PROPOSED CONCEPTUAL FRAMEWORK OF INVENTORY MANAGEMENT USING THE JUST-IN-TIME (JIT) PHILOSOPHY

by

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Introduction

The current global economy, including national domestic economies, has undergone critical changes in the last decade. Over the last years saw productivity and efficiency becoming a major concern of both practitioners and academicinans. Thus, a growing interest in developing models to increase productivity and decrease production costs has been observed.

Because of these deve- lopments, Minifie and Davis (1986) stated that one area that has become a focal point since the 1960s is inventories (materials) management. Inventories have ome a vital part of business since these are only necessary for production and efficiency, these also contribute to custo- mer satisfaction. Stevenson (1996) further added that al- though the amounts and dollar values of inventories carried by different types of firms varies widely, a typical firm probably has about 30 percent its current assets and perhaps as much as 90 percent of its working capital invested in inventory.

However, excess inventory diminishes a firm’s ability to compete and particularly affects the competitive priorities of price, quality, flexibility and time (Chase and Aquilano, 1995). It is for this reason that Finch and Luebbe (1995) stated that the Just-in-time philosophy describes excss iventory as one of the key wastes to eliminate. Appropriate levels of inventory enhance all the competitive priorities because they protect a business from disruptions that could hinder its operation. Although the Just-in-time philosophy has been considered an effective means of in- ventory management, Bahadur (1995) argued that, as with the earliest proponents of just-in-time when they adopted the concept from Japan in the early 1980's JIT is not a perfect system. They also did not expect it to work for everyone. The main idea was primarily to eliminate the inefficiencies caused by excess inventories. Excess inventory frequently exists and these not only disrupt and hinder operations but also could be a result of poor decision making. Thus, Ellram (1995) notes that if all suppliers were perfectly dependable, if machines never broke down, and if demand could be forecasted with perfect accuracy, inventory needs would diminish.

In the light of the arguments cited concerning this production management strategy, this paper aims to develop an alternative conceptual framework for inventory management under the JIT philosophy. In the first section, the paper presents the nature, functions and costs, and basic concepts of inventory management system and the just-in-time philosophy. A review of related literature in the areas of inventory management and JIT provides substantial background on the development of the proposed framework. From these discussions, the second section of the paper presents the proposed alternative framework for inventory management under JIT philosophy.

The Nature and Basic Concepts of Inventories and the Just-in-time (JIT) Philosophy In the development of a framework on inventory management, it is significant that the nature, the functions and costs of inventory managements should be understood. This leads to the integration of basic concepts necessary in the formulation of framework.

Conceptually, Noori and Radford (1996) defines inventory as the stock of any item or resource used in organization. On the other hand, an inventory system is the set of policies and controls that monitors levels of inventory and determines what level should be maintained, when stock should be replenished, and how large order should be.

By convention, manufacturing inventory generally refers to materials entities that contribute or become part of a firm's product output. Stevenson (1996) classifies manufacturing inventory into: (1) raw materials and purchase parts, (2) partially completed goods, called work-in process (WIP), (3) finished-goods inventories (manufacturing firms) or merchandise (retail stores), (4) replacement parts, tools, and supplies, and (5) good-irv transit to warehouses or customers. In services, inventory generally refers to the tangible goods to be sold and the supplies necessary to administer the service.

Functions of Inventory. According to Hohenstein (1982), Janson (1986), Noori and Radford (1995), Chase and Aquilano (1995) Finch and Luebbe (1995), and Stevenson (1996), inventories serve a number of functions. Among the most important are (1) to maintain independence of operations, (2) to smooth production requirement, (3) to decouple operations, (4) to provide a safeguard for variation in raw material delivery time, (5) to take advantage of economic purchase-order size, and (6) to hedge against price increases.

According to Assad et al. 1992, it is convenient to classify inventory according to the function it serves within the firm. Hax and Candea (1984) identify four basic categories: (1) Pipeline inventories result from the flow of goods in production and transportation stages and include work-in-process and intransit inventories. (2) Cycle stocks or lot-size inventories result from procuring, transporting, or producing items in batches to take advantage of certain lot size economies or to meet technological constraints. (3) Seasonal inventories result when the demand for a product is seasonal; the firm builds inventory during low- demand periods in anticipation of the peak periods. (4) Safety stocks protect against uncertainties in demand for the goods or unreliable supply of inputs. Safety stock reduce the risk of shortages during surges of demand or when the supply of goods is interrupted.

