Contemporary Inventory Management Techniques:
A Conceptual Investigation

Stephen ARO-GORDON

Baze University Abuja, NIGERIA
Department of Accounting, Banking & Finance
Plot 686, Cadastral Zone C 00,
Behind National Judicial Institute, Abuja, FCT
stephen.aro-gordon@bazeuniversity.edu.ng

Jaideep GUPTE

Shri Dharmasthala Manjunatheshwara
Institute for Management Development (SDMIMD)
Mysore
jgupte@sdmimd.ac.in

Abstract

Objective: The literature acknowledges the capacity of diverse inventory management techniques to reduce material wastages while simultaneously increasing cost-efficiency, thereby helping the organization to achieve superior performance. In this regard, research so far tends to treat multiple inventory management techniques in silos; there has been relatively few significant attempts to undertake a holistic review and presentation of the several key emerging techniques available to today's practitioner, hence the motivation for the present paper, which primarily aims at referring the reader to an outline the conceptual literature on contemporary inventory management practice. **Data:** The research design is exploratory so as to guide the development of a conceptual framework for more detailed empirical study as the next stage of the research project. Consequently, relevant data were sourced primarily from a survey of relevant literature and from the experience of authors as management teachers and practitioners. **Analysis:** Content analysis technique was primarily adopted for the study. **Results:** The study, among other findings, identifies and presents twelve emerging pivotal inventory management techniques, revisiting their essence and basic features respectively for robust inventory management, especially in the emerging business environment where cost-management has become a key strategy to keep ahead of keen competition. **Conclusions:** The adoption of an appropriate combination of emerging inventory management approaches can improve corporate service delivery in terms ensuring steady flow of materials while also minimizing the attendant carrying/handling costs. Hence, the imperative for continuous training and re-training of staff in order to enhance professionalism and productivity of store managers, particularly with regards to technology-aided inventory control system, was

stressed. The contribution was not exhaustive; as competition becomes keener, innovative practices will continue to come into the light, hence some scope for future research are also indicated at the end of the paper.

Keywords: *Customer satisfaction, Cost-effectiveness, Supply chain management, Service delivery, Software applications, Stock levels, Warehouses and stores*

JEL Codes: *D04, 22, 46, F61, L21*

Introduction

With the ever surging demand in products and services across several economic sectors, more and more management practices have evolved to ease the process of effective and efficient service delivery to customers and other organizational stakeholders. Inventory management is increasingly regarded as a tool for optimal use resources and for achieving overall operational efficiency across industries (Akindipe, 2014). However, universality of inventory management challenges such as delays, stock-outs, and loss of production time is widely recognized and researchers continue to seek optimal solutions across the globe. Highly efficient delivery systems and supply chain management have thus become imperative, particularly for large organizations, to ensure smooth, efficient and quality delivery of products and services. In the emerging environment when customer satisfaction and service have become a prime reason for an organization to stand apart from competition, the need for effective inventory management is largely seen more as a requirement than just a trend. All organizations have some level of inventory which must be properly administered because they represent money. High operational costs provide strong motivation for discerning organizations to have greater stock management control. Various organizations have employed the basic inventory management techniques or inventory control methods to keep their inventory costs in check. Inventory management has thus become a crucial part of supply chain management. This contribution is designed to provide further insights into the understanding of stock control measures, thereby enhancing the managers' contribution to the continuity and efficient productivity of their organisation.

Problem Statement

While there are numerous studies in inventory management with diverse perspectives or emphasis, comprehensive materials that attempt to integrate the potential impact-areas of emerging inventory management techniques (IMTs) in today's increasingly complex society, are presently sparse. Research to date is diversified across many aspects that are basically directed at proffering optimal solutions to such stock control problems, particularly timely delivery of needed materials for seamless delivery of goods, products, and services. More sophisticated mathematical tools and computational algorithms are constantly being discovered or proposed while traditional analytical techniques are being applied in new ways. Consequently, a wide variety of inventory management opportunities are opening up to modern organisations but a holistic assessment of the impact of deployable tools appears to be currently lacking, particularly in an emerging economy like Nigeria.

There are various perspectives to the problem of inventory control in developing economies like Nigeria. Developing economies like Nigeria are currently faced with the challenges of maintaining socio-economic progress amidst unprecedented plunge in crude oil prices and tightening of global financial conditions that had led to sharply reduced export earnings and government revenues. It is therefore

imperative to use inventory management techniques to complement on-going campaigns to achieve operational efficiency, sealing leakages in revenue and wastes in expenditure, especially unnecessary inventories. Notably, the key challenge inventory control in the country has been attributable to the failure, on the part of the top management officials, to give a deserved attention to the function of warehouses and stores as well as their inability to employ the services of as well qualified stores officers to take charge of inventory supervision and management. There is a mistaken impression that inventory operation is a non-strategic function. Besides, there is the related issue of the dearth of storage facilities and the habit of stores procedure violation by various cadre personnel in many organisations, whether private or public (Yusuf, 2003). Thus, the practice of inventory management in Nigeria today requires significant improvement, given the poor level of computerization, non-determination of stock level, the involvement of illiterates and unskilled personnel in the management of inventory (Akindipe, 2014), but, some questions are apposite: What are the various emerging inventory management techniques (IMTs) and their comparative efficiency / utility? What key variables affect the adoption of inventory management techniques? What are the key benefits of a robust inventory management policy? What are the likely inventory management policy and research implications from the above enquiries? It is therefore hoped that this paper will go some way in sensitizing the reader to the importance and strategic role of inventory management for achieving superior performance, and the imperatives for building the requisite knowledge and capacity in the field.

