

## JUST IN TIME INVENTORY MANAGEMENT TECHNIQUE AND SUPPLY CHAIN PERFORMANCE IN PROCESSING FIRMS IN KENYA: A CASE OF CROWN PAINTS LIMITED

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### ABSTRACT

*The main objective of the study was to investigate the effect of just in time inventory management technique on supply chain performance in processing firms in Kenya with focus to Crown Paints Limited. This study analyzed several theories majoring on the deterministic inventory which deterministic models of stock control are utilized to decide the ideal stock levels in the company. This study adopted descriptive research design. Target population of this study was 279 staff working in various department at Crown Paints Limited. Stratified random sampling technique was used in this study to come up with a sample size of 81 respondents. Questionnaires were used to collect primary data. Qualitative and quantitative data was collected where quantitative data was coded in the SPSS (Version 22). Data has been presented using frequency tables and figures while interpretation has been done in prose form. Inferential statistics was used to establish relationship between just in time inventory management technique on supply chain performance. The study concluded that customer order cycle influence supply chain performance. There was significant relationship between customer order cycle and supply chain performance. The study concludes that supply chain cycle contributes to supply chain performance, and that there was significant relationship between supply chain cycle and supply chain performance. The study concludes that there was linear relationship between Takt Time and supply chain performance. There was significant influence of Takt Time on supply chain performance. The study concludes that pull system contributes to the supply chain performance. The study concludes that the overall significant relationship between pull system and supply chain performance. The study recommends that organizations should have multiple objectives like enhanced competitiveness, better customer service and increased profitability among other. To seek these objectives organizations should employ various defensive as well as offensive business performance improvement approaches. In order to receive an accurate result using takt time formula on supply chain performance, organizations should put both the production time available and the customer demand into frames. Goods should simply be produced according to the pace of consumption in the market a market demand-pull supply chain system.*

## INTRODUCTION

Just In Time is a concept for delivering a necessary volume of the required thing at a necessary purpose of time (Kimura & Terada, 1981). This concept was created by Ohno (1988), to meet out the worldwide rivalry, in which the work-in-process stock (WIP) is overseen and controlled more precisely than the Material Requirement Planning (MRP)-manufacturing framework to therefore decrease the manufacturing cost (Golhar& Stamm 1991; Monden 1981). The just-in-time (JIT) theory, spearheaded by Toyota during the 1960s, is referred to by various names, for example, stockless productions (Hewlett Packard); short cycle fabricating (Motorola); and lean assembling (Boeing). It started from a need to deliver a more noteworthy assortment of items in littler bunches in a dreary way with a similar production office. Its optional targets were to dispose of: squander, wasteful exercises, and work-in-process stock at each phase of the worth chain. The ideas of JIT and all out quality administration (TQM) have developed into the lean and six sigma the board ideal models (Bhasin & Burcher, 2006). The lean worldview is based on the strategies and systems its JIT and TQM forerunners. This is especially valid for obtainment and sourcing capacities where JIT acquisition or lean acquirement is the prevailing strategy.

The just-in-time procurement gives a savvy conveyance of just the important amount of parts at the correct quality, at the ideal time and spot. Lean has effectively been applied in different enterprises than the vehicle, for example, the administration business, human services and government, and keeps on advancing and spread (Bowen & Youngdahl, 2006). For example, Liker (2004) underlines that lean additionally proficiently can be applied in all business forms, including obtainment. Furthermore, provider connections are of high significance in lean for its prosperity and for the most part, the provider has an essential impact so as to make due in the undeniably serious commercial center.

Internationally, the concept of JIT has been discussed with focus on its influence on firm performance. In USA, even though Just in time in some cases has been actualized as though they were autonomous and unmistakable, they can likewise be utilized as three prongs of a coordinated tasks system (Kannan & Tan, 2015). In UK, Javadian, Nagendra and Fooladi (2013) on without a moment to spare assembling framework pointed that despite the fact that the JIT framework is by all accounts fascinating and less convoluted it requires a lot of coordination with the supply chain to maintain a strategic distance from delays in the production plan. Franco and Rubha (2017) did an outline about JIT (just-in-time)– stock administration framework in Brazil. The article pointed that the motivation behind JIT is to keep away from the waste associated with the overproduction, pausing, abundance stock, total quality control and dedication to the client.

In Africa, similar to some other landmass, the idea of JIT has been received in different nations. For example, Salaheldin (2015) did an investigation on JIT usage in Egyptian assembling firms. In South Africa, Mazanai (2016) led an examination on effect of the just in time (JIT) stock framework on the proficiency, quality and adaptability among assembling part, small and medium undertaking (SMEs). Self-controlled polls were disseminated to an example of assembling segment SMEs in the food, wood and furniture, metals, non-metals and different enterprises. In Nigeria, Adeyemi (2010) did an investigation on Just-in-time production frameworks (JITPS) in the developing nations. The organized polls were directed to the organizations to show whether they were embracing the method. The discoveries incorporate that genuinely larger organizations embrace JIT strategy more while the generally littler ones are as yet not mindful of the presence of the procedure.