Inventory Costs. Effective inventory (stock) management is a subject that leads to lower cost. According to Chase and Aquilano (1995), the following costs must be considered in making any decision that affects inventory size: (1) holding (or carrying) costs, (2) setup (production change costs, (3) ordering costs, and shortage costs.

Therefore, establishing the correct quantity j to order from vendors or the size of lots submitted to the firm's productive facilities involves a search for the minimum total cost resulting from I combined effects of four individual costs: hold-j ing costs, setup costs, ordering costs, and shon-l age costs.

JIT Inventory Management Principle. Schniederjans (1993) cites from Jordan (1988) that there are inventory management policies, rules, and procedures that are part of JIT. Six of the more commonly used of these can be chair acterized as JIT inventory management principles.

These principles include: (1) cut lot sizes and increase frequency of orders, (2) cut buffer inventory, (3) cut purchasing costs, (4) improve material handling, (5) seek zero inventory, and (6) seek reliable suppliers.

On the other hand, Just-in-time philosophy strives to maximize production effectiveness and efficiency by focusing on the continual reduction and eventual elimination of waste. Waste can be considered or expenditure that does not add value to a service or product. As cited by Finch and Luebbe (1995), Fujio Cho of Toyota describes waste as "anything other than the minimum amount of equipment, materials, parts, space, and workers time, which are absolutely essential to add value to the product. Toyota has identified seven prominent types of waste to be eliminated: (1) waste from overproduction, (2) waste of waiting time, (3) transportation waste, J4 inventory waste, (5) processing waste, (6) paste of motion, and (7) waste from product faefects.

In just-in-time, waste is eliminated in many ways. According to Noori and Radford (1995), one common approach to identifying waste is to expose problems so that they can be solved by eleminating things that conceal them. Although this approach may increase the short term impagt of the problem, it also creates an opportunity for long term improvement by exposing theproblem. Through this approach, just-in-time ac-complishes a number of specific objectives: simplify and increase the productivity of process, reduce inventory, involve the work force in decision making, and increase flexibility of facilities anf equipment.

Review of Related Literature

On Inventory Concepts and Models. While there have been many books and articles discussing the application of the Inventory and JIT concepts, present models on the selection an inventory control concept show several shortcomings. For one, according to Striekwold (1990, as cited from Grunwald and van der Liden, 1980), the suitability of a control concept is only indicated for rather extreme production situation. In practice, however, many industrial organizations are situated in the broad range of intermediate forms between these extremes. Hence, a more precise characterization of these intermediate forms would be necessary. Furthermore, the mathematical approach is mainly applied to simple situations (Forin, 1981). It has also been noted that quantitative comparisons have not been satisfactory, as different control concepts are compared for mutually different production situations (Krajewski, 1987). As also observed, none of the quantitative comparisons considers optimization of the control variables. If control concepts are not evaluated with optimal settings for control variables, the comparisons will not be fair.

However, some successful control concepts (models) that have been applied in manufacturing firms were illustrated by a number of authors. One of these was of Edward, Wagner, and Wood (1985, as cited by Assad, et al., 1992) who described Blue Bell's program for reducing its inventories. Blue Bell wanted to drastically reduce its large investment in inventory at a time of very high interest rate. According to them, since finished goods inventories accounted for two-thirds of the total inventory at Blue Bell, the inventory reduction required right control of these inventories. To achieve this objective, Blue Bell used the production and inventory planning process that comprises seven steps, each of which relies upon a different model.With inventory reductions in excess of $115 million over 21 months, Blue Bell's inventory reduction program was an unqualified success. The study concluded that well-established techniques of inventory planning are effective means of reducing inventory. Except for the marker2 selection model, all the models Blue used are covered in standard texts and are regularly taught to students. The study also concluded that the goal of reducing inventory led Blue Bell to alter its production planing in order to increase production flexibility. A somewhat unexpected (but pleasant) result was that this increase flexibility did not entail a greater fabric waste. Instead fabric waste was reduced by $1 million. Table 1 shows the production and inventory planning process at Blue Bell. The models are processed sequentially and the output of one model serves as the input to the next.

Aside from Blue Bell, another successful model illustration was made by Kleutghen and McGee (1985, cited by Assad, et al., 1992) who discussed a major inventory management program at Pfizer that reduced inventories by $23.9 million while increasing the level of customer service. According to them, as in many other successful inventory management programs, the key to inventory reduction at Pfizer is a clear understanding of the purpose served by inventories at different stages of the flow of materials through the manufacturing process.

