

# The Impact of Inventory Management Practices on the Performance of Ghanaian Technical Universities: A Quantitative Approach

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## ABSTRACT

This study investigated the effect of inventory management factors on technical universities. These factors were made up of accuracy, capacity, investment, shrinkage, performance and turnover. Data was collected by the use of likert scale questionnaire from 399 various units in the technical universities in Ghana. The Smart PLS was employed to analyze the data. The findings of the study showed the effect of inventory accuracy, capacity, investment, shrinkage and turnover on the performance. However, the inventory investment effect on capacity and inventory turnover on capacity affected the inventory management. Inventory shrinkage has the potential to burden the inventory system through both increased holding cost and ordering cost. This shows that the inventory manager should pay more attention to the cheap items in order to reduce loss associated with inventory cost.

Key Words: Inventory management, Smart PLS, Practices, Technical universities and Ghana

## INTRODUCTION

Inventory management and control is fundamental for institutions and organizations as they strive to reduce costs and operate efficaciously in an uncertain supply chain environment. The principal objectives of inventory management according to See and Sim (2010). Organizations with the aim of accomplishing stock objectives are mandated to take into consideration its performance metrics. Inventory objectives ought to be clearly defined with the corporate strategy and the organization's strategic plan as well as ensuring a clear and concise metrics assessment. Inventory is made up of work-in-

progress stock, raw materials, spare parts, consumables and finished goods. A study conducted by Kariuki and Rotich (2017) outlined various reasons for holding inventory. They found out that keeping so much inventories may result in funds being locked up which results in the rise of holding cost, deterioration of materials in stock, obsolescence and theft. Therefore, this activity does not warrant the organization to keep all kinds of goods in stock. Moreover, stock out of materials could lead to an interruption of products for sales; poor customer relations and underutilized machines and equipment.

But whatsoever be the case, top management of the organization has to allocate a portion of its funds for the purchase and management of inventory items. The various departments in the organization might have different attitudes toward inventory. For instance, the Art faculty might desire monolithic inventory in reserve to meet virtually each and every demand that comes. The Engineering and Mechanical faculties in a similar way would ask for stocks of materials so that the production system runs uninterrupted. The finance unit on the other hand, would continually argue for a minimal investment in inventory issues so that other resources could be earmarked to solve other pressing matters rather than inventory related commitments Joseph (2018). Inventory performance relationship is a research area that has been developed considerably in operations management literature and has also provided mixed findings to that effect. Various reports from studies have been undertaken (Ahmad & Zabri, 2018; Elsayed & Wahba, 2016); Masudin and Kamara (2018) and to ascertain the positive effect that inventory reduction has on organizational performance be it archival data or survey, no clear proof has been established for this relationship. Ahmad and Zabri (2018) indicated that the influence of organizational life cycle with respect to the correlation between organizational performance and inventory distinguishes that the management of inventory cannot be isolated from the other organizational settings. It is also subject to the interests and authority of equity holders. John, Etim, and Ime (2015) discovered that decision making with regards to inventory, is a dynamic procedure which involves equity holders. The effect of inventory management on organizational performance was conducted among these 1,358 manufacturing organizations in three functional industrial areas in Greece. The study spanned from 2000-2002 where the focus was on food, textiles and chemicals. The findings from the study proposed that, the higher the levels of inventories held by an institution, the lower the rate of return Koumanakos (2008). Prempeh (2015) sampled the opinions of managers on the impact of inventory management practices on the financial capability of manufacturing industries in Ghana. Organizations vis-a-vis industries currently have embraced effective inventory management practices. Previously, management of various organizations were of the view that over stocking of inventory was advantageous and thus also, an indication of wealth Odhiambo and Kihara (2018). Gitau (2016) asserts that effective inventory management is very critical in the running of any commercial enterprise. To avoid overstocking and

maintain a minimal inventory, physical and logical stock needs to be evaluated with the right inputs in order to have accurate inventory records. This in turn would cause a reduction in overhead costs and increase consumer satisfaction where consumer demands would be fulfilled whenever a request is made. It would also improve the activities and general performance of the procurement function. According to Eraslan and İÇ (2019), having accurate forecasting and timed stock replenishments were as a result of the proper management of inventory by the procurement function of the organization. Though there has been numerous significant studies on supply chain management, production planning, inventory control as well as uncertainties and the effects, they have on the whole procurement procedure, there are still more prospects for future research to focus more on real-life inventory systems. Hitherto, models were formulated within static situations which was regarded as normal scenarios with baseline settings exhibited in other studies. These models have led to various types of uncertainties. Moreover, these plethora studies K. Zhu, Shen, and Yao (2019) are of the view that there be a need for an intensive research into the relationship that exist between the supply chain operation process and the different sources of uncertainty. Most of the studies undertaken were focused mainly on attaining an accurate inventory policy for subsequent order quantities in production, manufacturing, and retail firms within global supply chains. The effective management of inventory in most of our tertiary institution's supply chains is one of the key elements for success. Any institution or organization would ideally prefer to have sufficient inventories to satisfy the needs and demands of its end users to guard against losing its customers or causing employees dissatisfaction as a result of inventory stock-outs. However, most institutions and organization's today, do not keep or hold too much inventory due to the cost of carriage or storage. The greatest challenge in the management of inventory has to do with how to effectively balance the demand and supply of inventories of goods and services. Keeping sufficient but not too much inventory is the ultimate objective for any establishment Riza and Purba (2018). So far a plethora of studies on inventory management and performance were conducted based on profit making by enterprises. These firms are primarily profit seeking, whose inventory management practices differ from nonprofit organizations such as the educational sector. With reference to the above background, this study seeks to delve deep into the effect inventory management practices has on the overall

performance of organizations with respect to Technical Universities in Ghana. The remainder of this paper is arranged as follows: The introduction is described in Section 1, Literature review in Section 2, and the Hypothesis and Methods in Section 3. The discussion is elaborated in section 4 and finally, conclusions are presented.

