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Design Of A Web Based Inventory Management System For Small And Medium Sized Production Companies

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ABSTRACT
The study examined the design of a web based inventory management system small and medium sized production companies. All around the world, inventory managers are faced with the complexities of simultaneously striving to retain constant manufacturing operation, render quality and adequate services to customer and keep goods at optimum level as well as having proper inventory management policy in place. This project "Web Based Inventory Management System for Small Business Owners" is used to automate all process small and medium sized production companies, which deals with Production, sales, purchases, and stock and employee details. The project will be designed using Microsoft Visual Studio.Net 2010 as front end and Microsoft SQL Server 2008 as backend which works in .Net framework version4.0. The coding language used is C# .Ne. In all, the study showed revealed that production model will enhance a systematic work operation, create a uniform standard on products and improve on quality of products in companies. The study gives details of sales model on web-based inventory management system gives history of purchase order, financial record of daily purchase, financial budget of the company and annual financial history of the company. Further the study showed that purchases model on web-based inventory management system gives record of daily consumption rate, supply rate, distribution, movement of products and decline in product distribution for small and medium sized production companies. Besides, the study revealed the stock model on Web-based inventory management system keeps total records of available products, history of products sent out on daily bases, ascertain the capacity of production of goods and gives information to organization on the need to improve on production capacity in small and medium sized production companies. Finally the study gave its perception of employee details model on Web-based inventory management system gives labor requirement, essential requirement for high skilled workers in key sector, budget for staff management and record for labor shortage in small and medium sized production companies. Based on the findings obtained from the study, it was recommended that small and medium sized industries should develop a Web-based inventory management system to manage production, purchase order, sales system, company stock and employee details.

Keywords: Design, Web-Based, Inventory, Management, Production, Companies

INTRODUCTION

All around the world, inventory managers are faced with the complexities of simultaneously striving to retain constant manufacturing operation, render quality, adequate services to customer and keep goods at optimum level as well as having proper inventory management policy in place. As company grows a number of problem also arises, first a varieties of item are needed to be maintained in the inventory making it difficult to for managers to keep track, therefore a formal record keeping will have to evolve, besides that as quantities in inventory grows more space is required to do business. Due to local and global competition any company that must survive in the competitive world must take an advantage of effective management of its inventory seriously therefore the use of intelligent approach for effective and efficient inventory management system has become indispensable. This work developed an intelligent system implemented in a web based environment to integrate multiple stores also providing an effective coordination of all of the stores, intelligently determining the different reorder points of all the disparate stores in the systems and communicating the information back to the centralized store using Java Remote Method Invocation (RMI) with a secure socket layer (SSL), implemented using My Structured Query Language (MySQL), Database Management System, Hypertext Markup Language (HTML), JavaScript, Hypertext Preprocessor (PHP) and Xampp (Apache). The work optimized the performance of inventory management integrating multiple systems and providing an efficient coordination and monitoring moving away from single store into distributed system relating real time status of supplies at the different stores.

The proposed system is a complete inventory tool for small businesses into trading, production and other services. It will contain a feature with stock alert. Enterprise Resource Planning is complete management tool which performs product details, sales, billing and stock details etc. The proposed project maintains all relevant details about the industry such as product management, billing and reporting. The product management contains adding new product, updating the prices, and stock management of each product. The admin can enter new products through the software.

The inventory management system is the mix of innovation that involves both hardware and software along with cycles and techniques that manage the observing and upkeep of loaded items, regardless of whether those items are organization resources, crude materials, and supplies, or completed items fit to be shipped off merchants or end customers. An inventory management system comprises of a system for distinguishing each stock items and its related data, for example, standardized identification marks or resource labels; hardware instruments for perusing standardized tag marks, for example, handheld standardized tag scanners or cell phones with standardized identification filtering applications; Inventory the board programming, which gives a focal information base and perspective for all stock, combined with the capacity to examine information, create reports, gauge future interest, and that's just the beginning; Processes and strategies for marking, documentation, and announcing. This ought to incorporate a stock administration strategy like Just in Time, ABC Analysis, First-In First-Out (FIFO), Stock Review, or another demonstrated philosophy; People who prepared to follow these strategies and cycles. Materials Management (Khobragade, Punam, et al., 2018) is related to organizing, getting, taking care of and giving the reasonable material of right quality, perfect sum at right spot in fortunate time to coordinate and schedule the creation development in an integrative course for a mechanical undertaking. Stock Management is fundamentally the technique by which an affiliation is given the items and undertakings that it needs to achieve its objectives of buying, amassing and improvement of materials. Stock organization systems are critical to how associations track and control inventories. Having the option to measure stock in a fortunate and definite manner is fundamental for having consistent business exercises since stock is routinely one of the greatest current assets on an association's bookkeeping report. Stock is a summary for items and materials, or those product and materials themselves, held open in stock by a business. A perfect inventory management system will mention to you what product is available, what is on hand when it will show, and what you have sold. With such a framework, you can design buys wisely and rapidly perceive the quick things you need to reorder and the sluggish things you should write down or uncommonly advance. Mendhe, Utkarsha, et al. (2017) some retailers track stock utilizing a manual label framework, which can be refreshed day by day, week after week, or even month to month.

