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Simulation Technique in Solving Managerial Decision Making Problems Under Stochastic Environment

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Abstract: *In the recent years, digitalization has progressed to the economic growth by leaps and bounds, creating innovations and discoveries in diverse fields. It is important that management sector starts realizing and understanding that how the utilization of technology will impact their organizations progress and thus the economic progress of the country in the global area. The role of digitalization in modern age managements has revolutionized business models causing increased productivity and tremendous growth. In general, any activity requires a longer action often characterized by degree of uncertainty in terms of the objective pursued. Because of the complexity of real economic system, not all system can be adequately represented by a model that can be solved by analytical method and covering all issues of management decision analysts. In such cases, it is considered that simulation technique is only alternative available.*

Key Words: **Simulation, Digitalization, Stochastic, Inventory, Financial planning.**

1. Introduction

Simulation is a numerical technique for conducting experiments on digital computers, which involves certain types of mathematical and logical relationships necessary to describe the behavior and structure of a complex real world system. Organizations require managing a huge amount of data and inventory and this is made easier by simulation technique usage. In fact, the automated processes that information technology provides can increase the productivity level of management systems thus leading to the economic growth. Socio- economic development largely depends not only on objective factors (natural resources, geographical position and Human potential etc.) but also on subjective factors life efficiency of actions taken by governing bodies to solve major problems of economic processes. Moreover, simulation technique beings increased security for the confidential and sensitive data stored in the system, making it less prone to vulnerabilities. With the ease and integrity of digitalization, it is easier for the organizations to instantly retrieve and analyze data for monitoring trends and making pre-decision for crucial decision- making process. Development of simulation approach to study social processes is strongly correlated to progress in computer technology. The increasing computational power of modern computers and increasing possibilities of graphic representation allow simulation with adequate metaphors and analogies to real processes. A simulation study requires well designed methods of modern development, validation and verification. A model of real phenomenon is always a simplified, idealized and representative of the processes.

2. Simulation models can be classified into four categories:-

(a)Deterministic models

(b)Stochastic models

(c)Static models

(d)Dynamic models

The use of these simulation models enables an organization to provide insights into certain managerial problems where analytical solution of a model is not possible or where the actual environment is different to observe. Computer simulation can compress the performance of a system over several years and involving large calculations into a few minutes of computer running time.

3. Stages of simulation procedure:-

The following steps are performed for simulation procedure:-

(a)Select the measure of effectiveness.

(b)Decide the variables which influence the measure of effectiveness significantly.

(c)Determine the cumulative probability distribution for each variable in step 'b'.

(d)Choose a set of random variables.

(e)Consider each random number as a decimal value of the cumulative probability distribution.

(f)Insert the simulated values thus generated into the formula derived from the chosen measure of effectiveness.

(g)Repeat steps 'e' and 'f' until sample is large enough for the satisfaction of decision maker.

Monte- Carlo technique has become so much important part of simulation models. However, it is only a special technique of simulation. The technique of Monte- Carlo involves the selection of random observations within the simulated model. This technique is restricted for applications involving random numbers to solve deterministic and stochastic problems. The principle of this technique is replacement of actual statistical universe by another universe described by some assumed probability distribution and then sampling from this theoretical population by measure of random numbers.

4. Applications of simulation techniques :-

Simulation has a large number of applications in all the diverse fields. It can be used on mathematical models of real- life systems as inventory control, production scheduling, network analysis and many more. In this paper we will discuss some of its applications in details which can help managerial economic in a way to maximize the profits and minimize the risks.