## LITERATURE REVIEW

### Inventory Management and Organizational Performance

A well-organized inventory control system does not deal in the same way with all products, but it applies methods of control and analysis in agreement with the economic importance related to each of the product. Inventory management derives from the importance of stock for the company, and therefore, the need to manage and control them is essential to maintain a level of inventory that allows at a minimum cost and maximum service to customers. The basic reasons for inventory management are: protect against uncertainties, allow production and purchase under economically advantageous conditions, cover anticipated changes in demand and supply and maintain transit between production and storage points. According to Ren, Chan, and Siqin (2019) inventories are all materials and goods which are maintained by firms in order to meet future demands. In addition to this definition, Vilorio and Robayo (2016) categorized them as products in process, finished goods, raw materials and final products that are available physically to the organization and is utilized by the company in the prospect of finishing or starting the process of production or to market the finished products. Inventory management is one of the most discussed phenomenon of management-related studies. Wild (2017) suggests that firms ought to conform market seasonal to the cost and procedures of production and should arrange products for sale. Another key point in inventory management is to consider how the inventory is moved and stored. If this does not take place in an appropriate manner then it will result in damages to the inventory material, and consequently, inflict additional cost to the firm. Effective and efficient inventory management can be a great competitive advantage to reduce costs, optimize operations and ensure business profitability Hugos (2018). Inventory management in the departmental stores is a set of activities with the purpose of ensuring the supply of materials necessary for the operation of the firm, in the correct time, in the quantity required, in the desired quality and at the

best price. Before the right time, it causes high stocks, above the company's need. After the correct time, it causes lack of material to meet the needs. In addition to the required quantity, it represents immobilizations in idle inventory. Without quality attributes, it entails higher costs and unrealized profit opportunities. If the required quantity is short, it can lead to insufficient inventory Prajogo, Oke, and Olhager (2016). Inventory management is vital and often absorbs a substantial part of an organizations operating budget, which means that it must be strictly monitored. Another point of attention is the legislative issue Ballou (2007). The firm that demonstrates inconsistency between the physical inventory and the accounting can be assessed by the Treasury. Inventory management is a vital issue and often absorbs a substantial part of an organization's operating budget. Since they do not add value to products, the lower the level of inventory that a productive system can manage to work with, the more efficient it will be Wild (2017). The efficiency of its administration can create the difference with competitors, improving quality, reducing time, reducing costs among other factors, thus offering a competitive advantage for the firm itself. It is essential that companies minimize the quantity of stocks in the supply chain in order to rationalize storage costs and maintain them. To move in the right direction, it is important to understand that like all other processes in an organization, inventory management needs to be constantly reworked to flow according to the dynamics of the firm and always bring good results. The improvement of the productive quality, the reduction of operational times, the careful reduction of costs, among other aspects, are some of the benefits obtained through effective inventory management. Nikpour (2017) organizational performance encompasses three specific areas of firm outcomes: namely financial performance, product market performance and shareholder return. Specialists in many fields are concerned with organizational performance including strategic planners, operations, finance, legal, and organizational development. Organizational performance consists of the actual output or results of an organization as measured against its intended outputs (or goals and objectives). Presenting this literature in a chronological way can also make it very difficult to follow. A more beneficial way is to present literature review in a thematic approach. This should give the readers a fuller and clearer picture of the accumulated research evidence. The review is carried out by capturing positive relationship, negative or no relationship, and moderators/mediators to the relationship. A research

carried out by Ezzahra, Ahmed, and Said (2018) discovered that organizations that adopt the JIT system of inventory management have an upper hand in the improvement of their earnings as a result of an improvement in inventory turnover. This goes a long way to tell the significance of inventory turnover management in an organization. On the effect of inventory reduction on productivity, a research by X. Zhu, Yuan, and Zhang (2018) made it evident in their findings that there is a positive relationship between inventory reduction and productivity output growth. The outcomes showed a 10% reduction in inventory leads to about 1% gain in labor productivity. The conclusion drawn was that reduction in inventory could be viewed as an important driving force of process improvement. Findings from a study by Rasit, Satar, and Ramli (2018) and Panwar, Jain, Rathore, Nepal, and Lyons (2018) was also in support of the positive effect that inventory reduction has on the performance of an organization which practices JIT. Additionally, the findings of Rasit et al. (2018) published that a reduction in inventory has a positive effect on return on investment, profits and return on sales. Panwar et al. (2018) additionally indicated in their research that the overall performance in organizations has been improved through inventory reduction as well as costs in quality and increased customer responsiveness. Another research by Ahmad and Zabri (2018) on the relationship between inventory and overall performance confirmed a positive connection or correlation between stock turnover and organization performance. These performance measures were return on sales, return on assets, and cash flow margin. Furthermore, Ahmad and Zabri (2018) also brought to light the positive effect that inventory turnover has on organization performance. Opperman (2018) also made a suggestion in their findings that, inventory turnover has a knock-out effect. However, it also has no direct relationship with organizational performance. A Positive relationship between inventory turnover and capital is influenced by the kind of investments. Capital investments which includes but however not limited to investments in warehouses, equipment, information technology and logistics management systems. These investments also lead to an improved inventory distribution, efficient execution of consumer orders and an increase in stock turnover Lyu, Chen, and Huo (2019). At the organizational level, a positive impact on inventory overall performance is highly braced. Ahmad and Zabri (2016), found out that having lower inventory and higher organizational overall performance are positively correlated. Ahmad and Zabri (2018) further

argued that organizations with high inventory levels are more susceptible to achieving bad financial performance. Bendig, Brettel, and Downar (2018) observed that organizations with good and accurate inventory long-term returns have more or less lower than average inventories. Lin, Liang, and Zhu (2018) emphasizes that organizations with remarkable overall performance have lower inventory levels than those firms that achieved terribly worse performance. Similarly, a study conducted by Khan and Siddiqui (2019) used a sample of Greek firms and disclosed that the higher the firm's stock level, the lower its profitability rate. A significant inventory performance relationship also corroborated the results of Elsayed and Wahba (2016) in Indian industries. Another report by Ahmad and Zabri (2018) revealed a positive and substantial relationship between inventory daily-reduction and profitability by adopting a sample of UK firms. Elsayed and Wahba (2016) found a positive relationship between inventory efficiency and financial performance with several industries in Egypt. In a study conducted by Elsayed and Wahba (2016), findings showed that stock turnover and total sales are not correlated. Similarly, in another research carried out by Rasit et al. (2018) it was concluded that there was no substantial divergence with regards to return on assets between JIT organizations and non-JIT organizations. Moreover findings of Ahmad and Zabri (2018) disclosed that inventory and organizational performance have no substantial relationship. In Germany, Heim, Miszak, and Lustenberger (2017) commented in their study findings that reduction in inventory has a restrained effect on the performance of an organization. Nonetheless, Heim et al. (2017) once again established that organizations with the lowest or highest inventory levels also have an experience of the worst or better performance levels. Golas and Bieniasz (2016) investigated 722 public companies in the US. They found out that organizations with high gross margins normally maintain higher stock levels, which in the long run results in lower stock turnover. Inventory turnover could indirectly be correlated to gross margin as a result of the impact of price, product variety and length of the product life cycle Gaur and Kesavan (2015). Inventory shrinkage has no positive impact on an organization's performance. Judging from a wider perspective, inventory shrinkage has a negative effect on organizational performance. Coherently, adopting a zero inventory policy is not always encouraged. Ismail, Isa, and Mia (2018) asserts that the positive effect in inventory reduction on performance is dependent to the execution of TQM and performance goals.

