

# Effect of ICT on Successful Implementation of Vendor Managed Inventory among Manufacturing Firms in Nakuru County, Kenya

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**Abstract:** *This study sought to assess the factors affecting successful implementation of VMI among manufacturing firms in Nakuru County. The study was motivated by the fact that despite the evidence of value addition by the VMI technique towards effective and efficient supply chain, there has not been enough research on the topic. In addition, most manufacturing firms especially in Kenya are yet to adopt and successfully implement the technique in enhancing their supply chain performance. As a result, this study used a descriptive census design to enhance the understanding of VMI towards its successful implementation among manufacturing firms. The data for this study were obtained using questionnaires which were structured in both open and closed ended questions. The analysis of data was conducted using SPSS program. Regression analysis was conducted to measure relationship between the variables of study. Findings of this study were considered significant in enhancing strategies towards effective implementation of VMI among supply chain participants and line organizations. The study also sought to add knowledge to the existing literature on VMI technique and highlight the relationship between VMI and supply chain performance. The findings of the study indicated that the various factors of VMI implementation had a statistical significant relationship with successful implementation of the strategy. This led to the rejection of all the hypotheses of the study. For successful implementation of VMI, the study concluded that there should be extensive sensitization on the VMI strategy and its benefits towards enhancing supply chain performance. In addition, quality information should be shared among supply chain partners to enhance confidence and trust that was considered critical to successful implementation of VMI strategy. The study also concluded that ICT is key to the successful implementation of VMI strategy. The study recommended EDI as the major IT platform that should be utilized to enhance the success of VMI among manufacturing firms.*

**Keywords:** Vendor Managed Inventory, Stock Management, Vendor, Electronic Data Interchange, Just in Time Distribution and Bull whip.

## 1. Introduction

A Vendor Managed Inventory is a collaborative strategy between a customer and supplier to optimize the availability of products at a minimal cost to the two parties. The supplier takes the responsibility for the operational management of the inventory within a mutually agreed framework of performance targets which are constantly monitored and updated to create an environment of continuous improvement. A VMI consignment is essentially an arrangement whereby the owners of goods, the “consignor”, delivers its goods to another party, the “consignee”, for use or for sale by the consignee, with the proceeds of the sale being remitted to the consignor only after the actual use or sale [11]. A typical VMI program involves a supplier which monitors inventory levels at its customer’s warehouses and assumes responsibility for replenishing that inventory to achieve specified targets through the use of highly automated electronic messaging systems [8]. The supplier thus makes the replenishment decision, rather than waiting for the customer to reorder the product. Anecdotal evidence suggests that a consignee may enjoy reductions in holding costs and some operational costs plus cash flow benefits [8], while a consignor needs to bear the burden (of inventory carrying and demand forecasting) but probably gain chances to improve other production and marketing efficiency [9]. Thus a systematic evaluation of the profit implications of a VMI program on both trading partners will certainly facilitate future supply chain coordination. Increased complexity and highly integrated supply chain in current business environment has increased

pressure for companies to adapt to current competitive pressure globally. In the recent past, there has been increased interest in the need for cooperation between the buyer and the supplier [5] as a competitive strategy. Contemporary research in supply chain management relies on an increased recognition that an integrated plan, for the chain as a whole, requires coordinating different functional specialties within a firm (e.g., marketing, procurement, manufacturing, distribution, etc.). Consequently, emphasis on supply-chain coordination has increased in recent years [2], [15], and [24]. The vendor managed inventory technique is a novel approach to the management of inventories in supply chains. It is based on an improved collaboration between the company and its suppliers, one that is acquiring growing importance in industrial environments.