Significance of the Study

The need for the present study can be viewed from three perspectives. First, the results from this study are expected to educate the reader on the benefits of robust inventory management policy to modern organizations. While the literature is awash with siloes of inventory control techniques in the field, to the best of our knowledge, sparse research to date has been focused on the relative impact of the many inventory management tools (IMTs) that dot the market, research, and learning space today. Putting the IMTs together as attempted in this paper may provide some starting point towards integrated thinking as a way of dealing with complexities in modern inventory control. Thus, this paper is expected to ease development of comprehensive and sustainable inventory management policy which is a tedious process for many organizations (Achebo & Omoregie, 2013; Seungjiae *et al,* 2015; Mei *et al,* 2015).

Secondly, enhanced awareness of emerging IMTs in a more systematic or integrated manner is expected to result in superior organizational performance through wider measurement perspectives and more informed recognition of risk and uncertainty in inventory management. Beneficiaries across the sectors, operations managers, senior management, state actors, and other stakeholders, can take advantage of the digital technological tools to build advanced inventory solutions faster than the competition, and to complement efforts to significantly improve operational efficiency across economic sectors, public or private.

Thirdly, this exploratory paper could also serve as a resource base to students, scholars and researchers interested in carrying out further, more precise research in inventory management, in terms of increasing researchers' familiarity with the changing scope of inventory management, and providing a systematic guide/framework towards successful implementation of practice-oriented, evidence-based research agenda in inventory management.

Organization and structure of the paper

For ease of exposition, the paper is structured into five sections, with this section as the introduction. Section two reviews the concerning literature focusing on the broad conceptual and empirical

appreciation of inventory management. The research methodology adopted for the study is briefly explained in Section three. Section four presents the overall results of the study, while Section five concludes the paper and provides a general scope for further research.

Review of Literature

Conceptual Framework

The essence of inventory management is to augment business operations so as to ensure effective flow of goods, products, and services (Chalotra, 2013). In this context, 'inventory' is the aggregate list of items; a quantity of goods in stock or stock of the product which an organization is producing for sale and the components that make the sale. 'Stock' consists of a wide range of goods or materials – stationery, office equipment, plant, machinery, consumables, etc. available for use or sale. The element of 'management' or 'control' is thought to be pivotal in this context because any 'control' is deemed a process by which events are made to conform to a set plan. The term 'control' has familiar synonyms such as management, overseeing, administering, conducting, planning, superintending, guiding, organising, supervising, regulating, supervising, all performed so as to prevent "helplessness", "neglect", "weakness", or "mismanagement" in the system. Thus, inventory management is the supervision of supply, storage and accessibility of items in order to ensure an adequate supply without excessive oversupply. Stock Management is often associated with understanding the inventory mix of an organisation and the different levels of demand on that inventory, depending on diverse external and internal factors that can exert demand for materials in a given period (Adebayo *et al,* 2012; Enikanselu, 2008; Yusuf, 2003; Inventory, 2014; *Oxford Advanced Learner's Dictionary*, 2005).

In private business, any item of property held in stock by a firm, including finished goods ready for sale, goods in the process of production, raw materials, and goods that will be consumed in the process of producing goods and services to be sold. Inventories normally appear on a company's balance sheet as an asset. Inventory turnover, which indicates the rate at which goods are converted into cash, is a key factor in appraising a firm's financial condition. Fluctuation in the ratio of inventory to sales is known as inventory investment or disinvestment. The monetary value of the inventory also appears on the income statement in determining the cost of the goods sold. The cost of goods sold is determined by adding the inventory on hand at the beginning of the period to the cost of purchasing and producing goods/services during the period and subtracting from this total the inventory on hand at the end of the period. In many organizations' financial statements, inventories are usually priced at cost or at market value, whichever is lower. The purchase costs of the materials usually fluctuate during the year which makes it necessary to determine which cost-flow assumption is to be used for inventory management purposes.