To reduce inventories, Pfizer examined cycle stock, work-in- process, and safety stock inventories separately in each, stage of its production process. It then developed simple models to determine the appropriate sizes of inventories of each kind at each stage. Pfezer uses a material requirements planning (MRP) system to coordinate the timing of purchases with the projected production plan for finished goods. To improve this process, Pfezer fine-tuned the parameters of the MRP system, used a simple model to evaluate the purchasing economies associated with quantity discounts, and calculates safety-stock levels for purchased items. This reduced the inventory by $5.8 million.

Furthermore, the campaign3-sizing model for organic synthesis seeks the optimal number of batches to use for each item's production run. The problem in sizing each campaign is to determine the optimal number of batches that minimizes the sum of inventory carrying costs and changeover costs. The campaign sizes based on this model reduced inventory by $2.1 million. In addition, by using a scientific procedure for determining safety stock and taking the risk of stockouts into account explicitly, Pfizer was able to reduce its organic synthesis safety stocks by $5.1 million.

On the other hand, Golany, et. al., (1991) constructed a multi period and multi product liear goal programming (GP) model to provide HCL with a reliable production/inventory managerial control. The objective is to minimize a weighted sum of deviations from specified goals so as to keep the inventory system within desired bounds by appropriate penalties which reflect the relative importance of the goals (given within the constraint set). To apply this model they selected HCLs prime export product Q, characterized by a relatively large production cost. This product has a much greater economic significance in proportion on the overall production volume. Also, its profit contribution per on is relatively large, making it extremely undesirable to lose orders or clients. The mathematical model was used and the notation was divided into three categories: data, policy parameter, and decision variables. In the mathematical formulation, the constraints are separated into ordinary physical) restrictions and goal constraints.

According to them, the model that was constructed for HCL has the following advantages: (1) The model analyzes several products and several periods simultaneously, thus considering mutual effects among products and periods. (2) The model accounts for the conflicting objectives of the different departments at HCL. (3) The model offers a dynamic analysis across time, generating warning ahead of time. (4) The model is characterized by considerable flexibility, allowing deviations in capacity, production, and safety stock limitations. Furthermore, although, this model was contracted only for one important product and its associated materials, however, the same concepts can be used to extend the formulation so as to encompass all the materials involved HCL's production..

In an effort to reduce inventories, lead time, and improve customer service, the management at ABC decided to implement simple input/output (I/O) controls. According to Wight (as cited by Fry and Smith, 1987), I/O can be stated simply as: the input to a shop over the same time period. It was decided that these controls would e tested on only one product line to evaluate effectiveness of I/O before implementing in the entire shop. The product line chosen was pliers, which represented about 40% of total sales fcmth a finished goods inventory of $1.4 million and a WIP inventory of $1.9 million.

To implement I/O controls, the company used six-step procedure: first, management must shift from local efficiency performance measures to global throughput measures. Second, identify al1 bottleneck to determine the maximum system throughput. Third, Set maximum inventory levels between work stations. Fourth, reduce production lot sizes. Fifth, Work only on the correct items. And finally, set input equal to output.

As a result of implementing I/O, pliers WIP shrank 42% from $1.9 million to $1.1 million, resulting in an annual saving of $200,000 in holding cost. The backlog shrank 93% from $700,000 to $47,000, while customer service increases from below 70% to above 90%. Customer-quoted lead times decreased from 120 days to under 60 days.

As explained by Galvin (1989), to solve the problems faced by a Manufactures of Plastic Product, three model were used in a heuristic, stepwise fashion. These three models were: (1) linear- programming/transportation model (refer to Stevenson, 1986), (2) Economic- lot- Scheduling model (ELSM) with sequence-dependent setup costs (refer to Gavin, 1987), and (3) simulation model for the economic-lot-scheduling problem (refer to Galvin, 1987).

As result of implementing those models, an actual saving from maximum throughput (based on fiscal year 1986 versus fiscal year 1987, as follows :

Although the actual saving of over $500,000 per year are unique for this particular company, the 14% increase in production efficiency is significant.