## 2. Statement of the Problem

The Vendor Managed Inventory is an industrial strategy for inventory management in supply chains that may be a strategic and profitable approach to stock management in uncertain environments where delivery lead times and or market demand vary over time. According to past studies [3], some firms have successfully improved their supply chain performance by implementing an approach known as vendor managed inventory (VMI), with VMI the specific delivery quantities are sent to customers through channel using data obtained from EDI. On the other hand, this policy as a strategic method for coordinating supply chain models is a relatively recent development. It has not been investigated until its introduction into the automobile

industry and moreover, not until a study was conducted [5]. In addition, VMI concept has been successfully used in many industries such as; automobile, retail, E-commerce, and construction. However its application in commodity sector is in the stage of infancy and is exposed to many challenges. In this regard, various manufacturing firms which have attempted to implement VMI technique have reported failure and found themselves in a dilemma situation irrespective of the numerous benefits attested to the technique in enhancing supply chain performance. In Kenya, the concept of Vendor Inventory Management has not yet been widely embraced by many manufacturing firms and this has made such organizations to experience increased cost in the execution of inventory management functions [4]. This study seeks to find out the factors affecting the successful implementation of VMI in enhancing supply chain performance among manufacturing firms. The research is motivated by the critical role played by VMI in enhancing the supply chain performance, being an under researched area of study and reported failures in its implementation among manufacturing firms.

### 3. Objective of the Study

#### 3.1 General objective

To investigate the factors affecting successful implementation of VMI among manufacturing firms in Nakuru County.

#### 3.2 Specific Objective

To assess the effect of information communication and technology on the successful implementation of VMI strategy

### 4. Research Hypothesis

The study was guided by the following research hypothesis  $H_0$ : Information communication and technology has no significant effect on the successful implementation of VMI strategy.

### 5. Conceptual Framework

The conceptual framework illustrates how the independent variable relates to the dependent variable. The dependent variable of the study is successful implementation of VMI while the independent variable is the Information and Communications Technology (ICT)

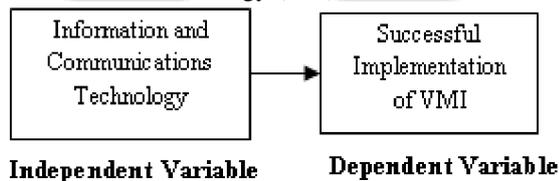


Figure 1: Conceptual Framework

### 6. Literature Review

This chapter presents a review of both the theoretical and empirical literature on working capital management with a

specific interest in working capital financing. The theoretical framework encapsulates the reviewed theories which will form the basis of the study. The empirical studies were reviewed in line with the study objectives and were conceptualized into a framework

#### 6.1 Theoretical Literature

In this section, the researcher reviewed the theories relevant to the successful implementation of Vendor Managed Inventories

##### 6.1.1 Rogers' Diffusion of Innovations Theory

The process of adopting new innovations has been studied for over 30 years, and one of the most popular adoption models is described by Rogers in his book, Diffusion of Innovations [20]. Much research from a broad variety of disciplines has used the model as a framework. Past studies mentioned several of these disciplines as political science, public health, communications, history, economics, technology, and education, and defined Rogers' theory as a widely used theoretical framework in the area of technology diffusion and adoption [10], [22]. Rogers' diffusion of innovations theory is the most appropriate for investigating the adoption of technology in higher education and educational environments [16]. In fact, much diffusion research involves technological innovations so that [19] usually used the word "technology" and "innovation" as synonyms. For Rogers, "a *technology* is a design for instrumental action that reduces the uncertainty in the cause-effect relationships involved in achieving a desired outcome". It is composed of two parts: hardware and software. While hardware is "the tool that embodies the technology in the form of a material or physical object," software is "the information base for the tool" [19]. Since software (as a technological innovation) has a low level of observability, its rate of adoption is quite slow.

Elements in the Diffusion of Innovations according to Rodgers are adoption which is a decision of "full use of an innovation as the best course of action available" and rejection is a decision "not to adopt an innovation". Rogers defines diffusion as "the process in which an innovation is communicated through certain channels over time among the members of a social system". As expressed in this definition, innovation, communication channels, time, and social system are the four key components of the diffusion of innovations. Innovation; Rogers offered the following description of an innovation: "An *innovation* is an idea, practice, or project that is perceived as new by an individual or other unit of adoption" [19]. An innovation may have been invented a long time ago, but if individuals perceive it as new, then it may still be an innovation for them. The newness characteristic of an adoption is more related to the three steps (knowledge, persuasion, and decision) of the innovation-decision process that will be discussed later. In addition, Rogers claimed there is a lack of diffusion research on technology clusters. A technology cluster consists of one or more distinguishable elements of technology that are perceived as being closely interrelated [19].