Nature of Inventory Management

Some notable issues within the scope of modern inventory management are illustrated in table 1.
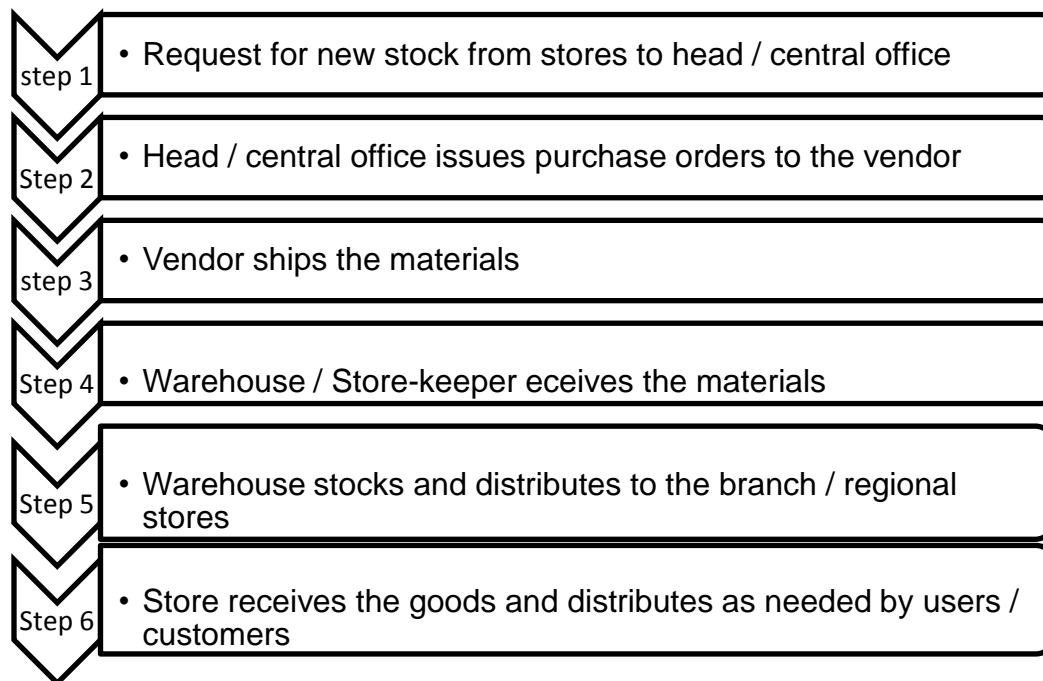
Table 1

Scope of modern inventory management

Key Questions in Inventory Management	Description
Where?	Supply availability, location of stores and associated facilities, logistics
What?	Users' needs, usage/frequency level
When?	Planning, efficiency
At what cost?	Budget, stock holding/warehousing and handling cost dynamics

Source: Developed by the authors (2015)

A Supply Chain Model of Inventory Control

Inventory control in a typical supply chain follows the sequence shown in Fig. 1.

Fig. 1: A supply chain model of inventory control

step 1	• Request for new stock from stores to head / central office
Step 2	• Head / central office issues purchase orders to the vendor
step 3	• Vendor ships the materials
Step 4	• Warehouse / Store-keeper eceives the materials
Step 5	• Warehouse stocks and distributes to the branch / regional stores
Step 6	• Store receives the goods and distributes as needed by users / customers

Source: Developed by the authors (2015)

The management of the inventory in the supply chain involves effectively and efficiently controlling not only of the *physical* quantities, but also the *costing* of the goods as it flows through the supply chain. There are a number of methods are in general use: Weighted Average Cost; First-in, First-out (FIFO) which assigns the cost of the last units purchased to the inventory and the cost of the first units purchased to the goods that were sold; and Last-in, First-out (LIFO) in which the reverse pattern is

followed. Other approaches include **LPP** (Last Purchase Price) method, BNM (Bottle Neck Method), but more detailed description of these techniques are beyond the scope of our present discussion.

Survey of Related Empirical Studies

A noticeable trend in inventory management research is the increasing application of mathematical models / computer technology, raising awareness on the economic benefits of robust inventory management, but significant research directed at comprehensively characterizing inventory management techniques (IMTs) has been rather sparse, despite its importance for sustainable financial management.

Zanoni *et al* (2014) used mathematical modelling to show that inventory management system performed better when operated under Vendor-Managed Inventory (VMI) and showed the potential of reducing the traditional inventory holding costs. Adoga and Valverde (2014) analyzed the warehouse and inventory management system in Shell Petroleum Development Company (SPDC) in Nigeria and demonstrated the utility of ICT as a veritable value-added tool in inventory management practice. Ali *et al* (2013) also tried to justify the use of modified Wagner-Whitin (WW) logistic-based approach to managing inventory of perishable products.

Kurano *et al* (2014) used statistical process monitoring tools with inventory levels and stock-outs as key metrics in achieving proactive inventory policy intervention in the context of cooperative supply chains. Their results showed the possibility of detecting out-of-control supplier signals beforehand and significantly reducing stock-outs through dynamic adjustments of inventory levels. Similarly, Achebo and Omoregie (2013) deployed probabilistic model to analyze secondary data over 2002 – 2012 of an indigenous towards developing inventory management policy (ordering and reordering levels) of electrodes packets used for welding oil and gas pipelines. Researchers have also explored other mathematical approaches such as Fault-Tree analysis and convexity to optimise inventory demand in aerospace manufacturing (Cheng *et al,* 2013), and bike-sharing (Raviv and Kolka, 2013).