Activity	$ Savings
Setup Costs (PolyP lines)	$ 105,000
Carrying Costs (@ 17%)	$ 136,000
PolyE Changeover Costs	$ 160,000
PolyE Labor Costs	$ 172,000
PolyE Electricity Costs	$200,000
Transportation Costs (Increase)	$(262,000)
TOTAL ANNUAL SAVING	$511,000

Ritchie and Tsado (1986) reviewed lot-sizing techniques for deterministic time-varying demand. The selection of the lot- sizing technique is also complicated by the nature of demand; when future demand is known exactly up to a clearly define time horizon, the optimal solution method of Wagner and Whitin (1958) can be used. In practice, however, future demand is rarely known exactly and can only be imprecisely forecast; there- fore methods which rely on a precise knowledge of demand far into the future have little practical application. Instead of having to understand 20 distinct techniques, Ritchie and Tsado (1986) classify the lot sizing techniques into three groups:

@Dl = Group 1.

@D2 = Minimizing holding and setup costs over the replenishment.

interval. There area two approaches (models) in this group: Silver-Meal Heuristic (Silver and Meal, 1973) and the Marginal Cost Approach (Groff, 1979).

@D1 = Group2.<MIS> <MI>

@D2 = Equal setup and holding costs.

There are three approaches (models) in this group: the Part-Period Algorithm (Mitra, et. al, (1983), the Simple Part-Period Algorithm (De Matties, 1968), and the Modified Economic Order Quantity (Mitra et. al., 1983).

@D1 = Group 3.

@D2 = Incremental Holding Costs.

There are three approaches (models) in this group: the Incremental Order quantity approach (Boe and Yilmaz, 1983), the Incremental Approach (Freeland and Colley, 1982), the Gaither's Rule (Gaither, 1981).

Furthermore, Ritchie and Tsado (1986) also reviewed the variation on the lotsizing rules. For some condition of demand, the rules described above do not perform well and this has stimulated the development of modifications to some of the rules in an effort to improve their performance. The modifications included rapidly decreasing demand (Silver and Miltenburg, 1968), frequent periods of zero demand (Silver and Miltenburg, 1968), Highly variable demand (Peterson and Silver, 1979), and low variability in demand (Gaither, 1983).

Additionally, Graff (1987) explains the limitations of cycle counting. Most of limitations discussed in his article arise from confusion between measurement and control. According to him, as a measurement system, cycle counting is adequate and usually necessary: as a control system, it is not equal to the task. Cycle counting should be treated just like any other inspection or quality control function at the end of a manufacturing process.

On JIT Inventory. Aside from the above concepts and studies in inventory, Pan and Liao (1989), Ritchie and Tsado (1986), and Graff (1987) introduced an inventory model under just-in-time purchasing agreements, a review of lot-sizing techniques for deterministic time-varying demand, and the limitations of cycle counting, respectively.

In their article, Pan and Liao (1989) used an order-splitting model to describe a JIT inventory system. In a JIT inventory system, the order quantity specified in the purchasing agreement may be large. To reduce the inventory carrying cost, Pan and Liao have to spit the order quantity into small deliveries and receive them frequently. They have also presented three simple rules for easy implementation of the model.

The model is intended for JIT system where production schedules are relatively stable and long term purchasing agreements are possible.

According to them, in a perfect JIT system, the quantity received in each delivery should be one unit. If daily delivery is possible, companies should try to achieve the goal of zero inventory. In practice, however, it may be infeasible for some companies to plan for receipts of thousands of items every day. In the case where everyday delivery is prohibitive, rational decisions on the optimal number of deliveries and the quantity to be received in each delivery are still needed. Therefore, the model proposed in this articles may be used to make a reasonable and efficient lot-sizing decision for a JIT system where daily delivery is too costly.

The success of Japanese industrial and manufacturing has been attributed to several factors, including government co-operation with and support for industry, Japanese management style, and cultural and social structure of Japanese society. Recently, much attention has been focused on Japanese production management techniques, especially on the design of just-in-time system and related implementation issues. Sev-ps; research methodologies have been used in e studies. Some researchers used an analytical ach model to JIT production (Germain, et al 1994 and Bitran and Chang, 1987), some used other computer simulation to study related design and adaptability problem (Chu and Shih, 1992).