In a manual label framework, you eliminate sticker prices from the item at the place to checkout. You at that point crosscheck the labels against the actual stock to sort out what you have sold. A key stock organization measure is restoration. A good inventory management system will make the user be informed what product is available, what is on hand, when it will show up and what you have sold.

Statement of the Problem

The existing system is purely manual system. Daily reports as well as transactions are maintained manually through ledgers. Calls and feedback and other report entries are entered manually in day books. Extensive amount of records has to be maintained to get a detailed vision on the reports. It takes lot of time for recording data. Paper work on the other hand is a cumbersome process. There are chances for errors and also updating of data is difficult. In order to overcome these problems, there is need to go for computerization. The existing inventory management systems is Time consuming, needs more power, Generation of monthly reports takes a lot of time as it has been referred from various ledger, Bulk amount of storage and paper, less security, Accurate and up-to-date reports are not possible within a short span of time.

Purpose of the Study

The objective of the study is to develop a web-based inventory management system for small and medium sized production companies. This system will record all inventories ranging from stocks, production, sales, marketing, accounts and staff information. Specifically, the study sought to:

1. Ascertain the implication of application of waterfall model on production, sales, purchases, and stock and employee details on web-based inventory management system for small and medium sized production companies in southern part of Nigeria.
2. Determine the effect of production model on web-based inventory management system for small and medium sized production companies in southern part of Nigeria.
3. Ascertain the effect of sales model on web-based inventory management system for small and medium sized production companies in southern part of Nigeria.
4. Find out the effect of purchases model on web-based inventory management system for small and medium sized production companies in southern part of Nigeria.
5. Figure out the effect of stock model on Web-based inventory management system for small and medium sized production companies in southern part of Nigeria.
6. Check the impact of employee details model on Web-based inventory management system for small and medium sized production companies in southern part of Nigeria.

Research Questions

The following research questions were developed and served as a guide for the study:

1. What is the implication of application of waterfall model on production, sales, purchases, and stock and employee details on web-based inventory management system for small and medium sized production companies in southern part of Nigeria?
2. What is the effect of production model on web-based inventory management system for small and medium sized production companies in southern part of Nigeria?
3. What is the effect of sales model on web-based inventory management system for small and medium sized production companies in southern part of Nigeria?
4. What is the effect of purchases model on web-based inventory management system for small and medium sized production companies in southern part of Nigeria?
5. What is the effect of stock model on Web-based inventory management system for small and medium sized production companies in southern part of Nigeria?
6. What is the impact of employee details model on Web-based inventory management system for small and medium sized production companies in southern part of Nigeria?

Scope of the Study

The study is limited to web-based inventory management system for small and medium sized production companies. The study also looks into small and medium sized production companies in southern part of Nigeria. The states in southern Nigeria includes; Rivers State, Bayelsa State, Akwa Ibom State, Cross Rivers State, Edo State and Delta States. Most of these states are oil producing states with commercial activities. There are reasonable sizes of small and medium production companies within its region.

LITERATURE REVIEW

Input Design and Output Design

Input Design converts the user-oriented inputs to computer-based formats. Inaccurate input data are the most common cause of errors in data processing. Error data entered by the data operator can be controlled by the input design. The goal of designing input is to make the data entry easy, logical and as free from errors as much as possible. The proposed system is completely menu-driven. It is a powerful tool for interactive design. It helps the user comprehend the range of alternatives available and also prevents them from making an invalid selection. All entry screens are interactive in nature. It has been designed taking into account all the constraints of the end-user.

Outputs are the most important and direct source of information to the customer and management. Intelligent output design will improve the system's relationship with the user and help in decision making. Outputs are used to make permanent hard copy of the results for later consultation. The output generated by the system is often regarded as the criteria for evaluating the performance of the system. The output design was based on the following factors.

¬ Usefulness determining the various outputs to be printed to the system user.

¬ Differentiating between the outputs to be displayed and those to be printed.