This is the age of computers, and inventory management researchers have also explored the use of technology to optimize stores management. Thus, contemporary research has stressed the need to support inventory management system with specific software especially in big enterprises (Suvittawat, 2015; Lin & Song, 2015).

As earlier noted, there has also been renewed interest by researchers to improve on the awareness of the economic benefits of robust inventory management. These studies suggest the need for modern organizations to do away with judgemental / qualitative approaches, in favour of quantitative methods, given today's increasingly complex and unpredictable environment. In this regard, Lopez *et al* (2013) applied quantitative demand forecasting methods along with two classic inventory models, namely ABC and EOQ, to demonstrate significant (up to 44 per cent) inventory cost reduction and improved customer service levels at a company in Mexico. Also, in the context of ABC inventory analytical tool, Hatefi *et al* (2014), made an attempt to use modified linear optimization method that improved the discriminating power among inventory items beyond what is obtainable by conventional approaches. Similarly, Seungjiae *et al* (2015) used financial statement data to establish the nexus between inventory management and firm profitability among U. S. manufacturing firms. The researchers found that a lower ratio of inventory to sales for a firm is associated with higher profit margin for the firm, but the specific IMTs that helped the enterprises to achieve profitability were not the focus of the study. In similar vein, Mei *et al* (2015) used the inventory management system to highlight the effectiveness (or ineffectiveness) of internal control of an entire organisation.

Relatedly, in the Nigerian context, Takum (2014) used a combined case study / survey methods to provide some useful insights into how Nigerian manufacturers optimized inventory management in terms of lead-time delivery and reduced stock-outs of products, goods and materials. Chalotra (2013) used similar approach to evaluate the role of inventory management in fostering entrepreneurship in district Udhampur, in Jammu and Kashmir. In both studies, the results suggest that robust inventory management leads to economy, efficiency, and cost-reduction, among other benefits.

Research Gap

What is clear from the foregoing literature review is the existence of a multiplicity of IMTs across industries and jurisdictions, but there is sparse work on comprehensive assessment of IMTs and their respective determinants in modern organizations. The multifarious approaches to inventory management and inadequacy of the current analytical frameworks or approaches to comprehensively characterize it constitute the motivation for the present research study in the Nigerian and Indian contexts. The paper therefore adopts a more holistic and developmental approach to inventory management practice and education, and, in this respect, the present study found some inspiration in similar recent multi-option inventory solution works such as Ranganatham (2014), Suvittawat (2015), Lin and Song (2015). Thus, this contribution is expected to ease development of comprehensive inventory management policy which is a tedious process for many organizations (Achebo & Omoregie, 2013).

Objectives

Thus, the main objective of this study is to explore the development of effective integrated inventory management policy with emphasis on applicability in emerging market economies. The specific objectives are:

1. To identify and summarize the various inventory management techniques (IMTs) as a guide to further empirical research in the field.

2. To identify possible determinants of inventory management techniques.

3. To identify the major benefits of a robust inventory management policy, using the case of Nigeria Customs Service (NCS) as an illustration.

The paper is also expected to make some useful commentaries on the likely inventory management policy and research implications from the study.

Research Questions

Based the preliminary literature survey on the subject-matter, the following research questions were raised specifically for the purpose of the study:

1) What are the various emerging inventory management techniques (IMTs) and their comparative efficiency / utility?

2) What are the possible determinants of inventory management techniques?

3) What are the key benefits of a robust inventory management policy?

Methodology

Methodology of the study consists of exploratory survey of relevant literature and analysis of a case organization for enhancement of knowledge on the subject-matter (Kothari & Garg, 2014). Online and offline sources were searched for academic papers, conference proceedings, and websites and books that dealt with various inventory management techniques (IMTs). Scholars and researchers mainly in Nigeria and India were consulted to obtain contemporary perspectives on the subject. Guided by the study objectives, the focus was to identify the contemporary IMTs for enhanced comprehension of the subject-matter. Additionally, further helpful insights were obtained from one of the author's participation at Nigerian Customs Service Training programme on effective store-keeping techniques held at the Public Service Institute of Nigeria Abuja, on 19th May 2015, hence, given the limitations of time, manpower, money, and other logistical issues, the ease of including the Nigeria Customs Service (NCS) as an illustration of the utility of inventory management in large-sized public organizations like NCS. The present study emphasizes the public service context because, in the final analysis, it is the managers and employees of the civil service who are responsible for ensuring effective implementation of government programmes and policies that affect the citizenry including the private sector (Olaopa, 2015).

Discussion of Results

Research question one: On identification and summary of contemporary inventory management techniques (IMTs)

Based on the analysis of the related literature (Scott, 2015; Chand, 2015; Adebayo *et al,* 2012; Joseph, 2014), some of the widely used contemporary approaches to inventory management system are:

1. Setting up and monitoring various stock levels

2. Preparation of accurate inventory budgets

3. Automated inventory system

4. Establishing proper purchase procedures

5. Inventory Turnover Ratio

6. ABC inventory classification technique

7. Just-In-Time inventory management technique

8. Bulk-purchase approach

9. Vendor-Managed Inventory (VMI)

10. Out-sourcing inventory control personnel

11. Lead-time analysis

12. Software applications and tracking system

Setting Up and Monitoring Various Stock Levels

Perhaps, the first approach is to establish a system for monitoring various levels of inventory so as to ensure optimality, utmost effectiveness, and efficiency. Having high levels of inventory adds to expenses and increases overhead costs, hence, inventory levels and stock-outs are critical metrics for development of proactive inventory management policy in any organization (Kurano *et al,* 2014; Achebo & Omoregie, 2013).