Germain, et al. (1994) studied the effect of just-in-time selling on organizational structure. In leral, they found that: (1) there was positive,direct effect of uncertainty but no effect of JIT integration; (2) there were positive effects on performance control both from JIT selling and directly from uncertainty; (3) JIT selling positively affected specialization, whereas the effect of un-certainty was indirect and positive; (4) operations decentralization was predicted only by uncer-tainty directly; and (5) scheduling decentralization was inversely affected by JIT selling and by uncertainty indirectly. Finally, they noted that size predicts integration (<$Elambdasub2,2>), specialization (<$Elambda sub 4,2>), operations decentralization (<$Elambda sub 5,2>), and scheduling decentralization

(<$Elambda>sub 6,2 >) at 0.05 or better, as well as performance control (<$Elambda sub 3,2>) at 0.10. This demonstrated the size imperative commonly found in studies of structure and supported the inclusion of size as a control variable.

Focusing on a multiple-case analysis, Ferrin (1994) investigated planning just-in-time supply operation. He selected a sample three firms for investigation based on characteristics of the manufacturing process (make-to-stock or make-to-order), manufacturing volume, product, product value, position in the distribution channel, sales volume in dollars, and material value.

Ferrin (1994) found that all three cases support the conceptual distinction between supply macro and micro-channels. In every firms investigated, there were at least two different approaches for moving materials from supplier to plant. In two firms, the distinction between specific macro-channels was based on the daily quantity of material used and the quantity of material shipped. In the other firm, the distinction between the two JIT micro-channels was based on the nature of the supplier's business, either distributor or manufacturer. In his field investigation revealed that the JIT supply micro-channels employed by the research subjects were not totally consistent with the theoretical environment.

The study of Companies A and C illustrated the implementation of JIT supply was influenced by such contextual factors as product complexity, volume of production, and diversity of product line. These factors appeared to influence management perceptions of what was and beneficial. The three investigations returned mixed findings regarding the validity of model as a predictor of actual practices. Relating to the model as predictor, only one investigation comprehensively supported the model. Landeros, et al., (1995) introduce a model for developing and maintaining buyer-supplier partnerships. The development portion of the model consists of four stages: (1) buyer's expectations, (2) seller's perceptions, (3) mutual understanding and commitment, and (4) performance activity. However, certain problems in the performance activity stage can place the relationship in jeopardy and move the partnership to another stage: (5) corrective action. The model continues by illustrating three approaches to mitigate these performance problems and bring stability back to the relationship: (1) operational unilateral adjustment, (2) operational bilateral adjustment, and (3) managerial bilateral adjustment. Landeros, et al., (1995) added that the key to stable,

mutually beneficial buyer-supplier partnership over time is understanding how problems may enter a relationship and how they can best be eliminated.

Traditional accounting systems have failed to match revenues and expenses properly in today's JIT purchasing (Gagne and Discenza, 1992). According to them an alternative approach is to utilize activity based costing (ABC), which helps accurately measure overhead costs for a basis of cost allocation. Cost control is also improved because costs are identified with the activities that incurred the costs. Better cost control and better product mix decisions are facilitated by use of an ABC system. One of the most important facets of JIT purchasing is the concept of inventory reduction. Ansari and Heckel (1987) observe that many American managers, however, expect that they will loss in additional freight costs what they save from inventory reduction. In their article. Ansari and Heckel correct that misconception. According to them, it appears that the additional transportation costs associated with some JIT programs are viewed by a number of purchasing and materials managers as deterrents to using the JIT purchasing approach. In actuality, a perceptive manager should be concerned with the sum of all the incremental costs associated with a Jm program. Generally speaking, the major incremental costs to be considered axe shipping cosJ and inventory holding cost. In the firms studiedj the sum of these relevant costs favoured the utilization of JIT purchasing. In other words, inventory cost saving more than offset any additional transportation costs.

The article of Dion, et al., (1992) report the results of an investigation of the changes in the role of the professional buyer that result from JIT implementation. They interviewed samples of buyers, totaling 60 respondents. either face-to-face or by telephone. From a oped ating point of view, the study found that higher product quality and supplier service levels as well as closer buyer-supplier relationships develop. The role of the buyer was found to expand irm other functions of the business, such as production and marketing, focusing less on specific tran action details and more on the maintenance supplier relationships.

In 1989, Zamora evaluated the performance of the Just-in-Time in four Philippine manufacturing companies. Employing the case study a| proach, she found that the most important tor contributing to the success of the JIT effort is top management support. She added that the most important factor that influences the choice of specific JIT projects is the nature of manufacturing processes and equipment used in the company.