¬ The format for the presentation of the output (Aswanth, et al, 2019)

For the proposed system, it is necessary that the output should be compatible with the existing manual reports. The outputs have been formatted with this consideration in mind. The outputs are obtained after all the phase, from the system can be displayed or can be produced in the hard copy. The hard copy is highly preferred since it can be used by the controller section for future reference and it can be used for maintaining the record.

The control and maintenance of inventory is a problem experienced virtually by all business sectors. Inventories management is crucial for the sustainability and growth of any organization. Disregarding the necessity of inventory in any organization can lead to its shutting down, especially if the variables of productivity are poorly managed in progression to meet customers' need or desires. Inventory problem encompasses having adequate items available when desired by the customers and the stock of items must be in good condition, meaning that stock should not be too much or too little also, companies be positioned to meet customers' demands in term of quantity and quality. Considering improvement in customer satisfaction, the proficient management of inventories has become significant, because excess or shortage of inventories has remote effects on the supply chain cost therefore the need for inventory management has been articulated, it is observed that on one hand the need for sales and inventory management is growing while on the other the possibilities of artificial intelligence and software development being the fundamental part of inventory are also progressing. A major challenge is to ascertain the potential synergy between the business trend and artificial intelligence trend, the problem of an organization and the retailers can be taken as paradigm for instance, in order to sell an item, the retailer or manufacturer must sustain a stock of that item to meet the demand for it. Due to challenges that are associated with traditional inventories which range from theft, floods, loses in profit and frauds, it is difficult to maintain perfect inventory record thereby causing discrepancies in records. Although inventories over decades have moved from manual systems to automated system, the efficiency and effectiveness of the system in cases where more than one store exist cannot be guaranteed, therefore there is a need to provide coordination and monitoring of all these stores in an intelligent manner that will

increase productivity. The focus of this paper is to develop an intelligent inventory management system to coordinate stores of an organization; this is implemented in a web – based environment.

Anigbogu et al. (2011) worked on an intelligent model for sales and inventory management. In their work, they focused on the mutual impacts of trends in inventory management and artificial intelligence after observing the need for emergence of inventory and intelligence, also the discrepancy between theory and practices of inventory, the workable approach presented still possess some restrictions because they are built on standalone systems which was not sufficient enough to capture the growing performance inventory optimization, also the database used has a limited space and cannot accommodate large data.

Chede et al. (2012) worked on Fuzzy Logic analysis based on Inventory Considering Demands and Stock Quantity on hand. Their work was based on the principle of fuzzy knowledge bases two-stage tuning. According to this principle the construction of the "inputs – output" object model can be performed in two stages, which in analogy with classical methods, can be considered as stages of structural and parametrical identification. The result shows the fuzzy logic approach model gave the most appropriate result in term of inventory as they can get the value for any input in the system to optimize the inventory. The work was only proposed and not implemented. Tanthatemee et al. (2012) worked on Fuzzy Inventory Control System for Uncertain Demand and Supply. In their work they propose a fuzzy logic control to treat the uncertainty regarding demand and supply in continuous inventory control system. MATLAB's fuzzy logic tool was used to represent the continuous inventory control system, the demand, supply, order and reorder points were described by linguistic terms with the main objectives to evaluate the order quantity and reorder point in each period taking into account the demand and supply uncertainties. . The result clearly shows that fuzzy logic control can extremely safe total inventory cost, moreover there was no shortage in any data set of tested data of the fuzzy logic control model which means that it provides customer satisfaction although demand and supply are uncertain. The work only handles uncertainties in supply and demands from a single store and not in multiple store Loizides (2013), worked on Development of SaaS Inventory Management System, he discovered the irregularities in the management of inventory of Caterpro Ltd which was associated with loss and inconsistencies in data recorded. His focus was to develop a software as a Service web and more specifically an Inventory management system, to provide a basic tool for tracking as well as monitoring sales and inventory to individuals and small scale business who cannot afford the investment of a complete dedicated inventory management systems. The system was developed using PHP Designer 8, HTML, and CSS. The outcome of the research was the development of software as a Service Inventory Management System web application for Caterpro Ltd, with functions and scripts in order to give the required functionality to the web and meet the predefined requirements set from the company. The work was not built with intelligence.