An effective way to manage inventory is to determine the inventory demands of the business. Seasonal inventory should be limited and there should be a cut-back on dormant or slow-moving inventory. Overall, it is important for the managers to avoid over-stocking/under-stocking of materials by deciding on various stock levels. Table 2 highlights some of the quantitative techniques and their respective roles in modern inventory management.

Table 2

Determining stock levels for effective inventory management

S/No	Stock Level	Description	Rationale and Formula
1	Re-ordering level (ROL)/ordering point/ordering limit	The point at which order for supply of material should be made	This is a function of maximum consumption rate (MCR) and order lead time (OLT), i.e.. $ROL = MCR . OLT$. OLT is the period between placing an order and receiving the ordered item.
2	Maximum Level/Maximum Point/Maximum Limit (MAL)	The level above which stock should never reach	This avoids sinking capital in inventories, wastages from deterioration and obsolescence of materials, extra overheads, etc. This is a function of Minimum Level of Consumption (MLC) and ROL, i.e. $MAL = MLC . ROL$
3	Minimum Level of Consumption (MLC)	This represents the lowest quantity of a particular material below which stock should not be allowed to fall.	Minimum level of inventories should be maintained always so as not to create bottle-neck. MLC is a function of three variables, namely, ROL, (NRC) Normal Rate of Consumption, and OLT, i.e. $MLC = ROL - (NRC . OLT)$
4	Average Stock Level (ASL)	The average of MAL and MLC	$ASL = \dfrac{MAL + MLC}{2}$
5	Danger Level (DL)	The level below which the stock should under no	Danger level is slightly below the MLC. This is a function of ASL and

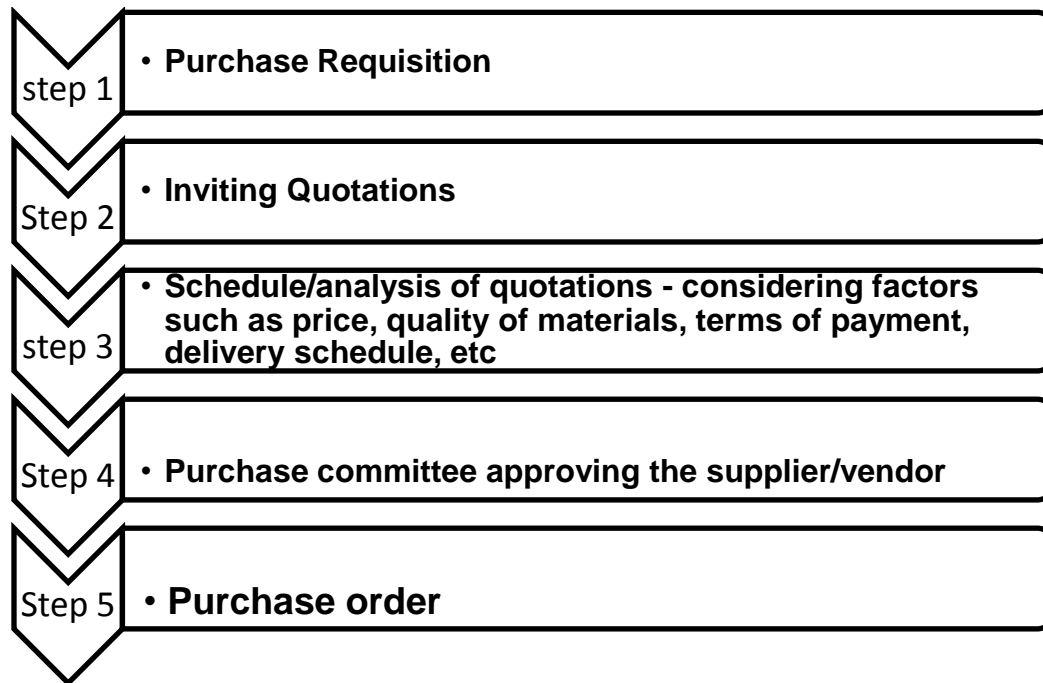|		circumstances be allowed to fall.	EST (Emergency Supply Time), i.e. $$DL = ASL \,.\, EST$$
6	Economic Order Quantity (EOQ)	This seeks to balance quantity of purchase at a time (Q), annual requirement/demand quantity of an item (A), fixed cost per purchase order (S), and annual holding cost per unit (I).	$Q = \sqrt{\frac{2*A*S}{I}}$

Preparation of Accurate Inventory Budgets

Having established a proper monitoring / inventory control system, the next thing is to prepare realistic inventory budgets. Preparation of purchase budget is the normal practice of organisations that have sizable inventory requirement. A purchase budget is often prepared bearing in mind the anticipated sales/revenue targets of the constituent Departments/Units of the organisation. Actual performances are periodically compared with budgeted figures as a good framework for controlling purchase of materials. Bad forecasts can lead to organisations having to store huge amount of inventory due to unexpected decline in demand. This can lead to high carrying costs. Classification of inventory into 'predictable' and 'unpredictable' materials can be helpful, so that sound inventory can be maintained for the predictable portion of the inventory. Happily, there are numerous interactive accounting software packages to assist the inventory manager in automating the function.