In Kenya, Manese (2014) did an investigation on the Just in time selection and execution of significant oil organizations in Kenya. The examination configuration utilized in this investigation was a graphic study research plan with an outline of a contextual investigation. Elyas and Richu (2012) did an examination because of Enterprise Resource Planning (ERP) on process duration of supply of oil items in Oil Industry in Kenya. The examination discoveries indicated that Enterprise asset arranging; Enterprise asset choice help and Information stream have a positive critical impact on gracefully chain execution.

## STATEMENT OF THE PROBLEM

Inventory management has empowered firms to have sufficient amounts of top notch things accessible to serve client needs, while likewise limit the expenses of conveying stock (Brigham & Ehrhard, 2015). Be that as it may, dealing with these inventories so as to accomplish their destinations has represented an extraordinary test to the organizations. Numerous organizations have not yet settled the amount to put resources into inventories and the correct stock levels to hold so as fulfill clients' needs and demands. In lion's share of assembling ventures, stock establishes the most noteworthy piece of current resources (Songet, 2006). Assembling firms achieve huge reserve funds from powerful stock administration which sums between half - 60% of all out expenses. A possible 6% saving money on complete

expense through powerful stock administration is reachable (Chen, 2005). In this view, the examination wishes to survey the impact of the effect of just in time inventory management technique on supply chain performance.

The greater part of exact examinations embraced on without a moment to spare stock administration method and supply chain management have set up that there is a critical positive relationship exist between the two. Kithaka (2010) in his investigation discovered that stock administration robot influences the exhibition of general stores since it prompts improved client support conveyance levels and decreased operational expenses. Bai and Zhong (2008) discovered that stock administration is significant for most organizations yet is particularly urgent for the independent ventures due to their restricted assets. Ndunge (2012) discovered that stock administration applications empowered consumable oil firms to limit wastage of stock and furthermore limit their expenses. Gakinya (2013) discovered that stock administration can impact an association's flexibly chain execution by accomplishing administration conveyance to the clients, satisfying estimate needs and increasing a serious edge. Anichebe and Agu (2013) in their exploration discovered that the authoritative adequacy can be improved by acceptable stock administration. John and Ime (2014) set up that stock administration practices can improve the operational presentation of a firm through effectiveness in capital usage, expanded help level, and diminished lead time and that organizations that execute stock administration models can deal with material deficiencies, item stock outs, and the component pile up. It is therefore clear that little research has been undertaken in Kenya on the effect of effect of just in time inventory management technique on supply chain performance. Therefore, the current study seeks to fill this research gap by investigating the effect of just in time inventory management technique on supply chain performance in processing firms with focus to crown paint.

The supply chain execution measures are utilized to decide the productivity and viability of a current framework, or to think about contending elective frameworks. Beamon (1998). They give the important criticism data to uncover progress, upgrade inspiration and correspondence and analyze issues (Chan, Qi *et al.* 2003). Estimating it encourages a more prominent comprehension of the supply chain, emphatically impact conduct and improve the overall execution (Shepherd & Gunter 2006).

## STUDY OBJECTIVES

### GENERAL OBJECTIVE

The overall objective of this study was to examine the effect of just in time inventory management technique and supply chain performance in processing firms with focus to Crown Paint Limited.

### Specific Objectives

- i. To determine the effect of customer order cycle on supply chain performance of Crown Paints Limited.
- ii. To establish the effect of supply chain cycle on supply chain performance of Crown Paints Limited.
- iii. To examine the influence of takt time on supply chain performance of Crown Paints Limited.
- iv. To investigate the pull system on supply chain performance of Crown Paints Limited.

## THEORETICAL LITERATURE REVIEW

### Deterministic Inventory Theory

Deterministic Inventory theory was first proposed in 1975 by Buzacott. Deterministic models of stock control are utilized to decide the ideal stock of a solitary thing when request is generally to a great extent dark. As indicated by Croom and Jones (2010), deterministic stock hypothesis is one of the key procedures utilized by firms to create stock hold gauges. Deterministic models of stock control are utilized to decide the ideal stock of a solitary thing when request is for the most part to a great extent dark. Deterministic inventory model helps to understand the challenges of irregular large orders and visit little requests.

This theory is relevant to the study as it provides a link with the independent variable of demand forecasting to the study. However, one notable criticism of this model is that this kind of model rarely exist and, and it is for sure that some uncertainty is always associated with the inventory system. This is due to the fact that, Deterministic inventory theory assume the situation to be deterministic and subsequently render the numerical model to upgrade on framework contentions.

## Theory of Constraints

The Theory of Constraints (TOC) was developed during the 1980s by a physicist named Eliyahu Goldratt, who was known to possess outstanding and in-depth knowledge of systems who had and was subsequently and released it in the form of the business novel “*The Goal in 1984*”. From that point forward, TOC has kept on advancing and create, and today it is a huge factor inside the universe of the board best practices. In any case, the beginnings of the TOC identify with the advancement of a product creation plan during the 1970s, known as Optimized Production Technology, additionally planned by Goldratt. The Theory of Constraints is a procedure for recognizing the most significant restricting variable (for example requirement) that disrupts the general flow of accomplishing an objective and afterward efficiently improving that imperative until it is not, at this point the restricting variable. In assembling, the requirement is regularly alluded to as a bottleneck.