METHODS

Research Design

The study adopted the survey research design and the software development approach in this research is the classic life cycle model or the waterfall model. According to Pressman, (2012), the waterfall model is a classic model with a systematic and sequential approach to the level of system progress in all analysis, design, code, testing, and maintenance. The waterfall development model used is combined with the prototyping paradigm to help make it easier for researchers to define user needs and anticipate changing needs in the software development process. Prototyping is a technique that can be implemented in the context of other process models, although the prototyping paradigm can be used as a stand-alone process model (Pressman, 2012). Prototyping can help developers and users understand what to build first when requirements are still general. The phases in the Waterfall Model according to Sommerville's references are as follows:

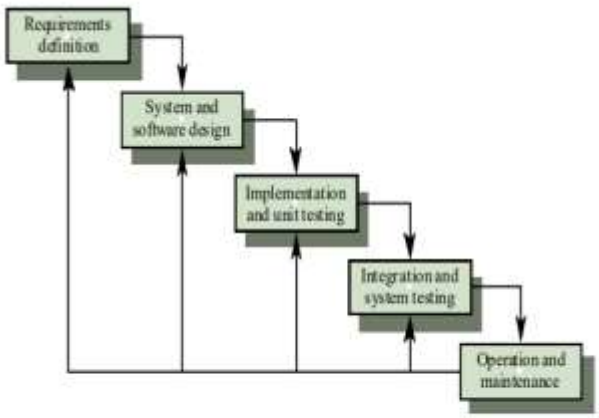


Fig 1. Waterfall Model Sommerville

Population of the study

The study used a population of 257 managing directors from selected small and medium production firms in southern part of Nigeria. The population size was obtained from corporate affairs commission in Federal Inland Revenue.

Sample and Sampling Techniques

The study used a sample population of 120 managing directors from selected firms in southern parts of Nigeria. The figure was obtained through the application of random sampling technique.

Instrument for Data Collection

The study developed an instrument titled "Design of a Web Based Inventory Management System Small and Medium Sized Production Companies**"** (DWBIMSSMSPC). The instrument is a four point rating scale consisting of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). The response options were weighed as 4, 3, 2 and 1 respectively. The instrument consists of a total of twenty items. The instrument also consists of a waterfall design model which consists of analysis, design, code, testing, and maintenance.

Validation of the Instrument

The DWBIMSSMSPC instrument was subjected to face and content validation. The instrument items were administered to an expert in a production firm in Bayelsa State for review. The expert checked the language content of the research questions. After implementing necessary corrections, the instrument was sent out to field.

Method of Data Analysis

The data obtained from the study were analyzed using simple mean and chart models. The mean was calculated across each item. A mean value of 2.0 and above was considered as adequate. While a mean item of 1.99 and below is considered as inadequate.

DATA ANALYSIS

Research Question 1

What is the implication of application of waterfall model on production, sales, purchases, and stock and employee details on web-based inventory management system for small and medium sized production companies in southern part of Nigeria?

Figure 1: Waterfall model on production, sales, purchases, and stock and employee details on web-based inventory management system for small and medium sized production companies in southern part of Nigeria

Figure 1 describes the waterfall model on production, sales, purchases, and stock and employee details on web-based inventory management system for small and medium sized production companies in southern part of Nigeria. The waterfall model was adopted to guide the web development process for a small and medium size production firm.

Research Question 2: *What is the effect of production model on web-based inventory management system for small and medium sized production companies in southern part of Nigeria?*

Table 1: Effect of production model on web-based inventory management system for small and medium sized production companies in southern part of Nigeria

S/N	ITEMS	MEAN	DECISION
1	Production model will enhance a systematic work operation in companies.	3.23	Agree
2	Production model will create a uniform standard on products in most companies.	3.56	Agree
3	Production model will improve on quality of products in most companies.	3.22	Agree
4	Production model will provide work progress history on products types in companies.	3.27	Agree

Findings obtained from the study showed that items 1, 2, 3 and 4 all agreed to the fact that production model will enhance a systematic work operation, create a uniform standard on products and improve on quality of products in companies.

Figure 2: Effect of production model design chart on web-based inventory management system for small and medium sized production companies in southern part of Nigeria