Automated Inventory System

This approach provides a rigid control over the inventory at all times. The physical stock can be regularly verified with the stock (quantity) records maintained in the stores and valuation records of the cost office. Notwithstanding, the existence of automated inventory system, the imperative for establishing proper procurement procedure as part of inventory management policy cannot be overemphasised.

Fig. 2: Robust inventory purchase procedures

step	
step 1	• **Purchase Requisition**
Step 2	• **Inviting Quotations**
step 3	• **Schedule/analysis of quotations - considering factors such as price, quality of materials, terms of payment, delivery schedule, etc**
Step 4	• **Purchase committee approving the supplier/vendor**
Step 5	• **Purchase order**

Establishing Proper Purchase Procedures

A proper purchase procedure is imperative to ensure the appropriate inventory control. The procedure will vary from organization to organization, but the steps in Fig. 2 are typical.

Beyond setting up proper purchase system, the inventory manager needs to monitor the usage or demand for he items in terms of conducting regular inventory turnover and ABC analyses, and these two approaches are explained briefly below.

Inventory Turnover Ratio (ITR)

This is an inventory/cost minimization approach. ITR is usually computed as follows:

$$ITR = \frac{Cost\ of\ materials\ consumed}{Average\ inventory\ held\ during\ the\ period}$$

The comparison of various inventory turnover ratios at various periods with those of previous years may indicate four types of inventories shown in table 3.

Table 3

Inventory Turnover Ratio (ITR): Four types of inventories

S/NO	INVENTORY TYPE	DESCRIPTION/IMPLICATION
1	Slow-moving inventories (SMIs)	These have very low ITR. The manager should take all necessary steps to keep such inventories at the minimum levels.
2	Dormant inventories (DIs)	These inventories have zero demand. Firm decision has to be taken whether to retain or scrap them.
3	Obsolete inventories (OIs)	Similar to the dormant inventories, these inventories are probably no longer in demand due to their becoming out of fashion.
4	Fast-moving inventories (FMIs)	These inventories are in hot demand and any shortage can create serious bottleneck in the organization's operations.

Obviously, a good ITR analysis would help the enterprise to closely monitor the FMIs, while minimizing the wastages that could be associated with high level of SMIs, DIs and OIs.

ABC Inventory Classification Technique

The ABC (Always Better Control) is a well-known IMT that large firms adopt to have an efficient control on a huge amount of inventory items (Hatefi, *et al,* 2014. The technique aims at engendering effective control of materials by classifying the inventory into three groups, A, B, and Q, according to their respective values as shown in Table 4.

Table 4

ABC analysis - Three classes of inventories

S/NO	Inventory Group	Description/Implication
1	Group A	This Group constitutes the costly items which may be only 10-20% of the inventory but account for up to 50% of the total value of the stocked items.
2	Group B	This Group comprises items which constitute 20-30% of the stored items and represent about 30% of the total value of the total inventory.
3	Group Q	This residual Group covers about 70-80% of the stocked items and valued at about 20% of the total inventory.

As mentioned earlier, research has made effort to use mathematical models such as linear optimization approach to improve on discriminating power among inventory items (Hatefi *et al*, 2014).

Just-In-Time (JIT) Inventory Management Technique

As the name implies, JIT is a model that attempts to replenish inventory for organizations just when the inventory is required. It will be the preferred method for very expensive inventory items, that is, items with relatively higher purchase price, holding costs or ordering cost, but low levels of demand. The model attempts to avoid excess inventory and its associated costs. As a result, organizations receive inventory only when the need for more stock is approaching. For JIT approach to succeed, a crucial requirement is to ensure timely delivery by the vendor. This is to avoid expensive and irreparable business downtimes occasioned by any delay in inventory delivery, a major operational management issue among many Nigerian manufacturers (Takim, 2014).

Just-in-time, as an evolving area in scheduling, aims to improve return on investment by reducing in-process inventory and associated carrying costs. As a production scheduling strategy, JIT is indicated in single and parallel machines environments while it is beginning to be considered in the flow shop machine environment (Adamu *et al*, 2014).