## Transaction Cost Theory (TCE)

Transaction cost theory (TCE) was first proposed in 1931 by Commons (1931). According to the transaction cost economic theory, the determinants of transactions are; recurrence, particularity, vulnerability, constrained reasonability and shrewd conduct. The Transaction Cost Economics (TCE) hypothesis contends that the utilization of ICT will prompt diminished exchange costs related with the administration of exchanges and by efficient coordination.

In exchange cost financial aspects (TCE) the focal point of the firm is to limit the aggregate of exchange expenses and creation costs. Exchange costs influence the association's choices on how they arrange their exercises, regardless of whether to move towards vertical incorporation (progression) or to favour showcase trade. In this manner, TCE characterizes the limits of the firm. Therefore, TCE recommends that the decision of whether to partner with suppliers or not should be based on the efficiency of governance. High frequency of transaction costs, uncertainty and assets specification guide firms towards hierarchy. Exchange cost financial matters hypothesis distinguishes and clarifies the conditions appropriate for a firm to deal with a monetary trade inside, and the conditions under which it ought to deal with a monetary trade remotely.

(Lopez, 2013), ICT assets sway on correspondence improvement for both inside and outer correspondence and coordination of exercises and this empowers a quicker and progressively productive utilization of data both inside the firm and with outside operators, for example, clients and providers. Exchange cost monetary is pertinent to this examination since it unmistakably reveals insight into the job of the carefully empowered flexibly chain the board in serious situations. Along these lines, this hypothesis is pertinent to the examination as it connects the autonomous variable of data innovation to the investigation.

## Lean Theory

Lean Theory was first coined by John Krafcik in his 1988 article, "Triumph of the Lean Production System", based on his master's thesis at the MIT Sloan School of Management. According to Krafcik, Lean is the set of tools that assist in the identification and steady elimination of waste. As waste is eliminated, production time and cost are reduced while quality improves. Lean is also defined by Lyson (2000) as an extension of ideas of just-in-time, elaborating just-in-time as a pull-based system designed to align the production and business processes throughout the supply chain. Lean usage accentuates the significance of upgrading work course through vital operational techniques while limiting waste and being versatile. Adaptability is required to permit creation leveling utilizing apparatuses, for example, SMED, yet have their analogs in different procedures, for example, innovative work (R&D). Be that as it may, flexibility is regularly compelled, and in this way may not require critical speculation. All the more critically, these ideas must be recognized by workers who build up the items and start forms that convey esteem. The social and administrative parts of lean are ostensibly more significant than the real apparatuses or systems of creation itself. There are numerous instances of lean apparatus usage without continued advantage, and these are frequently accused on powerless comprehension of lean all through the entire association.

Therefore, this theory is important in this theory in providing an understanding on the effect of lean inventory practices on the supply chain performance. This is because, lean theory aims to enhance productivity by simplifying the operational structure enough to understand, perform and manage the work environment.

## Empirical Literature Review

In a study conducted in Sweden, Kazak and Wing (2014) conducted a study aimed at creating an effective system for enhancing customer support through the distribution of Just-In-Time (JIT) to increase the competitiveness of ELS. It was recommended on the basis of the study results and concluded that businesses should move from conventional production-oriented to market-oriented orientation by incorporating the viewpoint of consumers into the value chain. To deploy this, businesses should start from the end of the customer and recognize the needs of customers and develop mutually beneficial customer relationships.

In the United States, Green, Inman and Birou (2017) did a study on the effect of the JIT purchasing strategy on the efficiency of the supply chain. The study drew knowledge from manufacturing executives with marketing duties. To analyze the effect of the JIT-purchasing strategy on supply chain efficiency, a structural equation modeling methodology was used with a special emphasis on integration, performance management, specialization, and decentralization dimensions. Although earlier findings that JIT-selling impacts performance management and specialization are reinforced by the results of this research, the results alternately find support for a relationship between JIT-selling and integration and refute the previous finding that decentralization is linked to JIT-selling.

Ali and Deif (2014) conducted a study in Canada that evaluated the dynamic lean assessment among manufacturing firms in Canada for the implementation of takt time and supply chain efficiency. A complex model was introduced in the paper to determine the degree of leanness in manufacturing companies. The model is based on the approach of system dynamics and provides the manufacturing system with a "leanness score." Furthermore, the dynamics associated with the application of the term "One-piece flow" through "Takt time" were examined. Results showed that the overall performance would be improved by working on changing the cycle times of the system to follow takt time. Improvements are expressed in the overall quality of operation, overall performance of WIP, and overall efficiency of equipment. With its performance metrics, the built model will assist decision-makers in implementing various lean policies and help optimize system parameter settings.

