen and Straub, 2000). But if a technological advancement is just useless, its degree of usability becomes unimportant (Keil et al., 1995). Additionally, current TAM research indicates that the intention to use technology is the strongest indicator of actual utilization (Davis, 1989). Understanding precisely what motivates SCM to really use the technology is so crucial. In logistics and supply chain management, IT is crucial (Ballou, 1999).

3. Methodology

The study adopted a survey research design as it is a qualitative study. The entire staff of Jumia Nigeria was used as the target population of this study which was 1000 as at the time of this study as provided by (HR manager, 2021). A sample of 286 was drawn through Taro Yamane (1967) formular and selected through simple random sampling technique. The study used primary data and structured questionnaires which was validated through the computation of average variance expected (AVE) to test its validity at 0.5 standard valid level while the reliability of the instrument was tested through Cronbach alpha at 0.7 standard level and composite reliability at 0.7 standard level which result was displayed in the data analysis section of this study. Structural equation modeling (SEM) through the use of PLS algorithm and bootstrapping with the aid of SmartPLS 3 Software was used to test the formulated hypotheses at 5% significant level. The regression model of each of the hypotheses is given below:

$Y = \beta 0+\beta 1X1+\beta 2X2+\beta 3X3+....\beta nXn$

Restatement of Hypotheses

Ho_1: IoT has no significant effect on SCM of Jumia Nigeria.

SCM = β0 + IoT (e-Purchasing X1 + e-based Order Processing X2 + e-Customer Service X3 + e-Vendor Relationship X4 + e-Production Scheduling X5) + e

4. Data Analysis

4.1 Measurement Model

From table 1, as per the result delivered by the researcher using Partial Least Square (PLS) Algorithm and Bootstrapping, the data collected from 286 respondents were clearly tabulated in order to identify the constructs validity and reliability, T statistics, P Value and R Square results. After applying bootstrapping, the researcher acknowledged that 12 variables were analyzed which consist of 10 indicators and 2 latent variables. All factors were highly validated for the study.

Table 1 - Construct reliability and convergent validity

Constructs	Cronbachs Alpha	Composite Reliability	AVE	R Square	R Square Adjusted
Internet of Things (IoT)	0.975	0.981	0.911		
Supply Chain Management	0.877	0.924	0.734	0.899	0.898

Source: Smart PLS 3 Output (2022)

From table one above, the result of the PLS algorithm revealed that the old Cronbach alpha reliability method indicated a minimum Cronbach alpha value of 0.877 and maximum Cronbach alpha value of 0.975 for the indicators used in the structural equation model measured. This shows that the indicators used in this study are entirely reliable and will keep producing the same result when used again to measure the latent variables since all the values are above the standard value of 0.70. Also, the modern reliability test composite reliability shows a minimum value of 0.924 and a maximum value of 0.981 in the model. This further strengthen and support the reliability of the constructs. The average variance extracted (AVE) which show the validity of the indicators also shows a minimum value of 0.734 and a maximum value of 0.911. This implies that the constructs of this study are all convergently and divergently valid for this study and proves the validity of the instrument used since the values are above the minimum required standard of 0.50.

The table also reveals the R^2 and (adjusted R^2) which indicate the coefficient of determination and its adjustment against error effect. The table revealed that supply chain management is predicted by IoT variables up to 0.899 (0.898), which means that IoT predicts up to 89.9% (89.8%) of the variations in SCM of Jumia, Nigeria while other factors not considered in this study are responsible for the remaining 10.1%. This implies that the variables of IoT are significant predictors responsible for variations in SCM. This implies that SCM is significantly influenced by the combine and individual effect of IoT variables

Table 2 below shows the outer loading of the indicators of the study. The results of the SEM bootstrap analysis procedure revealed a good overall fit of the data to the proposed model. Based on the loading of each indicator on the constructs result above, by examining the outer loading of e-based order processing on IoT, it can be observed that e-based order processing has a high loading on IoT with the P value been significant ($\beta = 0.950$, $P = .000 < 0.05$). Thus, e-based order processing has high impact on IoT due to its high loading. This implies that the indicator is valid, thus, e-based order processing is highly significant to IoT.

By examining the outer loading of e-customer service on IoT, it can be observed that e-customer service has a high loading on IoT with the P value been significant ($\beta = 0.951$, $P = .000 < 0.05$). Thus, e-customer service has high impact on IoT due to its high loading. This implies that the indicator is valid, thus, e-customer service is highly significant to IoT.

By examining the outer loading of e-production scheduling on IoT, it can be observed that e-production scheduling has a high loading on IoT with the P value been significant ($\beta = 0.969$, $P = .000 < 0.05$). Thus, e-production scheduling has high impact on IoT due to its high loading. This implies that the indicator is valid, thus, e-production scheduling is highly significant to IoT.