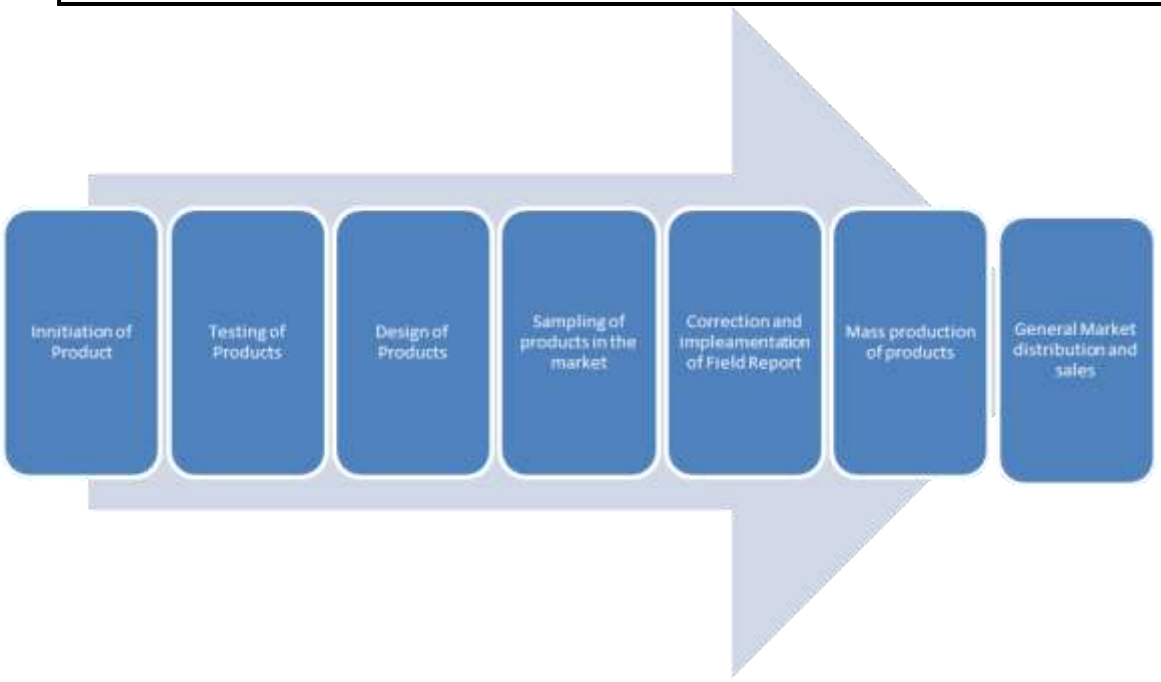


Figure 2 gives a vivid description of product production model chart in a small and medium size companies. The process commence with product initiation on the web design in inventory management system, the second phase deals with the testing of the products to ascertain its reliability. The design phase in the inventory system looks at all the factors responsible for the utilization of the products and salability. The products are finally sent to the market for feasibility study and assessment. The field report obtained from the survey on the products will be used to determine the quality of mass production. The next stage requires mass production of products in the companies. Finally, the product will be placed in the market for general sales and marketing.

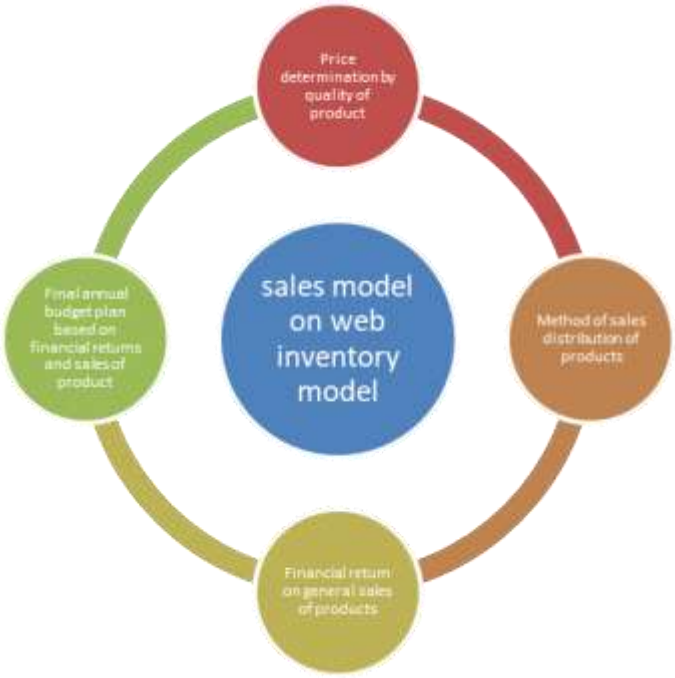
Research Question 3: *What is the effect of sales model on web-based inventory management system for small and medium sized production companies in southern part of Nigeria?*

Table 2: Effect of sales model on web-based inventory management system for small and medium sized production companies in southern part of Nigeria

S/N	ITEMS	MEAN	DECISION
5	The sales model on web-based inventory management system gives history of purchase order.	3.11	Agree
6	The sales model on web-based inventory management system gives financial record of daily purchase.	3.90	Agree
7	The sales model on web-based inventory management system gives financial budget of the company.	3.31	Agree
8	The sales model on web-based inventory management system gives annual financial history of the company.	3.12	Agree

Findings obtained from table 2 showed that item 5, 6, 7 and 8 all agreed that the sales model on web-based inventory management system gives history of purchase order, financial record of daily purchase, financial budget of the company and annual financial history of the company.