González, Framinan and Ruiz-Usano (2013) published a study in Spain aimed at proposing a technique for developing and running pull-based supply chains to manage the supply chain flow of materials. A literature review of the study issue was reviewed and a new mechanism for coordination of the supply chain was suggested. According to the findings of the report, their short-term control was found to be one key factor not yet deeply explored in supply chain management. A simple pull mechanism coordination mechanism, however, shows that it is realistic in the coordination of material flow between various companies within a supply chain.

While studies have been carried out around the world on inventory management techniques, none of the studies have been carried out in Kenya on the impact of just-in-time inventory management techniques and supply chain efficiency in Crown Paint Limited-focused processing companies. The current study therefore seeks to bridge this gap by analysing the impact of Crown Paints Limited's supply chain performance of customer order cycle, supply chain cycle, takt time and pull system on supply chain performance.

## SUMMARY AND RESEARCH GAPS

**Table 2.1 Summary of Research Gaps**

Study	Area of the Study	Methodology	Main Findings	Knowledge Gap	Focus of the current Study
Kazak and Wing, (2014)	Appropriate framework for improving customer service through Just-In-Time (JIT) distribution.	The study adopted a case study approach where data was collected in from Electrolux Laundry Systems.	Companies are recommended to shift from the traditional production-oriented to market-oriented focuses through incorporation of customers' perspective into the value chain.	The study did not interrogate on the reality as to whether JIT delivery enhance organization performance	This study will rely on the information that will be given by the respondents and further look at more indicators that were not studied by studies carryout out so far.

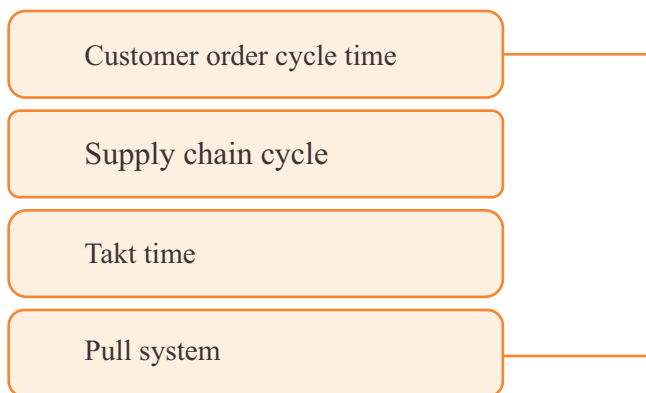
Study	Area of the Study	Methodology	Main Findings	Knowledge Gap	Focus of the current Study
Othman et al., (2016)	Relationship between supply chain integration, just-in-time and logistics Supply Chain performance.	Data were collected using mail questionnaires which were distributed to suppliers of Malaysian automotive manufacturers.	Supply chain integration, JIT purchasing and JIT manufacturing had direct and significant benefits to logistics performance.	This study investigated JIT purchasing and purchasing as constructs of supply chain.	The current study will investigate JIT purchasing as one of the component of the current study to provide the true picture of Kenyan situation
Mazanai, (2016)	Impact of application of Just-In-Time (JIT) delivery inventory management system in the manufacturing sector SMEs.	The study adopted descriptive survey research design. Self-administered questionnaires were used to collect data	Majority of SMEs in the manufacturing sector were not applying the JIT delivery inventory management principles.	The study investigates application of Just-In-Time (JIT) delivery inventory management system without clearly indicating the construct used to conduct the study.	The current study will clearly show the construct to be used to measure the JIT and how it affects supply chain performance in manufacturing sector in Kenya.
Ganiyu, Henry and Adekunle, (2019)	Effect of Just-in-time delivery on the financial performance of manufacturing organizations.	Descriptive survey research design was used Primary data were collected through a self-administered questionnaire	The findings of the study revealed that 39.4 and 16.3% variations in cost reduction and returns on investment are due to the impact of JIT delivery.	The study investigated how Effect of Just-in-time delivery on the financial performance however, the current study will show the effect of JIT of supply on supply chain performance.	The current study will indicate how application of JIT influence supply chain performance which is crucial process in manufacturing sector
Kinyua, (2015)	Nature of just-in-time delivery system on organization performance.	The study adopted a descriptive survey design. A questionnaire was used to gather primary data.	The study found out that JIT delivery system had positive effects on the organization.	The study investigates how JIT enhance organization performance. This study generalized the performance	The current study will specific construct of JIT on supply chain performance rather than general organization performance.
Betty (2015)	Factors affecting JIT inventory management practices at Nakumatt Supermarket	Data was collected by structured questionnaires. The study applied a case study research design.	The study established adoption of JIT delivery technique was very effective in enhancing the overall supply chain management at Nakumatt.	The study was conducted in service sector which deal with final products and supplying direct to the consumers	The current study will be conducted to the manufacturing sector where other players are involved in the business.