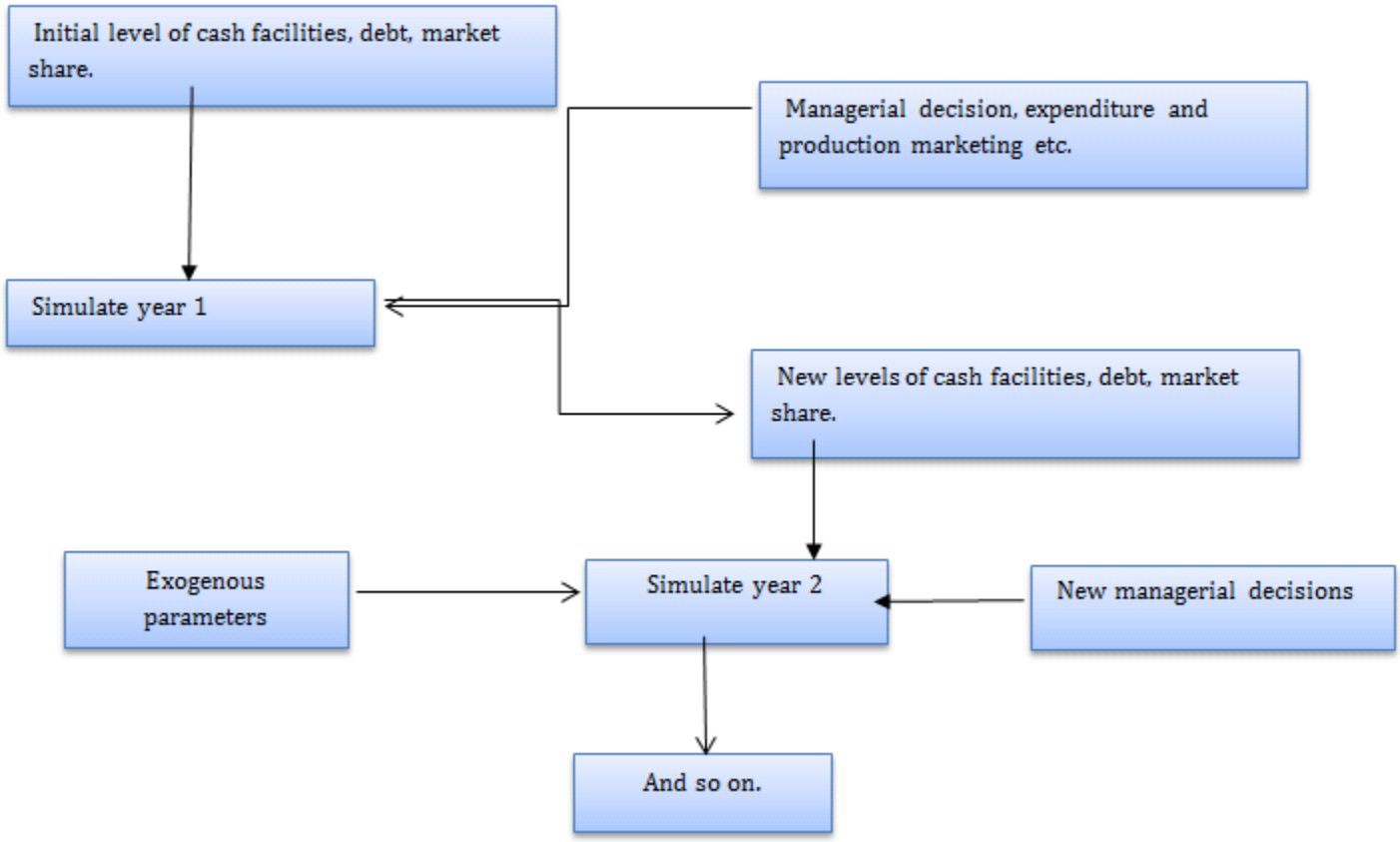
(i) Applications in inventory control: - For providing efficient service to the customers, it is necessary to choose to reorder point with proper consideration of demand during lead time. If the lead time and demand of inventory per unit time both are random variable, then the simulation technique can be applied to determine the effect of alternate inventory policies and a stochastic inventory system of different combinations of order quantity and reorder point. The basic approach would be to find the probability distribution of use input and output functions of past data. Then, inventory system can be run artificially by generating the future observation on the assumptions of the same distribution.