Table 2 - Outer loadings

Constructs	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STERR|)	P Values
Information -> SCM	0.878	0.878	0.022	40.676	0.000
Inventory -> SCM	0.988	0.987	0.003	353.309	0.000
Location -> SCM	0.965	0.965	0.006	165.135	0.000
Production -> SCM	0.965	0.966	0.004	247.338	0.002
Transportation -> SCM	0.242	0.227	0.100	2.408	0.016
e-Based Order Processing -> IoT	0.950	0.950	0.009	109.965	0.000
e-Customer Service -> IoT	0.951	0.949	0.011	89.119	0.000
e-Production Scheduling -> IoT	0.969	0.969	0.005	202.580	0.000
e-Purchasing -> IoT	0.968	0.968	0.004	243.091	0.000
e-Vendor Relationship -> IoT	0.933	0.930	0.019	49.134	0.000

Source: Smart PLS 3 Output (2022)

By examining the outer loading of e-purchasing on IoT, it can be observed that e-purchasing has a high loading on IoT with the P value been significant (β = 0.968, P = .000 < 0.05). Thus, e-purchasing has high impact on IoT due to its high loading. This implies that the indicator is valid, thus, e-purchasing is highly significant to IoT.

By examining the outer loading of e-vendor relationship on IoT, it can be observed that e-vendor relationship has a high loading on IoT with the P value been significant (β = 0.933, P = .000 < 0.05). Thus, e-vendor relationship has high impact on IoT due to its high loading. This implies that the indicator is valid, thus, e-vendor relationship is highly significant to IoT.

By examining the outer loadings of the 5 SCM indicators (information, inventory, location, production and transportation) on supply chain management, it can be observed that the 5 SCM indicators have high and moderate loading on supply chain management with the P values been significant (β1 = 0.878, β2 = 0.988, β3 = 0.965, β4 = 0.965, β5 = 0.242; P1 = .000 < 0.05, P2 = .000 < 0.05, P3 = .000 < 0.05, P4 = .000 < 0.05, P5 = .016 < 0.05). Thus, SCM indicators have high impact on supply chain management due to its high and moderate loading. This implies that the indicator is valid, thus, the 5 SCM indicators is highly significant to supply chain management.

4.2 Structural Model and Hypotheses Tests

Table 3 - Path analysis

Constructs	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STERR|)	P Values
Internet of things -> Supply Chain Management	0.948	0.949	0.008	125.693	0.000

Source: Smart PLS 3 Output (2022)

Table 3 above show the path analysis of the constructs of the study. The results of the SEM bootstrap analysis procedure revealed a good overall fit of the data to the proposed model. Based on the bootstrapping result above, by examining the path analysis of the effect of internet of things on supply chain management, it can be observed that supply chain management was significantly influenced by Internet of Things (β = 0.948, t = 125.693 > 1.96 @ 5% sig. level, p = .000 < 0.05). Thus, Hypothesis one was supported by rejecting the null hypothesis and accept the alternative hypothesis which states that "there is significant effect of IoT on SCM". The R^2 at 0.899 indicates that, IoT explains a proportion of approximately 89.9% of the variance in the levels of SCM. This implies that the path is valid, thus, IoT significantly affects SCM of Jumia Nigeria.

The figure 1 depicts the path model of structural equation modeling. It also captured the result of the PLS algorithm. The e-based order processing, e-customer service, e-production scheduling, e-purchasing, e-vendor relationship the five indicators of IoT with correlation coefficient value of 0.950, 0.951, 0.969, 0.968 and 0.933 respectively. This indicates a strong and reliable relationship of the indicators as a predictor of IoT with the overall strong positive relationship been 0.948, that is, 94.8%.

The information, inventory, location, production and transportation are the five indicators of supply chain management with correlation coefficient value of 0.878, 0.988, 0.965, 0.965 and 0.242 respectively. This indicates a strong and reliable relationship of the indicators as a predictor of SCM since all the indicators are positive and high.

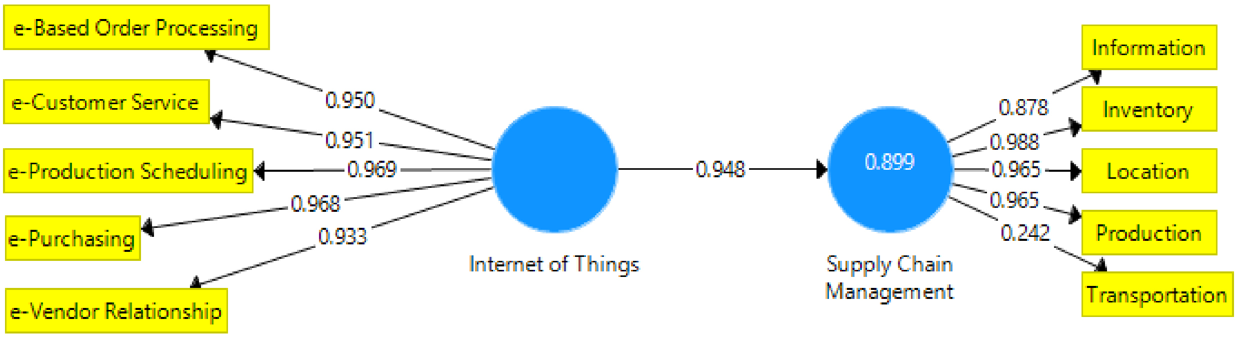

Fig. 1 - Structural equation path model

4.3 Discussion of Findings

Based on the analysis of operational data gathered via the field survey and the test of hypotheses, the following findings were revealed:

In examining the effects of IoT on SCM, the study result revealed that e-based order processing, e-customer service, e-production scheduling, e-purchasing, e-vendor relationship as factors of IoT all have significant effect on SCM of Jumia. It is also clear from table 3 that IoT has a standardized beta value and P value of 0.948 and 0.000 on SCM which its r^2 (coefficient of determination) indicates 0.899, that is, 89.9% approximately 90% on SCM indicating that IoT has significant effect on SCM. Thus, we reject the null hypothesis which states that **"There is no significant effect between IoT and SCM",** therefore we accept the alternative hypothesis when stated. The finding of this study agrees with that of Balaji & Roy (2017) and Büyüközkan & Göçer (2018) who found that availability and analysis of IoT-enabled real-time data ultimately allow stakeholders to make better operational decisions and enhance strategic outcomes at both SC and firm-level.

Thus, IoT has been found to be statistically significant to predict SCM. Therefore, harnessing IoT in the organization contribute significantly to help achieve corporate supply chain goals and higher supply chain management. This implies that through the adoption of IoT in processing customers' orders online, in providing electronic customer services, in scheduling production, in enhancing internet purchasing, in maintaining online vendor relationship influences the SCM of organizations through making organizational vital information available to both employees and customers at the best appropriate time. It also limiting information system inefficiency, through enhancing and facilitating the inventory management system of organizations, through creating online presence for wider reach in all locations, through building an effective system for production and operation scheduling and through facilitating transportation system by connecting to the nearest possible physical warehouse or shops for delivery of products.

5. Study Implications and Conclusions

5.1 Implications to the Theory

This study has so far examined how IoT is used to enhance supply chain management. This study therefore concludes that by theoretical implication, online base supply chain management has a lot of relevance, especially the IoT. It affects major areas of organizational supply chain such as procurement, delivery, transportation, inventory management and other aspects of the supply chain management. All these has been examined in the study. Also, as information has become a vital aspect of every organization, especially the supply chain aspect, the use of IoT helps in disseminating information as fast as possible and help obtain accurate information or data needed for effective supply Industry has been changed and the laws of competition have been rewritten since the introduction of the internet. The old norms still apply, but new channels and info-mediaries have emerged, altering the structure of business connections and those between enterprises and their customers in particular. Online collaboration between businesses and suppliers and partners will continue to develop in the near future as firms' source, produce and distribute goods and services. A wide range of operational areas, including as transportation, inventory, purchasing, customer support, production scheduling, order processing and vendor operations can all be quickly and accurately accessed by managers over the internet. This enables them to increase supply chain profitability. In the long run, the internet will allow logistics managers to monitor their supply chain activities and cut costs when inefficiencies occur. This has had, and will continue to have, a significant impact on the profitability of businesses.

5.2 Implications to the Practice

This study has found that IoT is not exclusive of supply chain management in modern organizations. Therefore, the conclusion of this study by practical implication is that, IoT affects significantly the performance of the of supply chain management of organizations in such action areas like company's location, production and service offering, transportation, inventory keeping amongst others. For most organizations which practice economic order quantity, IoT helps them to generate before-hand information regarding when to order, the level of stock and other aspects. While those that practice Just-in-time inventory will also be able to track customers' orders as fast as possible and deliver at the required time.

5.3 Further Scope of the Study

Although, several studies as examined in the literature review section of this work has examined how IoT has affected the supply chain of organizations, yet, the list of its relevance and effect is inexhaustive. Managers, company administrators and research and development department of globally organizations should look further into other dimensions of supply chain management that is affected by IoT which is yet to be considered in this study and make relevant conclusions that will help organizations benefit from the study.

Furthermore, this study concludes that the effect of IoT on SCM also enhances the quality of life of employees, customers and other stakeholders as it helps to automate processes and save labor costs and time both on the part of the employees and the customers in terms of getting to make orders fast and getting the order fast. It also helps to reduce waste which leads to employees achieving higher efficiency. It improves the service delivery system in place and makes service delivery way easier for the employees while making customers benefit quality service delivery. Reduce both employee and customers stress through making product manufacturing cheaper and easy to deliver goods to customers faster while also maintaining transparency in customers.

Acknowledgment

The authors fully acknowledged the Department of Business Administration, University of Ilorin for supporting this work.

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