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Simulation and its Applications in Inventory Control

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ABSTRACT
Simulation is a representation of reality through the use of a model or other device which will react in the same manner as reality under a given set of conditions. The analytic techniques used in inventory management are not sufficient to tackle all the important managerial problems requiring data analysis .Only small scale systems are amenable to these models.In Inventory control, to provide efficient service to customers the problem of determining the optimal replenishment policy arises .The use of simulation enables a manager to provide an insight into certain managerial problems where analytic solutions of a model is not possible or where the actual environment is difficult to observe.The purpose of this paper is to demonstrate the use of simulation in the design of an inventory control

1. INTRODUCTION
Simulation is the process of imitating a real phenomenon with a set of mathematical formulas .Advanced computer programs can simulate weather conditions,chemical reactions,atomic reactions and even biological processes.In theory any phenomenon that can be reduced to mathematical data and equations can be simulated on a computer.One of the tricks to developing useful simulations ,is to determine which are the most important factors .In addition to imitating processes to see how they behave under different conditions,simulators are also used to test new theories .After creating a theory of causal relationships, the theorist can codify the relationship in the form of a computer program. If the program the behaves in the same way as the real process,there is a good chance that proposed relationships are correct.

An inventory control system should take into account key factors such as demand fluctuation based on market trends, spoilage in unstable goods such as food or chemicals, shrinkage due to spills, product damaged in shipping, and shrinkage caused by staff. Demand fluctuation based on market trends can only be predicted in a general sense by analyzing past precedences with similar products and how they relate to new items. In contrast, the spoilage of unstable goods is usually a very predictable process and can be minimized by effectively estimating how much product will be sold before the shelf-life of the item expires, thereby eliminating over-purchasing. Within inventory control, estimating the market demand for unstable goods and ensuring that the company does not buy too much or too little of a product is among the most difficult of tasks, and must be supported by large volume data samples before an informed decision can be made. Shrinkage due to spills can be minimized through the employee training programs, although the exact amount of shrinkage will vary dramatically between locations and require some real-world data gathering. Shrinkage due to internal and external staff can be virtually eliminated by enhancing systemic security protocols, including adequate security monitoring and loss-prevention technology.

During the past many years simulated models in inventory management are discussed by many researchers. Donald.L.Byrkett(1978) demonstrated the use of simulation in the design of a forecasting and inventory control system The use of alternate approximate modelling strategies was simulated using an analytic simulation model of the real system on a relatively large sample of parts. Andersson(1980) described hierarchical planning methods which can be utilized in connection with material requirements planning have been evaluated in a simulation study. A simulation based decision support system for multiproduct inventory control management is developed by Masood.A.Badri (1999)The model in this system permits the management to obtain an inventory system-wide view of the effect of changes in decision variables on the performance measures of a furniture manufacturingfirm..Arboleda(2005)described the use of reinforcement learning algorithms and artificial neural networks for the optimization of simulation models. Several types of variables are taken into account in order to find global optimum values. The benefits of approach are demonstrated through the example of an inventory control problem frequently found in manufacturing systems.Kattan(2010) studied first time simulation model of inventory control system in supply chain management using barcode and Radio Frequency Identification (RFID). The main objective of this model is to compare two inventory systems in a supply chain, one using RFID, versus the barcode The model will help company to

consider moving from a barcode system to the RFID application.

When simulating an inventory control systems project, it is important to take stock of all the key elements of real-world inventory control without overlooking the critical real-world factors. A well-designed inventory control simulation should include data based on the recommendations of front-line employees who know where losses occur that might otherwise go unnoticed.A simulation model is easier to explain to management personnel since it is a description of behavior of some system or process.Hence even a non-technical manager can comprehend situation more easily than a complex mathematical model.

2. HOW TO IMPLEMENT SIMULATION IN INVENTORY MANAGEMENT

Choosing an inventory control strategy for the simulation experiment requires an intimate knowledge of the specific nature of the business being analyzed. A small-scale greengrocer, for example, should focus their inventory control strategy on anticipating consumer demand and minimizing loss due to spoilage, whereas a large stable goods retailer such as Wal-Mart, Kmart or Target can afford to make large purchase orders of items, store them in a warehouse and distribute them internally while receiving volume purchasing discounts.

To provide efficient service to customers,it is necessary to choose reorder point with proper consideration of demand during lead time.If the lead time and demand of inventory per unit time both are random variables,then the simulation techniques can be applied to determine the effect of alternate inventory policies on a stochastic inventory system i.e. different combinations of order quantity and re-order point.Thus we run the inventory system artificially by generating the future observations on the assumptions of the same distributions.

In inventory control, the problem of determining the replenishment policy due to uncertain demand and lead time can be solved by simulation.Instead of trying manually the three replenishment alternatives for each level of demand and lead time for a period of one year and then selecting the best one,we process on the computer and obtain the results in a very short time at a small cost.

Uncertainty and variation in construction process has an important influence on project performance. The common practice to deal with variation is the holding of inventory. A suitable inventory improves the performance of project. However, excessive inventory induces no-added value. Simulation experiments show that application of DES(discrete event simulation) and CONWIP(constant work-in-progress) provides an effective way of inventory control, simultaneously, maintain throughout the cycle time .

Using advanced computer simulation models is an economical way to help in decision-making which allows the user to visualize the effects of changes to existing systems and what the costs will be prior to implementation. Just -in-Time(JIT), Total Quality Management (TQM) ,decision support systems for continuous improvement, graphical display of physical elements, simulating dynamic changes of the system, communication tool, problem understanding tool, AS-IS vs. TO-BE models, random behaviour of system elements captured in models, manufacturing oriented models, models usually represent the flow of physical object, is used in Inventory control management.

A simulation model of a production system could be used for investigating operating strategies that would reduce the size of inventory, machine cycle times, assess various scheduling rules, or reduce the level of faults. By doing this, any changes to be done to the real system could be tested on the model to avoid risks of inadequate decisions, and business activities could then be better understood. When changes tested on the model are implemented in the real system, effectiveness of the system should be improved as well as the competitiveness of an organisation.

Simulation can be performed for existing or proposed systems to help cost-justification of decisions for improving the productivity of a system(Simulation). It analyzes the trade-offs between demand forecasts, material availability,lead times, and resource capacity to reduce product time in the supplychain and meet inventory and safety stock targets. Models were developed to include all the planning, production, and distribution functions in the current business process. It helps planners to meet forecasted and unexpected demand for produced goods.

A supply chain process is made up of the flow of materials,information, and services and the monitoring and control of this flow,which includes raw materials, procurement, production, inventorymanagement, order processing, warehousing, transportation, and distributionThe development of functions to support these operations is known as supply chain management (SCM). Simulations can help with justifying capital equipment expenditures, flexible automation changes, the effects of downtime and setup time of the new system, and material handling selections.

3. CONCLUSION

At the end we conclude that whenever the characteristics like uncertainity, complexity,dynamic interaction between the decision and subsequent event and need to develop detailed procedures,all combined together in one situation, then model becomes too complex to be solved by any one of the techniques of mathematical programming and probabilistic models.In such situations simulation is a reliable and dependable tool. Using simulation ,it is in general possible to evaluate the development during several years in a few seconds and it is easy to make various test runs with different inventory control techniquesThe effectiveness of business simulation software is not universally accepted, but it has gained

significant credibility by being used in at least three American universities.

4. REFERENCES

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