An Alternative Conceptual Framework for IT Inventory Management

Figure 1 shows an alternative conceptual framework for JIT inventory management. It reflects the methods of how to minimize total inventory costs while improving customer satisfaction while taking into consideration the factors lat influence implementation of an inventory lodel. This model was developed based on the eview of previous case studies, models and lit-rature. Although Figure 1 shows the overall framework for JIT, this paper focuses only on the wentory management component under JIT tailosophy.

Successful development and implementation of this model are achieved through the application and interaction of a various components. Those components are factors affecting the implementation, methods, and target areas of JIT.

In developing the small model, several factors such as manufacturing processes and type of facilities, product demand patterns, produci characteristics, supplier cooperation, top management support, and employee readiness and cooperation should be considered (Zamora 1989). Several methods could be used to implement an inventory model in certain target area of waste elimination. In process productivity, th elimination of unnecessary process steps, autc rnation and focus factories could be done t achieved increased process productivity. In terrr of worker involvement, the utilization of worker knowledge and talent, quality circles, empower workers and "jidoka" could be used to attain increased involvement among workers.

Total inventory reduction, which is the focus of the paper, could be achieved in terms of several alternative methods. It involves raw materials inventory, which consists of the inputs to the transformation process. It must not enter the physical system at a rate faster than outputs that are exiting the system, or inventory will accumulate. Thus, a company must receive purchased material at rate of consumption. Furthermore, the raw material reduction objectives cannot be adequately addressed without discussing the buyer/supplier relationships. Typically, one approach to developing more reliable supplier base is to reduce the number of supplier. A company must build relationship with suppliers through a system called partnering.

Work-in-process inventory is the goods within the production system. A technique known as batching has significant impact on the amount of WIP in the system. For the small batches to be economically feasible, changeover time must be reduced. Better design of processes and components has resulted in greater standardization of components, fewer components, and fewer changeovers. Better organization and training workers have made changeover easier and faster. Not only must batch sized be reduced, but each step in the process must also be linked to the demand for the final product to prevent inventory from accumulating. Companies use a so -called pull system to authorize the movement of the inventory from one work center to the next. Reducing the WIP inventory that exists between work centers exposes those work center that are prone to breakdowns. If a work center does not have a large buffer of WIP inventory, it may not be able to continue its work if there is a breakdown at a preceding work center, and an entire production line may stop soon thereafter. This model responds to this problem by greatly increasing the amount of preventive maintenance.

Finished goods inventories can be reduced by tying the production directly to the rate of consumption. If reduction rate is grater than the consumption rate, even for a short period of time, inventory will result. In reaction to demand fluctuation, companies typically have build up inventories during low demand times and have met high demand by supplying out of inventory and off the production line. Because high levels of finished goods inventories are taboo under JIT, this practice is limited. JIT companies strive to lock into a level load on-the plant for as long as possible. Furthermore, the reduction of inventory levels can contribute significantly to the development of differentiating capabilities through the direct linkages to price, quality, dependability, flexibility, and time.

The general objective of the JIT inventory management process is the elimination of waste through continuous improvement on all key aspects of the production process including the factors affecting the implementation of an inventory model and the methods used in the target areas. The results in increased performance could be measured in terms of increased process productivity, increased worker involvement and specifically, minimizing total inventory costs and improving customer satisfaction.

Conclusion and Recommendation

The effectiveness of the proposed JIT inventory management model, while conceptually developed based on previous case studies, depends largely to both internal and external support mechanisms of the organization. While the JIT philosophy has manifested remarkable contributions to productivity and efficiency in the developed countries, much has yet to be gained from it in the developing countries. Some problems can confound the adoption and implementation of JIT in the third world

sector, as in the case of Tanzania (Msimangin, 1993): financial constraints, inadequate supply of inputs required for the production mills to operate near capacity, international delivery delays, an inadequate transportation infrastructure, and unreliable product demand forecasts. These problems are also present in the

Philippines. Zamora (1989) identified several additional problems encountered in the implementation of JIT components in the Philippine setting: resistance to change, socio-cultural barriers, and lack of training, The success of any model or framework using the JIT philosophy must address these prob- j lems firmly. As in other cases, the successfti implementation of the proposed inventory management framework using the JIT philosophy could be achieved if existing local conditions aw considered to suit the requirements of the model] Flexibility of model adoption is therefore necessary.

Further, it is recommended that the proposed model be practically applied in applicable situations and empirical informal be obtained to improve the framework. In this sense, the proposed model will be tested as to its practical usefulness apart from being conceptual.

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