Uncertainty is an important obstacle to the adoption of innovations. An innovation's consequences may create uncertainty: "Consequences are the changes that occur in an individual or a social system as a result of the adoption or rejection of an innovation [19]. To reduce the uncertainty of adopting the innovation, individuals should be informed about its advantages and disadvantages to make them aware of all its consequences. Moreover, Rogers claimed that consequences can be classified as desirable versus undesirable (functional or dysfunctional), direct versus indirect (immediate result or result of the immediate result), and anticipated versus unanticipated (recognized and intended or not).

Communication channels; the second element of the diffusion of innovations process is communication channels. A communication is "a process in which participants create and share information with one another in order to reach a mutual understanding" [19]. This communication occurs through channels between sources. Rogers states that "a source is an individual or an institution that originates a message. A channel is the means by which a message gets from the source to the receiver". Rogers states that diffusion is a specific kind of communication and includes these communication elements: an innovation, two individuals or other units of adoption, and a communication channel. *Mass media* and *interpersonal communication* are two communication channels. While mass media channels include a mass medium such as TV, radio, or newspaper, interpersonal channels consist of a two-way communication between two or more individuals. On the other hand, "diffusion is a very social process that involves interpersonal communication relationships" [19]. Thus, interpersonal channels are more powerful to create or change strong attitudes held by an individual. In interpersonal channels, the communication may have a characteristic of *homophily*, that is, "the degree to which two or more individuals who interact are similar in certain attributes, such as beliefs, education, socioeconomic status, and the like," but the diffusion of innovations requires at least some degree of heterophily, which is "the degree to which two or more individuals who interact are different in certain attributes." In fact, "one of the most distinctive problems in the diffusion of innovations is that the participants are usually quite heterophilous" [19]. Communication channels also can be categorized as *localite channels* and *cosmopolite channels* that communicate between an individual of the social system and outside sources. While interpersonal channels can be local or cosmopolite, almost all mass media channels are cosmopolite. Because of these communication channels' characteristics, mass media channels and cosmopolite channels are more significant at the knowledge stage and localite channels and interpersonal channels are more important at the persuasion stage of the innovation-decision process [19].

Time; the time aspect is ignored in most behavioral research [19]. He argues that including the time dimension in diffusion research illustrates one of its strengths. The innovation-diffusion process, adopter categorization, and rate of adoptions all include a time dimension. These aspects of Rogers' theory will be discussed later in more

detail.

Social system; the social system is the last element in the diffusion process. A social system is defined as "a set of interrelated units engaged in joint problem solving to accomplish a common goal". Since diffusion of innovations takes place in the social system, it is influenced by the social structure of the social system [19]. Structure is "the patterned arrangements of the units in a system". He further claimed that the nature of the social system affects individuals' innovativeness, which is the main criterion for categorizing adopters [19].

## 6.2 Empirical Literature

In this section, the researcher reviewed empirical studies touching on the successful implementation of Vendor Managed Inventory Strategy. The studies were reviewed in tandem with the study variable which captures the study objective

### 6.2.1 Information and Communications Technology

Established electronic capabilities are a common feature of VMI. Usually VMI suppliers and customers use an ERP system with an integrated database. EDI linkages are also one of the enabling features in VMI [12]. Extranets can provide the information needed but some ERP systems enable more profound inter-firm integration of planning and execution of systems. By having a thorough integration full visibility through multiple echelons of the supply chain can be provided [12]. Linked information systems were also mentioned [6] as something that leads to more collaborative planning. They also found out in their research that good IT infrastructure will make it more likely that good results are achieved from VMI.

VMI can be made working either through the customer's or the supplier's IT system, but to implement it with many different suppliers the solution should be owned by the customer [23]. The quality of information systems has also been forwarded as an enabler for VMI. The objectives of IT in supply chain management and thus VMI are: Providing information availability and visibility; enabling a single point of contact for data; allowing decisions based on total supply chain information; enabling collaboration with supply chain partners [21].

The quality of information systems consists of the need for a broad communication interface and clearly identified and direct communication channels [7], [25]. The compatibility of information systems has also been emphasized as an enabling factor [1], [13] and [25].