Furthermore, a positive inventory performance relationship which was disclosed by Lee, Tang, and Chung (2016) solely applies to bigger firms. Shin, Ennis, and Spurlin (2015) analyzed the effect inventory has when used as a mediating variable, to test the relationship between investment in information technology and organizational performance. They concluded that reduction in inventory has a direct and significant impact on performance. Moreover, findings from a research by Alrjoub and Ahmad (2017) showed that although reduction in inventory affects the overall performance of an organization positively, the impact varies with the kind of inventory. In a similar vein Han, Porterfield, and Tomasi (2019) discovered that inventory performance relationship varies not only with the kind of inventory, but also varies with regards to the type of organization or industry. They established that, the impact of raw materials inventory on performance is larger than work in process and finished goods inventory. Furthermore, Ahmad and Zabri (2018) indicated that inventory performance relationship is different when compared with macroeconomic and industry specific environment. Han et al. (2019) established that inventory performance relationship is partly mediated by inventory leanness. With the adoption of the continuous review inventory policy by most organizations, there is a possibility of inconsistencies regarding physical counts of stock items and inventory records. The inconsistencies in stock data could cause an organization to incur additional inventory carrying cost. This could have an effect on the financial capability of an organization as well as its relationship with consumers. The purpose of the study is to investigate reasons underlining inventory management practices concerning stock record inaccuracies in the tertiary educational sector.

## **HYPOTHESIS DEVELOPMENT**

### **Inventory Investment and Performance**

According to Mahyadin, Mahidin, Asaad, and Zien (2013), inventory investment is an investment in physical stock of raw materials, work in progress and finished stock. In contrast to fixed investment, inventories are constantly being ‘turned over’ as the production cycle repeats itself, with raw materials being purchased, converted first into work in progress, then into finished goods, then finally being sold. The amount of inventory investment directly affects company’s profit and cash flow. Firm performance can be defined in terms of profitability and productivity. Letchumanasamy (2013), business firms are concerned with performance in the pursuit

of their goals. The performance of the firm as a whole determines its survival.

The study proposes that:

*H1: There is a direct significant relationship between inventory investment and performance*

### **INVENTORY TURNOVER AND ORGANISATIONAL PERFORMANCE**

A Positive relationship between inventory turnover and capital is influenced by the kind of investments. Capital investments which includes but not limited to investments in warehouses, equipment, information technology and logistics management systems. These investments also lead to an improved inventory distribution, efficient execution of consumer orders and an increase in stock turnover for organizational performance Lyu et al. (2019).

The study proposes that:

*H2: There is a direct relationship between inventory turnover and organizational performance*

### **INVENTORY ACCURACY AND ORGANIZATIONAL PERFORMANCE**

The inventory record inaccuracy refers to the discrepancy between physical inventory held in stock and the record of inventory stored in a firm’s information system Kök and Shang (2014). This discrepancy can deeply affect the performance of firms Sarac, Absi, and Dauzère-Péres (2010) by generating lost sales, delay penalties, re-scheduling, suboptimal planning and the increased use of small transport vehicles, among others Cannella, Framinan, Bruccoleri, Barbosa-Póvoa, and Relvas (2015); (Chuang & Oliva, 2015). Such inefficiencies are a natural consequence of uncorrected order patterns caused by the Supply Chain members affected by inventory errors. Essentially, they create critical distortions in order placement, as almost every order policy utilizes information regarding current inventory levels Bruccoleri, Cannella, and La Porta (2014), and if the recorded inventory quantity does not match the actual quantity on the shelf, the system will either order unnecessary items or fall short on orders Metzger, Thiesse, Gershwin, and Fleisch (2013).

The study proposes that:

*H3: There is a direct relationship between inventory accuracy and organizational performance*

## Shrinkage and Organizational Performance

Inventory shrinkage means the difference between the physical count of inventory from the total inventory that is recorded in the official company records. Inventory shrinkage is a real phenomenon that affects every single retail business on the planet. If not managed on time and with proper systematic approach, it can prove to be deadly in the long term. These differences might be due to various reasons ranging from natural causes or managerial errors, being stolen by employees, shoplifting or inventory getting damaged and disposed of without having any record. Whatever the reason, there is a discrepancy referred to as inventory shrinkage which needs to be accounted for to reconcile the accounting records with the physical count in order that the organization improves on its performance.

The study proposes that:

*H4: There is a direct relationship between inventory shrinkage and organizational performance*

## INVENTORY INVESTMENT AND ORGANIZATIONAL CAPACITY

Traditionally, the supply chain runs at a rate based on forecast to push the mix of semi-finished product downstream of the supply chain. However, with constantly changeable demands, this cannot improve the effective system output. Conversely, it only increases the finished product inventory, (running high risk of obsolescence) or reduce necessary throughput (running high risk of stock out). With the growth in demand uncertainty, supply chains now need to strategically locate inventory and capacity to enable both timely and efficient delivery in line with organizational and market demands. That is, the most important bottleneck is the firm's market demand.

This study proposes that:

*H5: There is a negative relationship between inventory investment and organizational capacity*

## INVENTORY TURNOVER AND ORGANIZATIONAL CAPACITY

Wild (2017) indicated that the purpose of inventory turnover is to improve three objectives. These are customer service, inventory value and operation cost. The optimal profit strategy is not sacrificing the performance of one objective to achieve the goal of another objective. The inventory manager needs to make value adjustment. Better inventory control turnover leads to lower cost, lower inventory level and even higher customer service level. For constructing and implementing inventory

management, Wild (2017) indicate that the information integration and knowledge-based computerization could be a continuous improvement method for inventory management. Tsai, Chen, Hwang, and Hsu (2010) indicated that through implementation of the ERP system, the redundancy or insufficiency of inventory could be solved, with improved inventory turnover rates. Several researchers applied the risk management in various supply chain management and inventory strategies. Fahimnia, Tang, Davarzani, and Sarkis (2015) reviewed various quantitative models for managing supply chain risks and various supply chain risk management strategies according to researches and actual practices. Li, Chen, and Wang (2011) indicated that traditional inventory models focus on characterizing replenishment strategies, and they proposed a framework for incorporating risk aversion in multi-period inventory models as well as pricing strategies.