Figure 3: Effect of sales model design chart on web-based inventory management system for small and medium sized production companies in southern part of Nigeria



Sales model on web inventory model is designed to give financial record in a small and medium company. The design model chart gives price determination by quality of products, method of sales distribution of products, financial returns of general sales of products and final annual budget plan based on financial returns and sales of products.

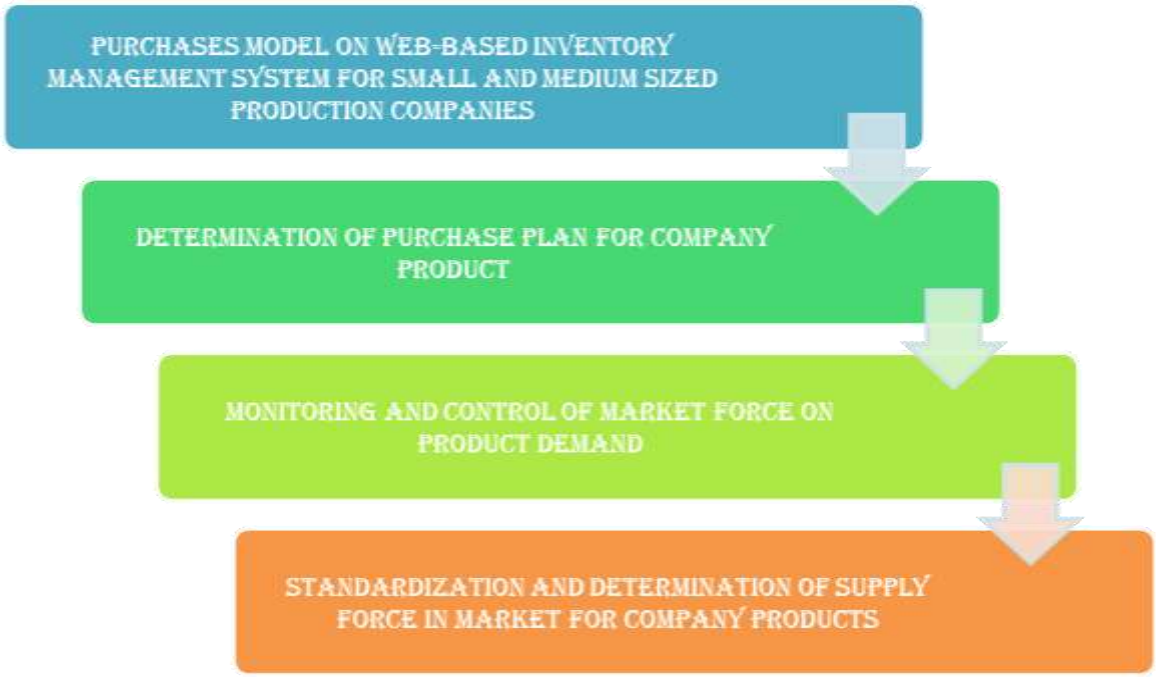
Research Question 4: *What is the effect of purchases model on web-based inventory management system for small and medium sized production companies in southern part of Nigeria?*

Table 3: Effect of purchases model on web-based inventory management system for small and medium sized production companies in southern part of Nigeria

S/N	ITEMS	MEAN	DECISION
9	Purchases model on web-based inventory management system gives record of daily consumption rate for small and medium sized production companies	3.88	Agree
10	Purchases model on web-based inventory management system gives record of supply rate for small and medium sized production companies	3.20	Agree
11	Purchases model on web-based inventory management system gives record of distribution and movement of products for small and medium sized production companies	3.09	Agree
12	Purchases model on web-based inventory management system gives record of decline in product distribution for small and medium sized production companies.	3.25	Agree

Findings obtained from table 3 showed that item 9, 10, 11 and 12 all agreed to the fact that purchases model on web-based inventory management system gives record of daily consumption rate, supply rate, distribution and movement of products and decline in product distribution for small and medium sized production companies.

Figure 4: Effect of purchases model design chart on web-based inventory management system for small and medium sized production companies in southern part of Nigeria



Findings obtained from figure 4 shows purchase model on web-based inventory management system for small and medium sized production companies. The design determines purchase plan for company products, monitors and control market force on product demand and standardize supply force in market for company products.