Study	Area of the Study	Methodology	Main Findings	Knowledge Gap	Focus of the current Study
Macharia and Mukulu, (2016)	role of just-in-time purchasing on realization of an efficient supply chain management	Cross-sectional research survey design. Questionnaires were used to collect data.	The findings revealed employed continuous improvement, and supplier relationship management significantly affect supply chain management efficiency.	The study was conducted in a Bidco Oil company.	The current study will focus on different parameters rather than the same used in the study.
Otieno and Odari, (2017),	role of pull scheduling on supply chain performance in the manufacturing sector in Kenya performance in public sector	Data was collected using questionnaire stratified random sampling	The study established indicated that 76.3% of change in Supply Chain Performance at LBDA can be explained by JIT components adopted	The study was conducted in a LBDA which may not present in the true picture across all sectors.	The study will be specifically conducted at of crown paint to establish the application of JIT on supply chain performance

### Conceptual Framework

A conceptual framework is a diagrammatic representation of the relationship that exists between study independent and dependent variables. For the purpose of this study, independent variables are customer order cycle, supply chain cycle, takt time and pull system. On the other hand, the study dependent variable is supply chain performance as illustrated by figure 2.1.

#### Independent Variables



#### Dependent Variable



**Figure 2.1 Conceptual Framework**

**Operationalization of Variables**

**Operationalization of Variables**

Variable	Indicators	Measurement Scale
Customer order Cycle Independent Variable	Reduced storage costs Reduced inventory management costs Demand forecasting Value Flexibility	Likert/ordinal
Supply Chain Cycle Independent Variable	Reduced inventory carrying costs Reduced insurance costs Less cash in short-term Efficient use of warehouse space	Likert/ordinal
<b>Takt time</b> Independent Variable	Overall equipment efficiency  Down time allowances Quality manufacturing Customer satisfaction	Likert/ordinal
<b>Pull system</b> Independent Variable	Make to order production Kanban pull Sequential pull Replenishment pull	Likert/ordinal
<b>Supply chain performance</b> Dependent Variable	Optimal and on-time deliveries Effective demand forecasting  Faster inventory turns Standardization of inventory movements	Likert/ordinal

**METHODOLOGY**

**RESEARCH DESIGN**

This research problem was studied through the use of a descriptive research design. According to Cooper and Schindler (2003) a descriptive study is concerned with finding out the what, where and how of a phenomenon. This study therefore was able to generalize the findings to specific departments within Crown Paint involved in procurement practices.

**TARGET POPULATION**

The population in this study was the Crown Paint Company. The target population of this study was 279 staff in various departments in Nairobi, Kisumu and Mombasa ports. These figure was obtained from HR department from Crown Piantis Limited. Mugenda and Mugenda (2003) explained that the target population should have observable characteristics to which the researcher intends to generalize the result of the study. This definition assumes that the population is not homogeneous.

**Table 3.1 Target Population**

Category	Frequency
Procurement Officers	67
ICT Officers	36
Finance	21
Production staff	35
Quality Assurance Staff	15
Administration Staff	40
Safety Staff	25
Transport & Logistics staff	40
<b>Total</b>	<b>279</b>

### SAMPLE SIZE AND SAMPLING TECHNIQUE

The study employed stratified random sampling technique in coming up with a sample size of 81 respondents from a total of specific departments from Crown Paint LTD, this represents 30% of the total population. Mugenda and Mugenda (2003) states that for descriptive studies 10%-30% of the accessible population is a representative sample.

**Table 3.2 Sample Size**

	Frequency	Sample Population	Sample size
Procurement Officers	67	0.3	20
ICT Officers	36	0.3	11
Finance	21	0.3	7
Production staff	35	0.3	5
Quality Assurance Staff	15	0.3	6
Administration Staff	40	0.3	12
Safety Staff	25	0.3	8
Transport & Logistics staff	40	0.3	12
<b>Total</b>	<b>279</b>	<b>0.3</b>	<b>81</b>

### RESEARCH INSTRUMENTS

The study employed a questionnaire to collect primary data. Questionnaires are appropriate for the study since they collect information that will not directly be observable as they inquire about feelings, motivations, attitudes, accomplishments as well as experiences of individuals (Mellenbergh, 2008). The questionnaire comprised of both open and close-ended questions. Franker (2006) stated that a questionnaire is useful in obtaining objective data because participants are not manipulated in any way by the researcher. Further, a questionnaire has the added advantage of being less costly and using less time as an instrument of data collection. The data instrument addressed the four research objectives while it was sub-divided into two sections.

### PILOT TESTING OF RESEARCH INSTRUMENTS

Cooper and Schindler (2003) indicated that a pilot test is conducted to detect weaknesses in design and instrumentation and to provide proxy data for selection of a probability sample. The pilot testing was conducted using the questionnaire on 10 staff in the same institution. The rule of thumb is that 10% of the sample should constitute the pilot test (Cooper & Schindler, 2003). The proposed pilot test is within the recommendation. The pilot testing group was selected through

random sampling technique. The purpose of the pilot testing was to establish the validity and reliability of the research instruments and hence enhance face validity (Joppe, 2000).