### 6.2.2 Electronic Data Interchange (EDI)

Electronic Data Interchange (EDI) is an effective tool for supply management that provides a way to transfer and use information among supply chain members [27]. The data in EDI is sent from a computer in one organization to a computer in another organization in a structured, predetermined way. EDI was originally developed more than 35 years ago but its use has not vanished due to popularization of Internet, rather it has expanded due to the expansion of communication capabilities and platforms for

it. In recent studies EDI has been reported as the most popular way of communicating between the supplier and the buyer [27]. Electronic Data Interchange (EDI) is commonly used in a VMI setting [12].

### 6.2.3 Enterprise Resource Planning (ERP)

The term ERP can be defined as an accounting-oriented information system for identifying and planning the enterprise-wide resources needed to take, make, ship and account for customer orders [14]. ERP programs are used as production planning and control tools. The supply chain competitiveness relies on how efficiently the information is shared between the members of the supply chain and this information can be shared by utilizing ERPs. "VMI programs do not require an ERP system, but since ERP systems are robust and scalable transaction-processing systems with an integrated database, they have become the typical enabling system platform for VMI." [12].

## 7. Research Methodology

The study was carried out using descriptive census design. The population of the study comprised all the manufacturing firms in Nakuru County. There were 22 manufacturing companies established in Nakuru County. The target population for the study comprised of the staff members of the managerial level of the entity majorly the supply chain managers and or procurement managers of the various entities. The sample for the study comprised the staff members of the 22 aforementioned firms. Given that the sample was equal to the target population a census method was justified. The study used questionnaire to obtain primary data. This was because questionnaires are fast, cheap and can be self administered [17]. The instrument was used since it was considered reliable and capable of obtaining detailed information on the topic of study. The questionnaire contained both open and closed ended questions for the purpose of giving the respondents a chance to provide more detailed information. The study also utilized secondary data from other publications where it will be considered necessary. To ascertain the reliability of data and data collection techniques, a pilot test was conducted using five questionnaires which will be distributed randomly among selected heads of procurement in various retail firms in Nakuru County. Reliability refers to the extent to which the data collection techniques or analysis will yield consistent findings. Therefore, the contents of the pilot test were used to modify and adjust questionnaires accordingly which enhanced their effectiveness and the procedure during actual data collection [18].

### 7.1 Data Processing and Analysis

The data gathered was analyzed using descriptive statistics which entails mean, standard deviation and percentages. The research used a statistical package SPSS version 21 to analyze and present data where data was presented in forms of tables, which were generated automatically by the SPSS program. To test the extent to which the independent variables affect the dependent variable, regression analysis was conducted. The following model applied;

$$Y = a + \beta_1 X_1 + e$$

Where:

Y = Successful implementation of VMI

A = Constant value

$\beta$  = Beta

$X_1$  = ICT

e = Error term

## 7.2 Research Findings

The findings of this study were based on questionnaires which were issued and returned on time by the various respondents. Out of the twenty two questionnaires that were issued among the various manufacturing firms, nineteen were returned accounting for 86% response rate.

### 7.2.1 Effect of ICT on successful implementation of VMI strategy

The following section presents findings on the effect of ICT on successful implementation of VMI strategy touching on the role of ICT and the ICT platform used in implementing the technique.

**Table 1: Role of ICT in VMI implementation**

	N	Min	Max	Mean	Std. Dev.
Implementation of VMI strategy requires technological investment	19	3	5	4.21	0.631
Extent to which IT enhance successful implementation of VMI	19	3	5	4.26	0.806
Provides information availability and visibility	19	4	5	4.89	0.315
Whether ICT enable a single point of contact for data	19	3	5	4.21	0.535
ICT allows decisions based on total supply chain information	19	2	5	3.95	1.026
ICT Enables collaboration with supply chain partners.	19	1	5	4.11	0.937

Table 1 presents the opinion of the respondents on the effect of ICT on the successful implementation of VMI strategy. It was revealed that successful implementation of VMI strategy requires technological investment as reported by majority of the respondents who agreed as indicated by the mean of 4.21. On the extent to which IT enhances successful implementation of VMI, majority of the respondents reported to a great extent (mean=4.26). The major role played by ICT towards implementation of VMI was reported by majority to be providing information availability and visibility as indicated by a mean of 4.89. Respondents also agreed (mean=4.21) that ICT enable single point of contact for data, that ICT allows decisions based on total supply chain information (mean=3.95) and that ICT enables collaboration with supply chain partners as indicated by a mean of 4.11 in Table 1 above.