The study proposes that:

*H6: There is a negative relationship between inventory turnover and organization capacity.*

## INVENTORY ACCURACY AND ORGANIZATIONAL CAPACITY

Heese (2007) examine the link between inventory inaccuracy and performance in the retailer supply chain. They imagined a supply chain with three links and one product, whose end customer's demand changes among the links. In the basic model, without alignment between the physical inventory and the inventory data system, the inventory data becomes inaccurate due to the poor quality of the process, theft, and items that become obsolete. In the second model, these factors that lead to inaccuracy are still presented but the physical inventory and the inventory data system are aligned at the end of each period. The results indicate that eliminating the inventory inaccuracy may reduce supply chain costs, as well as the level of actual inventory; Auto-ID technologies may be one of the means by which to achieve inventory accuracy. Shteren and Avrahami (2017) presented a number of retailers and stressed an additional factor that affects the area of operations management, poor performance or inability to implement an operations program. They described the impact of poor performance on inaccuracy in inventory entries. The study proposes that:

*H7: There is a negative relationship between inventory accuracy and organizational capacity.*

## **INVENTORY SHRINKAGE AND ORGANIZATIONAL CAPACITY AND METHODOLOGY**

Inventory shrinkage and information discrepancy between the physical stock and the database come from three major sources: loss, misplacement, and transaction errors. These result in the introduction of uncertainty in the actual physical inventory level in the organization. Elimination of inaccuracy in the inventory management system helps reduce supply chain costs and out-of-stock situations capacity. As one of the identification shrinkage types, ticket-switching arises from either operational error or theft when an 'expensive' ticket is replaced by a 'cheap' ticket at a retail store. In general, retailers carry a large number of items, which renders it very expensive and difficult to prevent the occurrence of ticket-switching incidents. The consequence of ticket-switching on the inventory system includes false-positives and false-negatives on the two ticket-switched items for every ticket-switching incident. The study proposes that:

*H8: There is a positive relationship between inventory shrinkage and organizational capacity*

## **ORGANIZATIONAL CAPACITY AND ORGANIZATIONAL PERFORMANCE**

Operations managers frequently face the problem of distributing the right amount of inventories at different organizational capacity levels in a supply chain. Typically, the goal of this stock positioning is to meet management-set customer service targets without violating budget constraints on the total inventory investment. In addition to determining an effective stock-positioning approach, managers seek to identify which supply levers will best improve organizational performance. Through computational experiments, we identify when improvement in supply performance will yield a significant reduction in total inventory investment. In particular, we see that the cost reduction from improving supply performance is high when demand variability is high, the number of components is high, the target service level is high, or the product is more expensive relative to components. Organizational capacity and performance of supply chain processes are important lever in the inventory management.

This study proposes that:

*H9: There is a direct relationship between organizational capacity and organizational performance*

The study fall under quantitative survey approach; this approach enables to quantify and describe the existing practice, as well as to measure the impact of the actual inventory management practice on organizational performance of technical universities in Ghana. The target population of this study was technical universities offering training and education to tertiary students in six selected technical universities in Ghana. The study adopted random and purposive sampling method. A sample size of three hundred and ninety nine respondents was engaged, involving procurement officers, stores personnel and supply chain specialists for the study. For this study, questionnaire has been designed and distributed to collect information based on a pilot study in order to ensure validity of the measurement items. A set of questions on each aspect of the inventory management practice and performance were derived from extensive literature review. This approach helped the researcher to get more accurate results about how efficient management of inventory can improve the performance of any firm or organization. Furthermore, the measurement scales were tested separately for their validity and reliability. The research framework was tested for hypothesis and structural fit through the method of SEM (structural equation modeling) and factor analysis (Jackson, Gillaspay Jr, & Purc-Stephenson, 2009); Kline (2015). All questions have been organized by using Likert scale ranging from 1 to 5 points. The data collection was also assisted by colleague staffs. In order to analyze the data obtained through questionnaires, Statistical Package for the Social Sciences software was used for both input/output analysis of descriptive statistics. To test the hypothesis and examine the relationship between the variables, SMART PLS was employed. The analysis of the results of the applied questionnaire were performed using the statistical method of structural equations (PLS - Partial Least Square). This technique is made up of diagrams causal factors involving three main components: indicators (observed measured variables), variable latent (construct, concept, factor); ways (correlation, a trajectory, or two senses / trajectories), this is suitable when variables used to represent a phenomenon cannot be measured directly F. Hair Jr, Sarstedt, Hopkins, and G. Kuppelwieser (2014). (Chin, 2010); McDonald and Ho (2002) describes the steps for the analysis and use of the technique of structural equations: 1) Create a theoretical model, based on a robust literature review; 2) Build a track diagram (path) of causal relations (or influencers); 3) Transform the diagram into a set of structural model;

4) Choose the data entry matrix appropriate to estimate the model proposed.

### MODEL MEASUREMENT

To test the study hypothesis we have used the structural equation model (SEM) whereas the testing has gone through Smart PLS software. Structural equation modeling used to evaluate the structural relationship between exogenous and endogenous variables. The structural equation modeling includes factor analysis and multivariate analysis of the model. Firstly we evaluate the model fitness and measure whether the paths showing the relationship between measured and latent variables are significant or not. Moreover, to evaluate the indirect and direct effects of all the constructs the testing was done. The use of (SEM) structural equation model has been observed to be a foremost procedure that has been used below different regression models and methods Hayes (2017). Moreover, the equation of regression in study targets at explaining each construct to assess the cause and effect relationship while all of the factors in the causal model could demonstrate their cause and effect at exact time. Likewise, the idea of using this model ensures to apply technique of bootstrapping which has been viewed as reasonable for both small and large sample size and does not require any kind of indirect effect Hayes (2017). The PLS model includes two different models, which include a structural model and a measurement model. This section includes an analysis of the measurement model. The measurement model implies the representation of the external connections existing between the various structures included in the study, with their indicator variable. On the other hand, the structural model implies the representation of internal associations that exist between the various constructs included in the study.

### Measurement of Outer Model

The goal of measure of fit in the measurement model is to study about the reliability and validity of the instrument and to check its reliability and validity we perform test of convergent validity and discriminant validity in software naming Smart PLS.

### Composite Reliability

Reliability measurements include reflective structure, Cronbach alpha, composite reliability and average variance extraction (AVE). Cronbach's alpha is used to assess the reliability of consistency and requires a minimum of 0.7 to be considered acceptable. However, Cronbach's alpha has limitations because it often underrates internal consistency reliability.