### DATA ANALYSIS

The study generated both qualitative and quantitative data. Quantitative data was coded and entered into Statistical Packages for Social Scientists (SPSS Version 21.0) and analysed using descriptive statistics. As Martin and Acuna (2002) observed SPSS is able to handle large amounts of data, and given its wide spectrum of statistical procedures purposefully designed for social sciences, it is also quite efficient. Qualitative data was analysed based on the content matter of the responses. Responses with common themes or patterns were grouped together into coherent categories. In addition, the researcher used multiple regression analysis to establish the strength of the relationship between the dependent and independent variables. The study also employed inferential statistics to establish effect of just in time inventory management technique on supply chain performance in processing firms. Specifically, the study used Spearman correlation to establish this relationship.

The regression equation is:

$$Y = \beta_0 + \beta_1 CO_1 + \beta_2 SC_2 + \beta_3 TT_3 + \beta_4 PS_4 + \alpha$$

Where: Y is the dependent variable (organization performance),

$\beta_0$  is the regression coefficient,

$\beta_1, \beta_2, \beta_3$  and  $\beta_4$  are the slopes of the regression equation,

$CO_1$  is the Customer order cycle

$SC_2$  is the Supply chain cycle

$TT_3$  is Takt time,

$PS_4$  is pull system

$\alpha$  is an error term normally distributed about a mean of 0 and for purpose of computation, the  $\alpha$  is assumed to be 0.

### DATA ANALYSIS, PRESENTATION AND INTERPRETATION

The study targeted a total of 81 employees from procurement officers, ICT officers, finance, production staff, quality assurance staff, administration staff, safety staff, and transport and logistics staff from crown paint limited. However, out of the 81 targeted employees of crown paint, the researcher was only able to obtain complete data for 70 employees representing a response rate of 86%. The response rate of 86% was deemed sufficient for the purpose of data analysis as Mugenda and Mugenda (2003) notes that a response rate of 50% is adequate for analysis and reporting, 60% is good and a response rate of 70% and over is excellent.

**Table 4.1 Response Rate**

Response	Frequency	Percentage (%)
Filled in questionnaires	70	86
Un returned questionnaires	11	14
<b>Total</b>	<b>81</b>	<b>100</b>

### CUSTOMER ORDER CYCLE AND SUPPLY CHAIN PERFORMANCE

#### Model Summary for Customer Order Cycle

The study investigated the contribution of customer order cycle on supply chain performance at Crown paint. The study established that customer order cycle contributes up to 45% to supply chain performance. This is as indicated by R 0.673 which indicates a strong positive correlation and also the  $R^2 0.453$  as shown in table below.

### Model Summary for Customer Order Cycle

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.673	0.453	0.429	0.101316

### ANOVA for Customer Order Cycle

In this study, the research tested the linearity between customer order cycle and supply chain performance at Crown Paints. Based on the output, customer order cycle had a value Significance of 0.003 which is much less than 0.05. Thus, we can conclude that there was linear relationship between customer order cycle and supply chain performance.

#### ANOVA for Customer Order Cycle

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0.067	1	0.067	9.932615	0.00262774
	Residual	0.371	55	0.006745		
	<b>Total</b>	<b>0.438</b>	<b>56</b>			

### Coefficients Correlation for Customer Order Cycle

The study also establishes that there was significance relationship between customer order cycle and supply chain performance (sig=.009, sig <0.05). The results presented in table below show that the influence of customer order cycle on supply chain performance was significant (F =9.9326, p <0.05).

#### Coefficients Correlation for Customer Order Cycle

Model	Unstandardized Coefficients		Standardized Coefficients		t	Sig.
	B	Std. Error	Beta			
Constant	0.452	0.147			3.065	0.004
Employee Training	0.473	0.186	0.391		2.548	0.015

## SUPPLY CHAIN CYCLE AND SUPPLY CHAIN PERFORMANCE

### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.661	0.437	0.423	0.084422

### ANOVA for Supply Chain Cycle

In this study, the research tested the linearity between supply chain cycle and supply chain performance at Crown paint. Based on the output, supply chain cycle had a value Sig. of 0.002 which is less than 0.05. Thus, we can conclude that there was linear relationship between supply chain cycle and supply chain performance at Crown paint.

**ANOVA for Supply Chain Cycle**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0.221	1	0.221	43.25623	0.00187
	Residual	0.281	55	0.005109		
	<b>Total</b>	<b>0.502</b>	<b>56</b>			

**Coefficients for Supply Chain Cycle**

The study also establishes that there was significance relationship between supply chain cycle and supply chain performance (sig=.017, sig <0.05). The results presented in table below show that the influence of chain cycle and supply chain performance was significant (F =43.256, p <0.05).

**Table 4.11 Coefficients for Chain Cycle and Supply Chain Performance**

Model	Unstandardized Coefficients		Standardized Coefficients		Sig.
	B	Std. Error	Beta	t	
Constant	0.28	0.099		2.834	0.000
Chain Cycle	0.673	0.121	0.661	5.571	0.017

**TAKT TIME AND SUPPLY CHAIN PERFORMANCE**

**Model Summary for Takt Time**

The study investigated the contribution of Takt Time on supply chain performance. The study established that Takt Time contributes to 47% to the e supply chain performance. This is as indicated by R=0.683, indicating a strong positive correlation and R<sup>2</sup>0.467 as shown in table below.