(ii) Application to capital budgeting:- An important decision of financial analysis is to select the optimum alternative among the various capital investment policies and evaluation risks involved with the specific decision. The main purpose of evaluating the risks is to determine the effect of various factors (e.g. selling price, market growth rate, market size, etc.) on financial parameters. The samples from the probability distributions of the factors involved can be drawn and analyzed to determine the rate of return on investment. The management to select investments having the same return but with lower variability. When the expected return and variability of each of a series of investments have been determined, the same procedure may be applied to study the effectiveness of various combinations of them in meeting management objectives. A computer can be used to carry out trails for the simulation process so as to obtain more accurate results. The process is repeated a number of times to obtain corresponding return on investment. A graph can be plotted after a sufficient number of trails have been performed for the rates of return and to obtain a frequency distribution. The probability that on investment will provide a return greater than or less than a certain amount can be determined from the frequency distribution. By comparing the probability distribution of the rates of return, the management is in a position to evaluate the respective merits of different investments involving risks.

(iii) Application to financial planning: - The main objective of a firm is to maximize the market share at the end of time horizon, to maximize the physical capital in the form of production and research facilities etc. The revenue depends upon the level of production but the amount one decide to produce depends in the inventory control, the problem of determining the optimal replenishment policy arises due to the probabilistic nature of demand and lead time. Thus 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 process on the computer and obtain the results in a minimum time at minimum cost. On the forecast for future demand which can be obtained from a forecasting model. This problem can be solved by simulating firm's problem on a period by period basis. The output of one year's activities forms part of the input for the next year. In one year, it receives the inputs as; the set of external interest rate, GNP etc. The set of managerial decisions and the simulated output from the previous year. The simulator itself contains sub models that reproduce and update pertinent aspects. These models use the inputs to make various endogenous decisions like price and the quantity produced. The overall model then simulates the behavior of the system under the conditions that would exist if these inputs and endogenous decisions had actually occurred. It does so using random number to select actual demand from a statistical distribution. The appropriate distribution of demand is itself determined by some combination of external inputs i.e. exogenous parameters and endogenous decisions. Then the price, quantity produced and the actual demand, the simulator can calculate the gross revenue and profits. The quantities

determine new financial position, which is a part of the internally generated inputs to the next period of activity.

5. The simulation process of financial planning:-



6. Simulation languages:-

The next important thing is the formulation of the computer mode deciding how many variables can be included in the model. A simulation computer program can be written in one of the conventional computer programming languages such as 'FORTAN, COBOL, ALGOL, PL/1' without restoring to a special purpose simulation language. However, the development of special simulation languages has considerably reduced the program preparation time and cost with features specially designed for different types of models and system.

The special purpose simulation languages which have been developed so far are GPSS, SIMSCRIPT, GASP, SIMPAC, DYNAMS, SIMULATE, CSL etc. The aim of these languages is to speed up the conversion of a simulation model to a computer program. These languages give automatic instructions for time keeping and other common simulation operations. GPSS (general purpose system simulator) can be used for a wider class of system in order to maintain a fixed set procedure for performing the simulation automatically. These are four entities that constitute the foundations of GPSS:-

(1) Transactions
(2) Facilities
(3) Storage
(4) Blocks

The basis of SIMSCRIPT language is the description of the system in terms of concepts of entity, attribute set and event etc. This language is more flexible than GPSS but requires knowledge of FORTRAN. The DYNAMO language is similar to SIMSCRIPT except that it simulates continuous type models instead of models involving individual events. This language is particularly more applicable to "Marcos" simulations rather small scale models of firms such as production scheduling and inventory etc.

7. Conclusion:-

The role of digitalization is modern age managements has revolutionized business models causing increased productivity and tremendous growth particularly, when it comes to dealing with each and every step of economic growth process, everything from accounting system to management information system have seen a makeover with digitalization. Economic processes of a country are best judged by the economic growth of its organizations. Due to the complexity in problems formulation or stochastic nature of the problems under study, simulation is often viewed as "method of last resort" or "management laboratory" which determines the effect of alternative policies by the use of system model which minimizes risk and time factors so as to maximize the profits, thus contributing towards the economic welfare of the nation.

8. References:-

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