Another method of measuring internal consistency reliability is composite reliability. A composite reliability value between 0.7 and 0.9 can be accepted. This is the accepted reliability value range. Estimation of reliability can be done by degree of constancy that lies amongst various variables Hair, Ringle, and Sarstedt (2011). Below is the table of composite reliability.

### Composite Reliability

Variables	Composite Reliability
ACCURACY	0.856
CAPACITY	0.968
INVESTMENT	0.920
PERFORMANCE	0.843
SHRINKAGE	0.798
TURNOVER	0.755

### Factor Loadings Significant

VARIABLE	CONSTRUCTS	ITEM LOADING
ACCURACY	ACUR1	0.931
	ACUR3	0.780
	ACUR4	0.857
	ACUR5	0.934
CAPACITY	CAP1	0.924
	CAP2	0.939
	CAP3	0.923
	CAP4	0.927
	CAP4	0.918
INVESTMENT	INV1	0.924
	INV2	0.629
	INV3	0.934
	INV4	0.928
PERFORMANCE	PER1	0.626
	PER2	0.863
	PER3	0.628
	PER4	0.888
SHRINKAGE	SHR11	0.924
	SHR13	0.904
	SHR14	0.765
TURNOVER	TURN1	0.935
	TURN3	0.908

Above is the mentioned table of (CFA) confirmatory factor analysis with the loadings. Construct with the loading of .5 are considered as strong loading variables whereas the constructs with the loading of below .5 are considered as less, are better to be removed from the table.

### Convergent Validity

On the other hand, convergent validity emphasizes on including outer loadings and assess whether indicators are positively correlated with other indicators of the same structure. AVE is used to measure the effectiveness of convergence to a particular level. The value of AVE greater than 0.5 indicates that the composition is interpreted as 50% or more according to the variation of the indicator. Indicators and outer loadings must be higher than 0.70, however, if the removal of the irrelevant indicator does not have any effect on the composite reliability, then the indicator should be considered between 0.4 and 0.7. These values indicate that constructs used in the research model are fit to the reliability and validity requirement by above mentioned statistical tests.

Constructs	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
ACCURACY	0.779	0.918	0.865	0.616
CAPACITY	0.959	0.959	0.968	0.858
INVESTMENT	0.880	0.925	0.920	0.745
PERFORMANCE	0.749	0.802	0.843	0.579
SHRINKAGE	0.651	0.853	0.798	0.564
TURNOVER	0.549	0.845	0.755	0.573

## Discriminant Validity

Discriminant validity can be determined by PLS through the three different tests which includes Heterotrait-Monotrait (HTMT) ratio of correlation and Fornell & Larcker criterion and cross loading of indicators. Along with these two specific tests, this research study also tests discriminant validity through Heterotrait-monotrait (HTMT) ratio. Following tables identify the results of collected data with respect to discriminant validity.

## FORNELL & LARCKER CRITERION

	ACUR	CAP	INV	PER	SHRIN	TURN
ACCURACY	0.785					
CAPACITY	0.698	0.926				
INVESTMENT	0.927	0.698	0.863			
PERFORMANCE	0.870	0.752	0.876	0.761		
SHRINKAGE	0.646	0.920	0.647	0.765	0.751	
TURNOVER	0.879	0.680	0.894	0.855	0.642	0.757

From the above table, it is identified that as related to discriminant validity, it is required to have proper Average Variance Extracted analysis. This test aims to identify that each square root of each AVE for each individual construct exceeds any other correlation exist between pair of latent construct. As according to the rule of thumb, it is identified that square root of each of the construct integrated in the model should exceed the value obtained after correlation of that construct with another construct. Moreover, it is also important that value of that construct should at least be 0.50. According to the results, all values are greater than 0.5 and also addressing the rule of thumb for discriminant validity.

## CROSS LOADING

	ACUR	CAP	INV	PER	SHRIN	TURN
ACUR1	0.931					
ACUR3	0.780					
ACUR4	0.857					
ACUR5	0.934					
CAP1		0.924				
CAP2		0.939				
CAP3		0.923				
CAP4		0.927				
CAP5		0.918				
INV1			0.924			
INV2			0.629			
INV3			0.934			
INV4			0.927			
PER1				0.830		
PER2				0.863		
PER3				0.879		
PER4				0.881		
SHRIN1					0.942	
SHRIN3					0.904	
SHRIN4					0.765	
TURN1						0.935
TURN2						0.908

Cross loading method is also executed for discriminant validity of the construct included in the model. As according to the rule of thumb, it is identified that cross loading value of each construct should exceed 0.70. Results indicate that except some of the constructs, values of all other constructs in the model are greater than 0.70. This test also confirms the requirement for cross loading for each construct included in the model.

## Heterotrait-Monotrait (Htmt) Ratio

	ACUR	CAP	INV	PER	SHRIN	TURN
ACUR						
CAP	0.767					
INV	0.641	0.745				
PER	0.740	0.885	0.581			
SHRIN	0.802	0.810	0.766	0.966		
TURN	0.619	0.854	0.601	0.913	0.895	

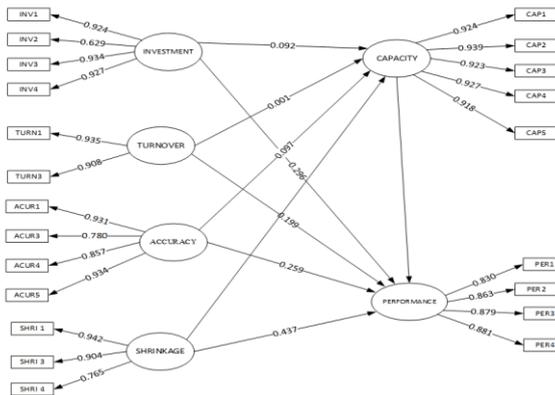
Heterotrait-Monotrait (HTMT) correlation ratio is also used for measuring discriminant validity. According to the rule of thumb for this specific test, it is suggested that HTMT values should be less than 1.