Research Question 5: *What is the effect of stock model on Web-based inventory management system for small and medium sized production companies in southern part of Nigeria?*

Table 4: Effect of stock model on Web-based inventory management system for small and medium sized production companies in southern part of Nigeria

S/N	ITEMS	MEAN	DECISION
13	Stock model on Web-based inventory management system keeps total records of available products in small and medium sized production companies	3.78	Agree
14	Stock model on Web-based inventory management system gives history of products sent out on daily bases for small and medium sized production companies	3.23	Agree
15	Stock model on Web-based inventory management system ascertain the capacity of production of goods in small and medium sized companies	3.45	Agree
16	Stock model on Web-based inventory management system gives information to organisation on the need to improve on production capacity.	3.78	Agree

Findings obtained from table 4 showed that items 13, 14, 15 and 16 all agreed that stock model on Web-based inventory management system keeps total records of available products, history of products sent out on daily bases, ascertain the capacity of production of goods and gives information to organization on the need to improve on production capacity in small and medium sized production companies.

Figure 5: Stock model design chart on Web-based inventory management system for small and medium sized production companies in southern part of Nigeria

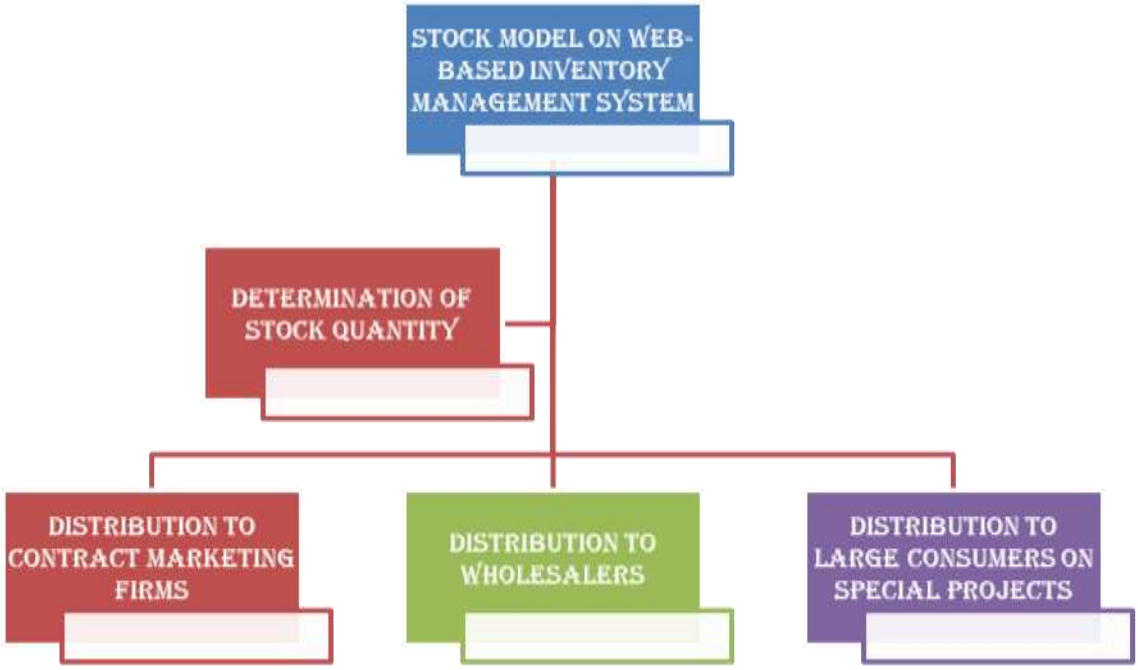


Figure 5 discussed extensively on stock model design chart on Web-based inventory management system for small and medium sized production companies. The design incorporates the determination of stock quantity in the company. It is based on the quantity that the company can provide products to contract firms, wholesalers and large consumers on special project to the firm. Based on this, that the product gets to the final consumers.

Research Question 6

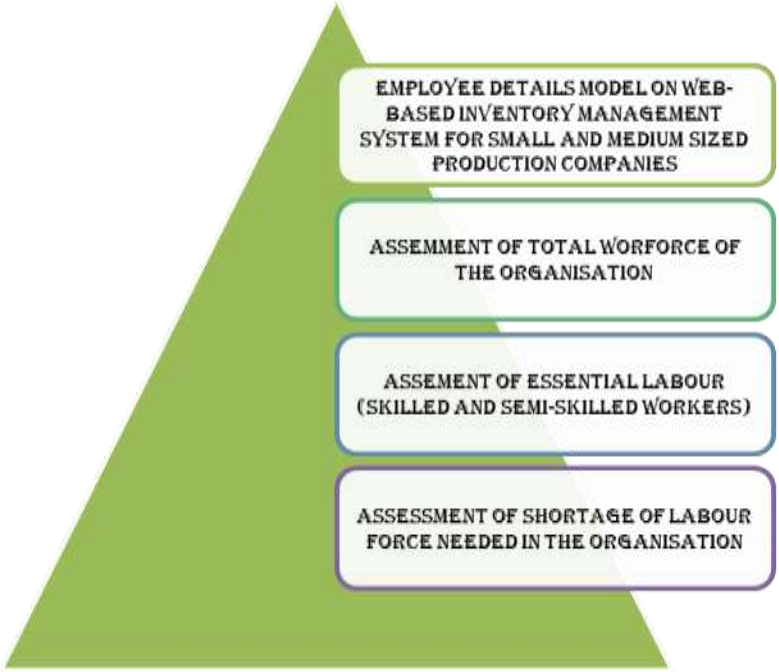
What is the impact of employee details model on Web-based inventory management system for small and medium sized production companies in southern part of Nigeria?