**Model Summary for Takt Time**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.683	0.467	0.225	0.0572288

**ANOVA for Takt Time**

In this study, the research tested the linearity between Takt Time and supply chain performance. Based on the output, takt time had a value Sig. of 0.008 which is greater than 0.05. Thus, we can conclude that there was linear relationship between Takt Time and supply chain performance at Crown Paint.

**ANOVA for Takt Time**

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	0.013	1	0.013	6.44	0.014
	Residual	0.111	55	0.002		
	<b>Total</b>	<b>0.124</b>	<b>56</b>			

### Coefficients Correlation for Takt Time

The  $\beta$  was also statistically significant ( $\beta = 0.367, t=2.233, p < 0.05$ ). The hypothesis that Takt Time influence supply chain performance was therefore confirmed because there was a statistically significant influence of Takt Time on supply chain performance at Crown Paint.

#### Coefficients Correlation for takt time

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	0.428	0.148		2.892	0.006
Takt Time	0.4332	0.194	0.367	2.233	0.031

### PULL SYSTEM AND SUPPLY CHAIN PERFORMANCE

#### Model summary for Pull system

The study investigated the contribution of pull system on supply chain performance at crown paint. The study established that pull system contributes 52.7% to the supply chain performance at Crown paint. This is as indicated by R 0.514, thus indicating a strong positive correlation and  $R^2 0.453$  as shown in table below.

#### Model summary for Pull System

R	R Square	Adjusted R Square	Std. Error of the Estimate
.726	0.527	0.514	0.61651

### ANOVA Results

In trying to test the significant of the model, the study used ANOVA. From table 4.20 the significance value is 0.0016 which is less than 0.05 thus the model is statistically significance in predicting the relationship between pull system and supply chain performance. The F critical at 5% level of significance was 61.38298. Since F calculated is greater than the F critical (value = 61.383), this shows that the overall model was significant.

#### ANOVA for Pull System

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0.577	1	0.577	61.383	0.0016
	Residual	0.517	55	0.0094		
	<b>Total</b>	<b>1.094</b>	<b>56</b>			

### Coefficients Correlation for Pull System

The  $\beta$  was also statistically significant ( $\beta = 0.235, t=2.546, p < 0.05$ ). The hypothesis that pull system influence supply chain performance was therefore confirmed because there was a statistically significant influence of pull system on supply chain performance at crown paint.

**Coefficients Correlation for Pull System**

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.548	0.261		2.102	0.037
Pull System	0.235	0.092	0.231	2.546	0.012

**INFERENCEAL ANALYSIS**

To compute the correlation between dependent variable and the independent variables the study conducted inferential analysis which involved Karl Pearson's coefficient of correlation, regression analysis, model summary and a multiple regression analysis.

**Karl Pearson's Coefficient of Correlation**

To show correlation between the study variables, the study used the Karl Pearson's coefficient of correlation (r). From the findings, it was clear that there was a positive correlation between customer order cycle and supply chain performance as shown by a correlation figure of 0.523, it was also clear that there was a positive correlation between supply chain cycle and supply chain performance with a correlation figure of 0.614, there was also a positive correlation between Takt time and supply chain performance with a correlation value of 0.746 and a positive correlation between pull system and supply chain performance with a correlation value of 0.520. This therefore shows that there was a positive correlation between supply chain performance, customer order cycle, supply chain cycle, Takt time and pull system.

**Coefficient of Correlation**

		Supply chain performance	Customer order cycle	Supply chain cycle	Takt time	Pull system
<b>Supply chain performance</b>	Pearson Correlation Sig. (2-tailed)	1				
<b>Customer order cycle</b>	Pearson Correlation Sig. (2-tailed)	0.523 0.002	1			
<b>Supply chain cycle</b>	Pearson Correlation Sig. (2-tailed)	0.614 0.001	0.341 0.004	1		
<b>Takt time</b>	Pearson Correlation Sig. (2-tailed)	0.740 0.003	0.120 0.010	0.0621 0.0043	1	
<b>Pull system</b>	Pearson Correlation Sig. (2-tailed)	0.520 0.012	0.340 0.001	0.0000 1.000	0.160 0.001	1

**Regression Analysis**

Further the researcher conducted a multiple regression analysis so as to establish the relationship between just in time inventory management technique on supply chain performance in processing firms with focus to crown paint. The main purpose of multiple regressions is to show the link between several independent or predictor variables and a dependent or criterion variable. The researcher applied the statistical package for social sciences (SPSS) to code, enter and compute the measurements of the multiple regressions for the study.