Bulk-Purchasing

This is an age-old approach to managing inventories; the method relies on the principle that if you purchase goods in bulk, you are able to procure them in much lower costs. The method can only be employed if management is sure that the item in question is a fast-moving group of inventory. If a material is in high demand then you should consider adopting this inventory management technique which can result in significant savings. However, the flipside is that bulk-purchasing could take much time, compared to smaller lots that need less storage space and manufacturing/delivery time. More than 50 percent of the current assets of a manufacturing enterprises and inventories usually form a sizable portion of most organizations' assets / working capital (Ranganatham, 2014; Takim, 2014), hence, bulk-purchasing is an attractive inventory management solution.

Vendor-Managed Inventory (VMI)

Under the VMI technique, significant gains can be made through transparent collaboration with credible vendors of critical inventories, especially in large-sized production management. VMI enables the vendor in a vendor/customer relationship to plan, monitor, and control inventory for their customers, with the vendor taking responsibility for managing the inventory within specific levels previously agreed upon, while the customer concentrates on improving demand accuracy (Zanoni *et al,* 2014; Kannan *et al,* 2013). The customer-organization relinquishes the order-making responsibilities in exchange for timely inventory replenishment that ultimately works towards increasing overall capacity planning and institutional efficiency. Mathematical models can be developed such that the total cost of the inventory management system (vendor's and buyer / customer costs) is minimized.

Out-Sourcing Inventory Control Personnel

Some organizations hire external inventory consultants to develop and manage internal inventory systems. Such inventory management specialists are responsible for maintaining accuracy, cycle counting, shipping and receiving, and managing order-picking operations. Dedicated inventory specialists can be partnered with to manage all inventory items that are on hand and in transit. They can

also perform adjustments, manage returns, validate delivery and implement inventory reporting strategies.

Lead-Time Analysis

Another very helpful way to managing inventory is to establish lead-time reports to understand how long it takes to replenish your inventory. Lead time is the amount of time it takes to reorder inventory. Suppliers deliver products at varying times after an order is placed. Some vendors / suppliers are notorious for late-delivery of inventories; such vendors ought to be sanctioned or delisted for optimal inventory management and overall cost-effectiveness.

Software Applications and Tracking System

Research results indicate that implementation of inventory management software applications has become a valuable tool for organizations looking to upgrade stock control system. While there may be a variety of such capabilities of applications today (Akindipe, 2014; Adoga & Valverde, 2014), a sizable number of inventory management applications give organizations a structured method of accounting for all incoming and outgoing flow of inventory within their facilities. Organizations save a significant amount in costs associated with manual inventory counts, administrative errors and reductions in inventory stock-outs. Inventory management software can also be customized to fit your individual needs. Additionally, many facilities develop a tracking system, ranging from spread-sheets to computer programs, to manage inventory and monitor turnaround times. They provide complete inventory control allowing inventory managers to do proper inventory record-keeping, material requirement planning (MRP) of getting the right item to the right place at the right time, inventory decision-making process such as anticipating workloads, determining order quantity and stock levels, organizing item levels and taking cycle counts in distribution centres or stores.

Research Question Two: On Determinants of Inventory Management Techniques

Determinants of inventory management techniques (IMTs) are variables that affect the choice of a particular IMT or a combination thereof. The results of the study indicate that the choice of IMTs will vary according to the size of the enterprise, large or small, and, in this context, the following deciding factors have been documented in the literature (Suvittawat, 2015):

I.   Space utilization – the big organizations would possibly have more inventories and also have the advantages of space utilization than small enterprises.

II.   Product sample / features/ differentiation

III.   Effectiveness of inventory management system

IV.   Inventory management objective

V.   Effectiveness of inventory picking system

VI.   Inventory cost-reduction strategy

VII. Problem recurrence

VIII. Effectiveness of IT system / specific software for inventory management.

Research Question Three: On the Major Benefits of A Robust Inventory Management Policy.

The research results (notably, Chalotra, 2013; Lopez *et al,* 2013) indicate that the specific prescribed benefits of a proper inventory management practice should include:

- Enhanced economy, efficiency, and overall better service level;

- Effective flow of goods and services;

- Enhanced profitability;

- Facilitated competitive ability;

- Increased service optimization;

- Enhanced market diversification;

- Paved the way for cost-reduction – lack of effective inventory management culture has been documented to propagate material wastage while simultaneously lowering cost-effectiveness;

- Improved customer demand planning;

- Simplified production and procurement planning; and

- Lower-level of uncertainty.

Importance and Scope of Inventory Management: The Case Of Nigeria Customs Service (NCS)

Part of the aims of this study is to make observations and suggestions for improving inventory management practices and research. In order to appreciate the value of the various contemporary inventory management techniques enumerated above, perhaps it is crucial to know why inventory control is important. Any organization needs a set of assets including inventory to actualize its mandate, goals, and objectives, in deed its existence or survival. Consequently, taking the Nigeria Customs Services (NCS) as a reference point, perhaps the importance of inventory management should be considered against the backdrop of the agency's mandate, namely: Intercepting contraband such as illegal drugs and weapons; checking travellers and their baggage, cargo and mail; assess and collect Customs duties and other taxes on goods and services; enforcing import and export restriction and prohibitions; collect accurate import and export data for economic statistical usage and planning; as the country's gatekeepers, using intelligence and risk assessment to target physical checks on containers, vessels or travellers; conducting investigations and audits, and prosecute offenders; protecting businesses against illegal trade malpractices; and working closely with other government agencies in accomplishing the collective aim of developing Nigeria (www.customs.gov.ng/Publications).

