International Journal of Research in Engineering, Science and Management
Volume 5, Issue 5, May 2022
https://www.ijresm.com | ISSN (Online): 2581-5792

Applications of Simulation Theory Model in Agriculture Sector using Monte-Carlo Simulation Technique

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***Abstract*: In this paper is concerned with real world problems were simulation theory using Monte's Carlo simulation technique. The simulation theory is an account of our everyday ability to make sense of the behavior of others. This paper makes a try to use Monte-carlo simulation technique inclusive of simulation theory troubles to provide an explanation for how the combination of these strategies in agriculture will no longer only assist in reducing of the triumphing problems in agriculture however additionally lead to better efficiency.**

***Keywords*: Agriculture, Simulation model, Loss of Quintal, Probability, Random numbers, Monte-carlo simulation technique.**

1. Introduction

Simulation is a procedure that studies a problem by creating a model of the process involved in the problem and then through a series of organized trials and error solutions attempt to determine the best solution. Sometimes this is a difficult/time consuming procedure. Simulation is used when actual experimentation is not feasible solution of model is not possible.

Simulation is a process involved with developing a model of some real phenomenon and then performing experiments on the model devolved with a view to predict the behaviour of the system over time. Thus, in simulation, a given system is copied and the variables and constants associated with it are manipulated in that artificial environment to examine how it behaves.

When we talk about the applicability of this theory in agriculture, we can say that it is useful in forecasting a set or a base of data for the future, basis on which future planning and execution can take place.

Agriculture basically supports the industry by integrating foreword linkages and hence we can say that agriculture is the base of growth for any country, thus equal importance should be given to improve the state of agriculture in the economy. Currently, we can clearly see that a surge in onion prices and a ban on the export of onions have not only impacted the consumer but also the producers, leading to a lot of wastage and instability in the economy.

Simulation can be helpful in analyzing and managing inventory to maintain optimal levels to reduce cost. However, it may be understood clearly that simulation is only descriptive in nature so that it describes the expected output for a given set of inputs. By itself, it does not provide any optimal solution.

In probabilistic simulation, one or more of the independent variables is probabilistic. i.e., it follows a certain probability distribution. Simulation is the imitation of the operation of a real-world process or system over time.

2. Methodology of Simulation

A simulation process consists of the following phases:

Define problem
↓
Introduce important variables
↓
Construct simulation model
↓
Specify value of variables of be tested
↓
Conduct the simulation
↓
Examine the result
↓
Select best course of action

Advantages and limitation of simulation:
The main advantage of simulation techniques are as follows.

- Simulation is flexible and straight forward technique it is easier to apply those pure analytical methods.

Practical application of simulation:
Some of the application in real world is given below:

- Aircraft scheduling.
- Assembly line scheduling.
- Bank teller scheduling.
- Bus scheduling.
- Telephone traffic routine.
- Brand selection.
- Advertising allocation.

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- Locating warehouse.
- Job shop scheduling.
- Design of distribution system.

Steps involved in Monte-Carlo simulation:

- Step I: Obtain the frequency or probability of all the important variables from the historical sources.
- Step II: Convert the respective probabilities of the various variables into cumulative probabilities.
- Step III: Generate of random numbers.
- Step IV: Based on the cumulative probability distribution table obtained in step II, obtain the interval (i.e., the range) of the assigned random numbers.
- Step V: Simulate a series of experiments or trails.

Example:

A farmer based on past data of 56 months has found the following probability of crops being damaged due to floods. Based on this data and using the random number below, he can forecast the data for a period of next 12 months, to accordingly understand, the loss that he shall have to incur if another flood happens. The loss per quintal is Rs. 200.

Table 1

Loss in quintal	500	1000	1500	2000	2500	3000
Probability	0.01	0.05	0.07	0.03	0.18	0.36

Random Numbers are 13, 93, 45, 67, 8, 12, 16, 89, 99, 33, 78, 35.

Table 2

Loss in Quintal	**Probability**	**Cumulative Probability**	**Random Numbers**
500	0.01	0.01	0
1000	0.05	0.06	1 to 5
1500	0.07	0.13	6 to 12
2000	0.33	0.46	13 to 45
2500	0.18	0.64	46 to 63
3000	0.36	1	64 to99

Generation of Random Numbers:

Based on the above, table we create table 3, wherein we forecast the loss that could happen due to floods in the next 12months. Using the simulation theory, an enterprise can plan their decisions for future accordingly. Inventory related decisions can be easily taken to avoid over burdening of surplus products and excessive stocks and also help in maintaining optimum levels of production.

Table 3

Month	**Random Numbers**	**Loss in Quintal**	**Total Loss**
1	13	2000	400000
2	93	3000	600000
3	45	2000	400000
4	67	3000	600000
5	8	1500	300000
6	12	1500	300000
7	16	2000	400000
8	89	3000	600000
9	99	3000	600000
10	33	2000	400000
11	78	3000	600000
10	33	2000	400000
11	78	3000	600000
12	35	2000	400000
TOTAL		28000	5600000

Forecasting loss for next 12 months using, Monte Carlo's Simulation Technique.

- Loss in quintal is calculated on the basis of cumulative probability. (e.g., random numbers 31 lie in the third of cumulative probability)
- Total loss =5600000
- Total loss in Quintal =28000
- Average in loss in quintal = loss in quintal/No. of months

  = 28000/12

The daily average loss in quintal=2,333.333

- Average in total loss = Total loss/No. of months

  = 5600000/12

The daily average Total Loss = 4,666.666

3. Conclusion

Agriculture as a whole is filled with complexity and issue which can be easily resolved using by Simulation theory. Also, simulation theory helps an individual to find Monte-Carlo solutions by converting larger models into smaller models. Thus, the applicability of operation research has wide roots and can be used to achieve higher returns from the investment in agriculture.

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