## Structural Model

In Partial Least Squares (PLS) method, structural model is used for testing the hypothesis through identifying different path coefficients. A structural model can be used by researcher for identifying the linear regression analysis of the dependent variable included in the model Henseler, Hubona, and Ray (2016). This specific model in SMART PLS enables researchers to identify the pattern of the association that exist among the constructs included in the research. Therefore, structural model is one of the evolving areas and is emphasized by the researcher to execute direct testing of the hypothesis in the research. For this research, entire model was assessed through using three different criteria including path coefficients, p value and t-statistics value Wong (2013). The validity of the structural model was executed through using SMART PLS as identified prior. Moreover, entire structural model was designed through using specific guidelines of Smart PLS. Moreover, thumb of rule was emphasized that indicate that a t statistics value should exceed 2 and R square value should be greater than 50%. For testing the hypothesis, P value is emphasized through considering rule that P value less than 0.05 will be considered as attainment of adequate evidence to accept the hypothesis. According to the findings, the study identified that ,there exist statistically significant association between inventory accuracy and firms' efficiency(t-statistics=5.054, P value=0.000, between lean inventory and firms' efficiency (t-statistics =2.430, P value=0.015) and between stock availability and firms' efficiency (t-

statistics=2.856, P value=0.004) as the p-values of the inventory accuracy, lean inventory and stock availability are less than the level of significance which means that they support the alternate hypothesis. Where there is insignificant difference between capacity utilization and firms' efficiency as the p-value=0.520 is greater than level of significance=0.05 which means that the alternate hypothesis is rejected.

**Model**



**Path Analysis**

	ORIGINAL SAMPLE (O)	SAMPLE MEAN (M)	STANDARD DEVIATION (STDEV)	T STATISTICS (O/STDEV)	P VALUES
ACCURACY -> CAPACITY	0.097	0.099	0.055	1.776	0.076
ACCURACY -> PERFORMANCE	0.259	0.260	0.058	4.458	0.000
CAPACITY -> PERFORMANCE	-0.173	-0.167	0.059	2.922	0.004
INVESTMENT -> CAPACITY	0.092	0.096	0.058	1.602	0.110
INVESTMENT -> PERFORMANCE	0.296	0.297	0.055	5.360	0.000
SHRINKAGE -> CAPACITY	0.797	0.791	0.029	27.891	0.000
SHRINKAGE -> PERFORMANCE	0.437	0.432	0.057	7.601	0.000
TURNOVER -> CAPACITY	0.001	0.002	0.041	0.018	0.985
TURNOVER -> PERFORMANCE	0.199	0.195	0.045	4.462	0.000

**DISCUSSION**

Comprehensive statistical tests were conducted with the aid of Smart PLS, in order to test the hypotheses. The findings led to either support or not to support the stated hypotheses in the study. The evaluation criteria employed for testing each hypothesis was p - values for each path coefficient. Additionally, significant t values were also used to indicate whether the hypotheses were supported or not. The rule of thumb used for testing each hypothesis was a t value greater than 1.96 and an alpha value of 0.05 for p value.

**Following table summarizes the testing of hypothesis:**

Hypothesis	Accepted or Rejected
ACCURACY -> CAPACITY	Not supported
ACCURACY -> PERFORMANCE	Supported
CAPACITY -> PERFORMANCE	Supported
INVESTMENT -> CAPACITY	Not Supported
INVESTMENT -> PERFORMANCE	Supported
SHRINKAGE -> CAPACITY	Supported
SHRINKAGE -> PERFORMANCE	Supported
TURNOVER -> CAPACITY	Not Supported
TURNOVER -> PERFORMANCE	Supported

The hypothesis H1, suggests that accuracy affects the firms' capacity. This hypothesis according to the results is not supported with (T Statistics=1.776, P value=0.076). This result of the study indicates that accuracy is an important element for technical universities 'inventory capacity. Technical universities needs to improve inventory capacity as an optimization which is an approach to shelf inventory management that minimizes the total expected annual cost and expected annual inventory holding cost. It is crucial for technical universities to emphasize on the delivery of services in an accurate reliable and appropriate manner according to the expectation of the organization. Technical universities should enhance the accuracy of the utilization of limited resources in order to ensure performance and create competitive advantage. Accuracy in inventory management has a strong positive effect on firm's value chain performance. H2 suggests that inventory accuracy affects the firm's performance. According to the findings this hypothesis is supported with (T Statistics=4.458, P value=0.000). This finding of the study indicates that accuracy in inventory management have the capability of influencing technical universities performance. Inventory accuracy is necessary for easy storage and retrieval of material, improved sales effectiveness and reduced operational cost. H3 suggests that capacity in inventory have the propensity to influencing the technical universities performance. According to the findings H3 is supported with (T Statistics=2.430, P value=0.015). This means that lean inventory system enhances firm's performance by identifying and eliminating waste. It can improve the flow of management by reducing the management or coordination costs. Lean practice is useful in reducing the lead time in work in progress inventories and flow of production. Waste can be minimized if technical universities practice

lean management system. The hypothesis H4, suggests that investment affects the technical universities performance. According to the findings, H4 is not supported with (T Statistics=1.602, P value=0.110). This explains that investment is an important factor for evaluating technical universities capacity for performance. The stock availability should be regularly checked through appropriate time intervals in order to enhance capacity. The hypothesis H5, suggests that investment affects technical universities performance. The findings of the results showed that H5 is supported with (T Statistics=5.360, P value =0.000).The more extensively investment is encouraged; the more successful performance is expected. The hypothesis H6, stipulating shrinkage has a positive impact on capacity is supported by the data with a significant (T statistics =27.891, P value = 0.000). This means that the shrinkage has the potential to burden the inventory system through both increased holding cost and ordering cost. The hypothesis H7, suggests that inventory shrinkage positively affects technical universities performance. Thus H7 is supported with (T Statistics =7.601, P value =0.000).This result in the introduction of uncertainty in the actual physical inventory level. Elimination of inaccuracy in the inventory management system helps reduce supply chain costs and out-of-stock situations. However, hypothesis H8 is not supported (T Statistics =0.018.P value =0.985).This explains that the optimal profit strategy is not sacrificing the performance of one objective to achieve the goal of another objective. The hypothesis H9, inventory turnover has a significant effect on the performance of technical universities with (T Statistics= 4.462, P value =0.000). This means that there is positive relationship between inventory turnover and capital is influenced by the kind of investments in the organization. The inventory management techniques have a positive influence on the performance of a company. These techniques of managing inventories help in proper planning of the materials needed by identifying the gap between the desired and the actual level of materials, allocation of resources, purchasing, sales and employment of staff and everything concerned with human resources management all of which reduces on the costs incurred by the organization in the production departments for improved performance of the technical universities in Ghana.