Clearly, the NCS would require steady and efficient supply of materials, tools, and goods needed to deliver sustainably on its above-stated mission. Thus, in this context, Inventory Control is important for the following reasons, among others:

First, robust stock control systems would ensure that shelves/stores are appropriately stocked with the working tools and materials that operatives need in order to do their work effectively. If inventory management policy or culture allows too much stock (as in excessive inventory) per time, it ties up the organization's money, which might be better spent on reducing running costs while boosting revenue flow. A mismanaged inventory can result in an unnecessary increase in the working capital. The excess funds could have been fruitfully directed to fuel the enterprise's growth initiatives, improve working environment, or research and development efforts.

Second, effective inventory control is associated with low storage costs, thereby increasing the organization's productivity level. Storage space is expensive (can be as high as ₦25,000 per sq.m./p.a. in Abuja); if organizations are able to manage their inventory properly, this would reduce the amount of materials that they need to store, which means that they would require less storage space, which would in turn lead to low warehousing rental costs.

Third, it can help to satisfy internal and external customers by providing them with the materials and services they need expeditiously. Weak inventory management leads to slower / availability and inadequacy of goods / services and longer delivery time. This could negatively affect staff morale and increase frequency of customer complaints. Hence, there is a positive relationship between customer satisfaction and strong inventory management system.

Fourth, some materials that are inventoried over a long period may spoil. This leads to unnecessary organizational overheads. Therefore, research-driven, robust inventory management can help greatly to reduce those costs.

Lastly, in a situation where you have inventories scattered in various places (i.e. multiple inventories), a proper system will be needed to efficiently and effectively manage those inventories on the basis of demand and supply.

Summary of Findings

I.   With recurring emphasis on automation of inventory management system, the present study notes twelve broad viable inventory management techniques to meet the challenges encountered in the operations of warehouses and stores across industries.

II. The choice of IMTs will vary according the size of the organization, with cost efficiency and space availability as key considerations.

III. Sustained profitability, cost-reduction, competitive ability, and enhanced capacity-utilization, and market diversification prospects are among the several key benefits of a robust inventory management policy.

Conclusion

In this paper, we made an attempt to investigate and summarize contemporary techniques for inventory management as a key area of concern in today's corporate administration. Twelve broad viable options

to meet the challenges encountered in the operations of warehouses and stores across industries, and, in this respect, the present study is a veritable addition to similar multi-option inventory solution works such as Ranganatham (2014), Lin and Song (2015), and Suvittawat (2015). Additionally, the results of the analysis based on related literature indicate that a proper inventory control system is closely associated with low storage costs, cost-reduction and timely delivery of requisite goods, products, materials and services to customers and stakeholders, thereby enhancing sustained profitability, competitive ability, and enhanced market diversification prospects. In the present environment of keener competition and revenue pressure, the organization does not have any other option than to manage resources more effectively to survive and to stay financially afloat. The adoption of an appropriate combination of some of these approaches can improve service delivery in terms ensuring steady flow of materials while also minimizing the attendant carrying/handling costs. The discussion was not exhaustive; as organizations become more competitive, more and more inventory management practices will continue to come into the light.

To that end, against the backdrop of tightening global financial conditions, the following suggestions can be made for improving inventory management practices in developing economies:

I.   Do not maintain too much inventory in your warehouse. Make use of accurate forecasting methods to help you efficiently procure the goods in a timely manner before demand escalates.

II. Make sure that you track your inventory items properly. Using bar codes and inventory tracking software can help. Having the proper software with data backup modules can also facilitate efficient manage inventory efficiently.

III. Order products based on priorities. Fast-moving products should be ordered first rather than randomly storing products into your inventory, thereby making your organization to incur huge storage costs unnecessarily.

IV. You should always have a backup plan in case of system failures. In this digital age, you should backup your inventory data into remote systems (cloud computing) in case you experience accidental loss of inventory data. A good backup plan can go a long way in making your inventory control a more efficient system.

V.   Process review: Organizations should explore the prospects of renegotiating terms and lower prices with inventory vendors, but mindful of maintaining product quality.

VI. Capacity-building: Promotion of inventory management culture should form part of the renewed campaigns to plug leakages, loopholes and wastages in public finance. Additionally, continuous training and re-training of staff in order to enhance professionalism and productivity should continue to attract senior management attention, particularly with regards to cost-effective computerised inventory control system.

Scope for Future Research

I.   To complement the present results and improve solutions locally, empirical analysis with numerical examples of real-world application of inventory management techniques among public and private enterprises should continue to be an interesting area of research, especially in the developing economies of Africa and Asia.

II.   Also, other emerging inventory management approaches such as Winters' Method, Q,R, (continuous review) policy, and Fault Tree Analysis, may need to be elaborated upon at the next stage of the research.

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