Table 5: Impact of employee details model on Web-based inventory management system for small and medium sized production companies in southern part of Nigeria

S/N	ITEMS	MEAN	DECISION
17	Employee details model on Web-based inventory management system gives labour requirement for small and medium sized production companies	3.25	Agree
18	Employee details model on Web-based inventory management system gives essential requirement for high skilled workers in key sector for small and medium sized production companies	3.24	Agree
19	Employee details model on Web-based inventory management system gives budget for staff management for small and medium sized production companies	3.13	Agree
20	Employee details model on Web-based inventory management system gives record for labour shortage in small and medium sized production companies	3.45	Agree

Findings obtained from table 5 showed that employee details model on Web-based inventory management system gives labor requirement, essential requirement for high skilled workers in key sector, budget for staff management and record for labor shortage in small and medium sized production companies.

Figure 6: Impact of employee details model on Web-based inventory management system for small and medium sized production companies in southern part of Nigeria



Findings obtained from figure 6 shows that employee details model on Web-based inventory management system for small and medium sized production companies. The design model shows the assessment of total workforce of the organization, assessment of essential labor needed by the company and shortage of manpower in the establishment.

DISCUSSION OF FINDINGS

Findings obtained from table 1 showed that the waterfall model was adopted to guide the web development process for a small and medium size production firm. This aid in building an electronic management system for daily running of an organization sales, production, purchases, and stock and employee details. This is in line with the view of Abisoye, Boboye, and Abisoye, (2013) that informed that inventory management system encompasses multiple operations for daily running of an organization.

The findings obtained from table 2 revealed that production model will enhance a systematic work operation, create a uniform standard on products and improve on quality of products in companies. This is in agreement with the view of Waters, (2003), that opined that inventory system place the organization in a position to deliver quality products in the market.

Findings from table 3 showed that sales model on web-based inventory management system gives history of purchase order, financial record of daily purchase, financial budget of the company and annual financial history of the company. According to the opinion of Loizides (2013), web based inventory system keeps track of purchase order history that informs the organization of its success rate.

Findings obtained from table 4 showed that purchases model on web-based inventory management system gives record of daily consumption rate, supply rate, distribution and movement of products and decline in product distribution for small and medium sized production companies. According to Karim, Mohd, and Mahbubul (2011), the web-based inventory system aid in monitoring the purchasing power of the organization.

Besides, findings obtained from table 5 showed that stock model on Web-based inventory management system keeps total records of available products, history of products sent out on daily bases, ascertain the capacity of production of goods and gives information to organization on the need to improve on production capacity in small and medium sized production companies. Fawcett, Ell ram, and Ogden, (2007), revealed that web-based inventory management system keeps records of company stocks movement.

Further findings obtained from table 6 revealed that employee details model on Web-based inventory management system gives labor requirement, essential requirement for high skilled workers in key sector, budget for staff management and record for labor shortage in small and medium sized production companies.

CONCLUSION

In all, the study showed revealed that production model will enhance a systematic work operation, create a uniform standard on products and improve on quality of products in companies. The study gives details of sales model on web-based inventory management system gives history of purchase order, financial record of daily purchase, financial budget of the company and annual financial history of the company. Further the study showed that purchases model on web-based inventory management system gives record of daily consumption rate, supply rate, distribution and movement of products and decline in product distribution for small and medium sized production companies.

Also the study revealed the stock model on Web-based inventory management system keeps total records of available products, history of products sent out on daily bases, ascertain the capacity of production of goods and gives information to organization on the need to improve on production capacity in small and medium sized production companies. Finally the study gave its perception of employee details model on Web-based inventory management system gives labor requirement, essential requirement for high skilled workers in key sector, budget for staff management and record for labor shortage in small and medium sized production companies.

RECOMMENDATIONS

Based on the findings obtained from the study, it was recommended that small and medium sized industries should develop a Web-based inventory management system to manage production, purchase order, sales system, company stock and employee details.

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