## CONCLUSIONS

This paper provides empirical justification for the impact of inventory management practices on the performance of Ghanaian technical universities. On

the basis of data obtained from respondents, the study found the following findings: Out of nine hypotheses, six hypotheses were supported while the remaining three hypotheses were not supported. The six hypotheses indicate the significant positive impact of inventory management practice on the performance of Ghanaian technical universities. Generally, the finding of this study implies that enhanced inventory accuracy, inventory investment and increased organizational performance could improve the levels of inventory management practice. Additionally, enhanced organizational performance provides a firm increased capital to implement various scientific inventory management techniques. Based on the results of this study, inventory control indicators allow the firm to organize, manage and utilize the best inventory control model in order to improve the flow of inventory. Furthermore, inventory control indicators could also allow the firm to measure and qualify how the inventory process works, and shows the strengths and weaknesses of the inventory control system currently used in the Ghanaian technical universities, such as inventory shrinkage. Inventory shrinkage has the potential to burden the inventory system through both increased holding cost and ordering cost. This issue is more profound when identifications are switched due to intentional or random causes Zhou and Piramuthu (2017). This show that the inventory manager should pay more attention to the cheap items in order to reduce loss associated with inventory cost. To this end, this study provides empirical evidence to support the literature regarding the impact of inventory management practices. We believe that this study contributes to extant inventory management literature by introducing the concept of inventory management practices on the performance of technical universities in Ghana. Further study can be directed to investigate the impact of inventory management practices in the different inventory management context.

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## REFERENCES

- [1]. Ahmad, K., & Zabri, S. M. (2016). Inventory management practices among Malaysian micro retailing enterprises. *Journal of Business and Retail Management Research*, 11(1).

- [2]. Ahmad, K., & Zabri, S. M. (2018). The mediating effect of knowledge of inventory management in the relationship between inventory management practices and performance: The case of micro retailing enterprises. *Journal of Business and Retail Management Research*, 12(2).
- [3]. Alrjoub, A. M. S., & Ahmad, M. A. (2017). Inventory management, cost of capital and firm performance: evidence from manufacturing firms in Jordan.
- [4]. Ballou, R. H. (2007). *Business logistics/supply chain management: planning, organizing, and controlling the supply chain*: Pearson Education India.
- [5]. Bendig, D., Brettel, M., & Downar, B. (2018). Inventory component volatility and its relation to returns. *International Journal of Production Economics*, 200, 37-49.
- [6]. Bruccoleri, M., Cannella, S., & La Porta, G. (2014). Inventory record inaccuracy in supply chains: the role of workers' behavior. *International Journal of Physical Distribution & Logistics Management*, 44(10), 796-819.
- [7]. Cannella, S., Framinan, J. M., Bruccoleri, M., Barbosa-Póvoa, A. P., & Relvas, S. (2015). The effect of inventory record inaccuracy in information exchange supply chains. *European journal of operational research*, 243(1), 120-129.
- [8]. Chin, W. W. (2010). How to write up and report PLS analyses *Handbook of partial least squares* (pp. 655-690): Springer.
- [9]. Chuang, H. H.-C., & Oliva, R. (2015). Inventory record inaccuracy: Causes and labor effects. *Journal of operations management*, 39, 63-78.
- [10]. Elsayed, K., & Wahba, H. (2016). Reexamining the relationship between inventory management and firm performance: An organizational life cycle perspective. *Future Business Journal*, 2(1), 65-80.
- [11]. Eraslan, E., & İÇ, Y. T. (2019). An improved decision support system for ABC inventory classification. *Evolving Systems*, 1-14.
- [12]. Ezzahra, S. F., Ahmed, A., & Said, R. (2018). Literature review on successful JIT implementation in developing countries: obstacles and critical success factors. Paper presented at the 2018 International Colloquium on Logistics and Supply Chain Management (LOGISTIQUA).
- [13]. F. Hair Jr, J., Sarstedt, M., Hopkins, L., & G. Kuppelwieser, V. (2014). Partial least squares structural equation modeling (PLS-SEM) An emerging tool in business research. *European Business Review*, 26(2), 106-121.
- [14]. Fahimnia, B., Tang, C. S., Davarzani, H., & Sarkis, J. (2015). Quantitative models for managing supply chain risks: A review. *European journal of operational research*, 247(1), 1-15.
- [15]. Gaur, V., & Kesavan, S. (2015). The effects of firm size and sales growth rate on inventory turnover performance in the US retail sector *Retail Supply Chain Management* (pp. 25-52): Springer.
- [16]. Gitau, R. W. (2016). *Inventory Management Practices and Organizational Productivity in Parastatals in Kenya*. Unpublished MBA Project, University of Nairobi.
- [17]. Golas, Z., & Bieniasz, A. (2016). Empirical analysis of the influence of inventory management on financial performance in the food industry in Poland. *Engineering Economics*, 27(3), 264-275.
- [18]. Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing theory and Practice*, 19(2), 139-152.
- [19]. Han, C., Porterfield, T., & Tomasi, S. (2019). An Exploratory Examination of the Direct and Indirect Effects of Industry Competition on Manufacturing Inventories. *Journal of Supply Chain and Operations Management*, 17(1), 111.
- [20]. Hayes, A. F. (2017). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*: Guilford Publications.
- [21]. Heese, H. S. (2007). Inventory record inaccuracy, double marginalization, and RFID adoption. *Production and Operations Management*, 16(5), 542-553.
- [22]. Heim, E., Miszak, F., & Lustenberger, M. (2017). Zero Inventory—ein überholtes Konzept? Sind tiefe Lagerbestände wirklich ertragssteigernd? *ZWF Zeitschrift für wirtschaftlichen Fabrikbetrieb*, 112(10), 666-669.
- [23]. Henseler, J., Hubona, G., & Ray, P. A. (2016). Using PLS path modeling in new technology research: updated guidelines. *Industrial Management & Data Systems*, 116(1), 2-20.
- [24]. Hugos, M. H. (2018). *Essentials of supply chain management*: John Wiley & Sons.
- [25]. Ismail, K., Isa, C. R., & Mia, L. (2018). Evidence on the usefulness of management