**Table 2: IT platform applied by respondents**

	Frequency	Percent
Electronic Data Interchange (EDI)	13	68.4
Enterprise Resource Planner (ERP)	6	31.6
<b>Total</b>	<b>19</b>	<b>100</b>

The major IT platform applied by the majority of manufacturing firms was reported to be Electronic Data interchange at 68.4% while only 31% applied enterprise resource planner as show in Table 2 above.

### 7.2.2 Inferential Analysis

This section presents the results of the inferential statistics methods used to analyze the data. These were done with the aim of making useful statistical inference to the data. Hence, the study used regression analysis. Regression analysis was used to identify the most significant factor and also show the level of influence of the independent variables on the dependent variable. The findings were presented as follows

**Table 3:** Multiple linear regression analysis model summary

	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.685 <sup>a</sup>	.470	.364	2.76922

- Dependent Variable: Successful implementation of VMI
- Predictor: (Constant), Use of ICT

The results in Table 3 shows that the value obtained for R, which is the model correlation coefficient was  $r = 0.685$  which was higher than any zero order value in the table. The adjusted r-square value of,  $r = 0.364$ , also indicated that the regression model could explain for approximately 36% of the variations in the successful implementation of VMI in Nakuru county.

**Table 4:** Regression results

	Unstandardized Coefficients		t	P-Value
	B	Std. Error		
(Constant)	8.345	13.111	-0.637	0.001
ICT	0.885	0.386	2.292	0.001

Dependent variable: Successful Implementation of VMI

**Successful Implementation of VMI =  $8.345 + 0.885X_1$**

The results in Table 4 indicates ICT significantly affects successful implementation of VMI ( $p$ -value < 0.01). The results further show that ICT positively affects the implementation of VMI. This is interpreted to mean that the more an organization embraces ICT the more likely it is to be successful in VMI implementation. The findings led to the rejection of the null hypothesis ( $H_0$ : Information communication and technology has no significant effect on the successful implementation of VMI strategy.)

## 8. Summary, Recommendations and Conclusions

### 8.1 Summary

Concerning the effect of ICT on the successful implementation of VMI strategy, it was revealed that successful implementation of VMI strategy required a significant amount of technological investment. It was also observed that ICT enhanced successful implementation of VMI, hence, underscoring its central role in VMI. Essentially, the role of ICT towards implementation of VMI was providing information availability and visibility. ICT enabled single point of contact for data and allowed decisions to be based on total supply chain information. The findings also revealed that ICT enabled collaboration with supply chain partners. The findings on this variable clearly suggest that ICT provided the necessary platform for the

implementation of VMI. These results support the conclusions by a study conducted in the past in which it was found that linked information systems led to more collaborative planning and that by having a thorough integration full visibility through multiple echelons of the supply chain can be provided [12]. Good IT infrastructure will make it more likely that good results are achieved from VMI.

### 8.2 Conclusions

Concerning the effect of ICT on the successful implementation of VMI strategy, it was concluded that successful implementation of VMI strategy required a significant amount of technological investment. The study concluded that the major role played by ICT in successful implementation of VMI strategy was providing information availability and visibility by enabling a single point of contact for data. This enabled collaboration with supply chain partners as reported by the findings of the study where majority of respondents utilized EDI as the major IT platform. The study on this variable clearly suggested that ICT provided the necessary platform for the implementation of VMI hence there was conclusion that successful implementation of VMI significantly depends on the quality of ICT.

### 8.3 Recommendations

ICT enhanced successful implementation of VMI, hence, underscoring its central role in VMI. This means that more investment should be made on ICT particularly in the areas of training and capacity building. The study recommends EDI as the most suitable ICT platform to be utilized in implementing VMI strategy. Companies are recommended to embrace ICT for the successful implementation of Vendor Managed Inventory Strategy (VMI).

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