## Multiple Regression

Multiple regression analysis was conducted to determine the relationship between just in time inventory management technique and supply chain performance and the four variables. As per the SPSS generated in table 4..., the equation is:

$$(Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \epsilon) \text{ becomes:}$$

$$Y = 1.308 + 0.558X_1 + 0.785X_2 + 0.620X_3 + 0.731X_4$$

The regression equation above established that taking all factors into account (customer order cycle, supply chain cycle, takt time and pull system) constant at zero, supply chain performance will be 1.308. The findings presented also shows that taking all other independent variables at zero, a unit increase customer order cycle will lead to a 0.558 increase of supply chain performance; a unit increase in supply chain cycle will lead to a 0.731 increase of supply chain performance; a unit increase in takt time will lead to a 0.785 increase in supply chain performance and a unit increase in pull system will lead to a 0.620 increase in supply chain performance. This infers that takt time contributes most to supply chain performance followed by supply chain cycle then pull system while customer order cycle contributed little to supply chain performance. This notwithstanding, all the variables were significant as their P-values were less than 0.05.

### Regression Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	std. Error	Beta	t	Sig.
(Constant)	1.308	0.342		1.623	3.57-02
Customer order cycle	0.558	0.310	0.172	4.342	2.76-02
Supply chain cycle	0.731	0.156	0.210	3.532	2.85-02
Takt time	0.785	0.322	0.067	3.542	2.02-02
Pull system	0.620	0.245	0.148	3.458	2.49-02

## Model Summary

### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.815	0.664	0.314	0.4211

Coefficient of determination explains the extent to which changes in the dependent variable can be explained by the change in the independent variables or the percentage of variation in the dependent variable (supply chain performance) that is explained by all the four independent variables (customer order cycle, supply chain cycle, takt time and pull system). The four independent variables that were studied, explain only 66.4% of the supply chain performance as represented by the adjusted R<sup>2</sup>. This therefore means that there are other factors not studied in this research that contribute 33.6% of the supply chain performance. Therefore, further research should be conducted to investigate the other (33.6%) JIT parameters which influence supply chain performance.

## RESEARCH FINDINGS

The objectives of this study were to investigate the relationship between customer order cycle, supply chain cycle, takt time and pull system on supply chain performance in processing firms with focus to crown paint.

The study aimed at determining the relationship customer order cycle on supply chain performance of crown paint. The study found that reduced storage costs, demand forecasting, value flexibility influence supply chain performance to a

great extent. The study established that customer order cycle contributes up to 45% to supply chain performance. Customer order cycle had a value Significance of 0.003 which is much less than 0.05. Thus, we can conclude that there was linear relationship between customer order cycle and supply chain performance. The study found that there is significant influence of customer order cycle on supply chain performance as shown by ( $F=9.9326, p<0.05$ ).

To the objective of effect of supply chain cycle on supply chain performance of crown paint. The study found that efficient use of warehouse space, cash in short-term, reduced insurance costs influence supply chain performance. The study found that supply chain cycle contributes to 0.44% to supply chain performance. The study also established that there was significant relationship between supply chain cycle and supply chain performance with Sig. of 0.002 which is less than 0.05. Influence of chain cycle and supply chain performance was significant ( $F=43.256, p<0.05$ ).

To the influence of takt time on supply chain performance of crown paint. Based on the parameters measured, the study established that down time allowances, quality manufacturing and customer satisfaction influence supply chain performance to a great extent. The study established that Takt Time contributes to 47% to the e supply chain performance. Additionally, the study established that takt time had a value Sig. of 0.008 which is greater than 0.05 showing that was linear relationship between Takt Time and supply chain performance at Crown Paint. significant influence of Takt Time on supply chain performance as ( $\beta=0.367, t=2.233, p<0.05$ ).

On the influence of investigate the pull system on supply chain performance of crown paint. From the study findings, Kanban pull, Sequential pull and Replenishment pull were found to influence supply chain performance to a great extent. The study established that pull system contributes 52.7% to the supply chain performance. The study established that the overall relationship between pull system and supply chain performance was significant.

## CONCLUSION

The study aimed at finding out relationship between just in time inventory management technique on supply chain performance in processing firms with focus to crown paint. Based on the findings the study made the following conclusion.

To the effect of customer order cycle on supply chain performance of crown paint. The study concluded that, reduced storage costs, demand forecasting, value flexibility influence supply chain performance to a great extent. The study concluded that customer order cycle influence supply chain performance. There was significant relationship between customer order cycle and supply chain performance.

On effect of supply chain cycle on supply chain performance of crown paint. The study concludes that efficient use of warehouse space, cash in short-term, reduced insurance costs influence supply chain performance. The study concludes that supply chain cycle contributes to supply chain performance, and that there was significant relationship between supply chain cycle and supply chain performance.

With regard to the influence of takt time on supply chain performance of crown paint. Based on the parameters measured, the study concludes that down time allowances, quality manufacturing and customer satisfaction influence supply chain performance to a great extent. The study established that Takt Time contributes to supply chain performance. Additionally, the study concludes that there was linear relationship between Takt Time and supply chain performance. There was significant influence of Takt Time on supply chain performance.

On the influence pull system on supply chain performance of crown paint. From the study findings, Kanban pull, Sequential pull and Replenishment pull were found to influence supply chain performance to a great extent. The study concludes that pull system contributes to the supply chain performance. The study concludes that there is overall significant relationship between pull system and supply chain performance.

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