- accounting systems in integrated manufacturing environment. *Pacific Accounting Review*, 30(1), 2-19.
- [26]. Jackson, D. L., Gillaspay Jr, J. A., & Purc-Stephenson, R. (2009). Reporting practices in confirmatory factor analysis: An overview and some recommendations. *Psychological methods*, 14(1), 6.
- [27]. John, N. E., Etim, J. J., & Ime, T. U. (2015). Inventory management practices and operational performance of flour milling firms in Lagos, Nigeria. *International Journal of Supply and Operations Management*, 1(4), 392.
- [28]. Joseph, C. H. (2018). INVENTORY MANAGEMENT PRACTICES AND SUPPLY CHAIN PERFORMANCE OF CONSTRUCTION FIRMS IN NAIROBI.
- [29]. Kariuki, S. W., & Rotich, G. (2017). Role of stores management in reduction of redundant stock, a case study of Keroche Breweries Limited, Kenya. *International Journal of Project Management*, 1(5), 80-97.
- [30]. Khan, F., & Siddiqui, D. A. (2019). Impact of Inventory Management on firm's efficiency—A quantitative research study on departmental stores operating in Karachi. *Social Science and Humanities Journal*, 964-980.
- [31]. Kline, R. B. (2015). *Principles and practice of structural equation modeling*: Guilford publications.
- [32]. Kök, A. G., & Shang, K. H. (2014). Evaluation of cycle-count policies for supply chains with inventory inaccuracy and implications on RFID investments. *European journal of operational research*, 237(1), 91-105.
- [33]. Koumanakos, D. P. (2008). The effect of inventory management on firm performance. *International journal of productivity and performance management*, 57(5), 355-369.
- [34]. Lee, J. Y., Tang, C. Y., & Chung, K.-H. (2016). The Financial Market, Governmental Policy Change, and Firms' Cost Performance. *International Research Journal of Applied Finance*, 7(11), 301-315.
- [35]. Letchumanasamy, R. S. (2013). The impact of transformational leadership on organisational climate for innovation, innovative work behaviour and organisational performance in governmentlinked companies. Doctoral thesis), Charles Sturt University, Australia.
- [36]. Li, J., Chen, J., & Wang, S. (2011). Risk management of supply and cash flows in supply chains (Vol. 165): Springer Science & Business Media.
- [37]. Lin, Y., Liang, B., & Zhu, X. (2018). The effect of inventory performance on product quality: The mediating effect of financial performance. *International Journal of Quality & Reliability Management*, 35(10), 2227-2247.
- [38]. Lyu, G., Chen, L., & Huo, B. (2019). Logistics resources, capabilities and operational performance: A contingency and configuration approach. *Industrial Management & Data Systems*, 119(2), 230-250.
- [39]. Mahyadin, F. A., Mahidin, R. S., Asaad, M. N. M., & Zien, R. (2013). The Influence of Inventory Management Practices towards Inventory Management Performance in Malaysian Public Hospitals. *Medicine*.
- [40]. Masudin, I., & Kamara, M. S. (2018). Impact Of Just-In-Time, Total Quality Management And Supply Chain Management On Organizational Performance: A Review Perspective. *Jurnal Teknik Industri*, 19(1), 11-20.
- [41]. McDonald, R. P., & Ho, M.-H. R. (2002). Principles and practice in reporting structural equation analyses. *Psychological methods*, 7(1), 64.
- [42]. Metzger, C., Thiesse, F., Gershwin, S., & Fleisch, E. (2013). The impact of false-negative reads on the performance of RFID-based shelf inventory control policies. *Computers & Operations Research*, 40(7), 1864-1873.
- [43]. Nikpour, A. (2017). The impact of organizational culture on organizational performance: The mediating role of employee's organizational commitment. *International Journal of Organizational Leadership*, 6, 65-72.
- [44]. Odhiambo, M. O., & Kihara, A. N. (2018). Effect Of Inventory Management Practices On Supply Chain Performance Of Government Health Facilities In Kisumu County In Kenya. *Journal of International Business, Innovation and Strategic Management*, 1(6), 145-166.
- [45]. Opperman, R. (2018). Analysing the relationship between inventory management and sustainable supply chain management. North-West University.

- [46]. Panwar, A., Jain, R., Rathore, A. P. S., Nepal, B., & Lyons, A. (2018). The impact of lean practices on operational performance—an empirical investigation of Indian process industries. *Production Planning & Control*, 29(2), 158-169.
- [47]. Prajogo, D., Oke, A., & Olhager, J. (2016). Supply chain processes: Linking supply logistics integration, supply performance, lean processes and competitive performance. *International Journal of Operations & Production Management*, 36(2), 220-238.
- [48]. Prempeh, K. B. (2015). The impact of efficient inventory management on profitability: evidence from selected manufacturing firms in Ghana.
- [49]. Rasit, Z. A., Satar, N. H. A., & Ramli, A. (2018). Effect of JIT on Organisational Performance: Influence of Performance Measurement System. *Journal of Engineering and Applied Sciences*, 13(8), 2108-2113.
- [50]. Ren, S., Chan, H.-L., & Siqin, T. (2019). Demand forecasting in retail operations for fashionable products: methods, practices, and real case study. *Annals of Operations Research*, 1-17.
- [51]. Riza, M., & Purba, H. (2018). The implementation of economic order quantity for reducing inventory cost. *Research in Logistics & Production*, 8.
- [52]. Sarac, A., Absi, N., & Dauzère-Pérès, S. (2010). A literature review on the impact of RFID technologies on supply chain management. *International Journal of Production Economics*, 128(1), 77-95.
- [53]. See, C.-T., & Sim, M. (2010). Robust approximation to multiperiod inventory management. *Operations Research*, 58(3), 583-594.
- [54]. Shin, S., Ennis, K. L., & Spurlin, W. P. (2015). Effect of inventory management efficiency on profitability: Current evidence from the US manufacturing industry. *Journal of Economics and Economic Education Research*, 16(1), 98.
- [55]. Shteren, H., & Avrahami, A. (2017). The Value of Inventory Accuracy in Supply Chain Management: Case Study of the Yedioth Communication Press. *Journal of theoretical and applied electronic commerce research*, 12(2), 71-86.
- [56]. Tsai, W.-H., Chen, S.-P., Hwang, E. T., & Hsu, J.-L. (2010). A study of the impact of business process on the ERP system effectiveness. *International Journal of Business and Management*, 5(9), 26.
- [57]. Vilorio, A., & Robayo, P. V. (2016). Inventory reduction in the supply chain of finished products for multinational companies. *Indian Journal of Science and Technology*, 8(1).
- [58]. Wild, T. (2017). *Best practice in inventory management*: Routledge.
- [59]. Wong, K. K.-K. (2013). Partial least squares structural equation modeling (PLS-SEM) techniques using SmartPLS. *Marketing Bulletin*, 24(1), 1-32.
- [60]. Zhou, W., & Piramuthu, S. (2017). Identification shrinkage in inventory management: an RFID-based solution. *Annals of Operations Research*, 258(2), 285-300.
- [61]. Zhu, K., Shen, J., & Yao, X. (2019). A three-echelon supply chain with asymmetric information under uncertainty. *Journal of Ambient Intelligence and Humanized Computing*, 10(2), 579-591.
- [62]. Zhu, X., Yuan, Q., & Zhang, W. (2018). Inventory leanness, risk taking, environmental complexity, and productivity: A mediated moderation model. *Journal of Manufacturing Technology Management*, 29(7), 1211-1232.