Designing a Simulation Based Cost Effective Control System for Logistics Management of Entrepreneurial Stratups: a Case Study on Logistic Firm

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Abstract

The study develops a model based on simulation for logistics management. The author'sopinions are collected in the form of literature survey and major points of concern were collected and infused in the model development of the whole of the firm. The case study is of alogistics firm where the parameters are collected and then a simulation model is designed. The modelis designed on ARENA software. The parameters of the case industry are placed in the model and then it is simulated for over .1 million hours. The result shows that the lead time related problems leads to a large waiting time for the batches. This way the study helped in analyzing the risks and it involves the use of simulation for centrally monitoring the logistics management firm for fluctuations or risks.

Keywords
Logistics management, Simulation, Logistics coordination, Logistics flexibility in logistics and ARENA modeling.

Introduction

In the present business scenario it is mandatory to understand the importance of logistics for any product's performance. The level of outsourcing has increased and it is possible to follow the deadline only by the efficient use of logistics. The involvement of techniques like Just-in-Time in case of technically sensitive products has lead to supplier and logistics upliftment further enhancing their importance. The logistics providers serve from industrial to common customers and hence their presence is quiet omnipotent. The rapid increase in the product line and stiff completion in the market arena are some of the important aspects related to logistics which increases their importance in present world. In our study we have developed a methodology for adopting a cost effective control system for a logistics provider firm with the help of simulation for assisting in the decision making.

The logistics management is actually that portion of supply chain in which the internal and external transports are being taken care and in order to maintain the parameters like quality and lead time it is mandatory for all the supply chains to have an efficient logistics. Most of the lower and middle level firms outsource this sector since they do not have expertise and resources to manage logistics by themselves only and hence they take the help of logistics providers. Most of such logistics providers have a wide variety of products in their catalogue. The problem associated with these firms is of better control and this particular factor involved the need for an efficient system which can

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help the optimizers for taking a better decision. There are always a lot of activities going on in this sector and a lot of transactions are moving in out continuously and in order to track such a system it has become mandatory that whole of the system is carving out for a better and prompt reply from the central control units. This study is very effective for those players which are not having huge resources so that they can carry out consultant services for efficient online decision systems. The logistics management and the major related issues are discussed in the literature survey done for the study and it provides necessary points on which we need to be concentrated while designing a virtual system for logistics monitoring based on simulation.

Literature survey

The main source of data collection before preparing any model for simulation is the special stress that is needed to be given to the most of the phenomenon that are lagging in optimism criteria. In this study the logistics management is studied with reference to the different point of views given by the authors. We have done structural literature review for analyzing the logistics problems and the solutions given by authors and how they can be implemented in our system for making it more viable. The structural literature review is as follows-

I. Risk or uncertainty management
II. Common Operational risks in logistics management
III. Methodologies suggested by authors for logistics management

We are hereby explaining the above points one by one with reference to the point of view given by various authors.

I. Risk or uncertainty management

The first and most important aspect related to any simulation or prediction for future is related to accurate positing of uncertainties. It is necessary to have an idea of uncertainties in the process before developing a model for it. The main authors that have contributed in conversion of uncertainty to calculated risks are Fan et al (2008) and Fang et al. (2012). All these authors have contributed in the conversion of uncertainty to risk. It should be noted that a formal risk management process that includes risk identification then assessment, mitigation and finally monitor or control is the main process suggested by these authors. In logistics management a lot of such uncertainties are present and needs to be modeled in the same fashion only. In our study we have taken special care to analyze this aspect by designing separate processes for each activity of logistics management firm.

II. Common Operational risks in logistics management

In general some common problems arise in the case of logistics management and are same in most of the operational activities like fluctuations, need of better statistically controlled processes and breakdowns in the various processes or equipments used. The main authors which have identified these aspects areNaim et al. (2010) and Gosling et al. (2010). All of these authors have advocated the need for development of a separate system for logistics due to a large number of problems like lead time, quality issues, technical knowhow, resources at disposal and inability to check seasonal demand. All these issues are kept in mind while designing the blocks for the system.

III. Methodologies suggested by authors for logistics management

The studies done by authors have suggested many innovative practices by different authors like most of them have desired the use of coordination and flexibility among the logistics. Coordination means using the same route for multiple deliveries to different end users which results in cost savings. The main authors advocating these aspects are Purvis et al. (2014) and Gösling and Geldermann (2014).

On the other hand the different aspects which are suggested by authors are the flexibility in the parameters. That is ability to adjust according to the needs and demands. Technological upliftments are to be adopted and it also comes under flexibility and is very useful in implementing techniques like JIT. The main authors which have advocated flexibility are Richey et al. (2012) and Šalkovska (2014). These two important aspects coordination and flexibility are dealt with due analysis and are emerging out as a solution for logistics related problems.

The complete literature survey is used to analyze the concept of logistics with relation to operational problems it is facing and these findings are adjusted with the model we are creating for logistics management. The concept of flexibility and coordination are two main concepts which have been evolved by the writers in order to protect the various problems. The mitigation of these problems or risks is much easier when it is already included in the automation and it increases the systems accuracy and the overall functionality of the system is also increased. The simulation process is the delay in detail in which the research methodology section and the results for validation of this concept suggested by this methodology of simultaneous simulation for complete process involving suppliers and warehouses for better decision making capabilities or the reports generated by the simulationson the case study firm are analyzed in data interpretation section.

Research Objective

The main objective of research is given below for which a research methodology is discussed in this section is given as –

· Simulation of an existing system to develop a model for logistics management of entrepreneurial startups.

· Applying parameters value inside the model for forecasting of Assembly line for optimization.

Research methodology

The main stress on this study is done on the adoption of current system into a virtual system which can be simulated in other words it is extremely necessary to prepare a virtual system that can be analyzed in the simulation software as a whole and then the results can be used to have a better monitor and control. In order to complete such a system we have analyzed a proceeding in which the logistic firm is analyzed along with the nodal centers involved which gives us a complete picture of not only the logistics unit but also the management at the nodal centers from where the assortment and distribution network moves on to its complex stages. This alignment of logistics centre with the distribution nodes allows us to be more efficient and accurate.

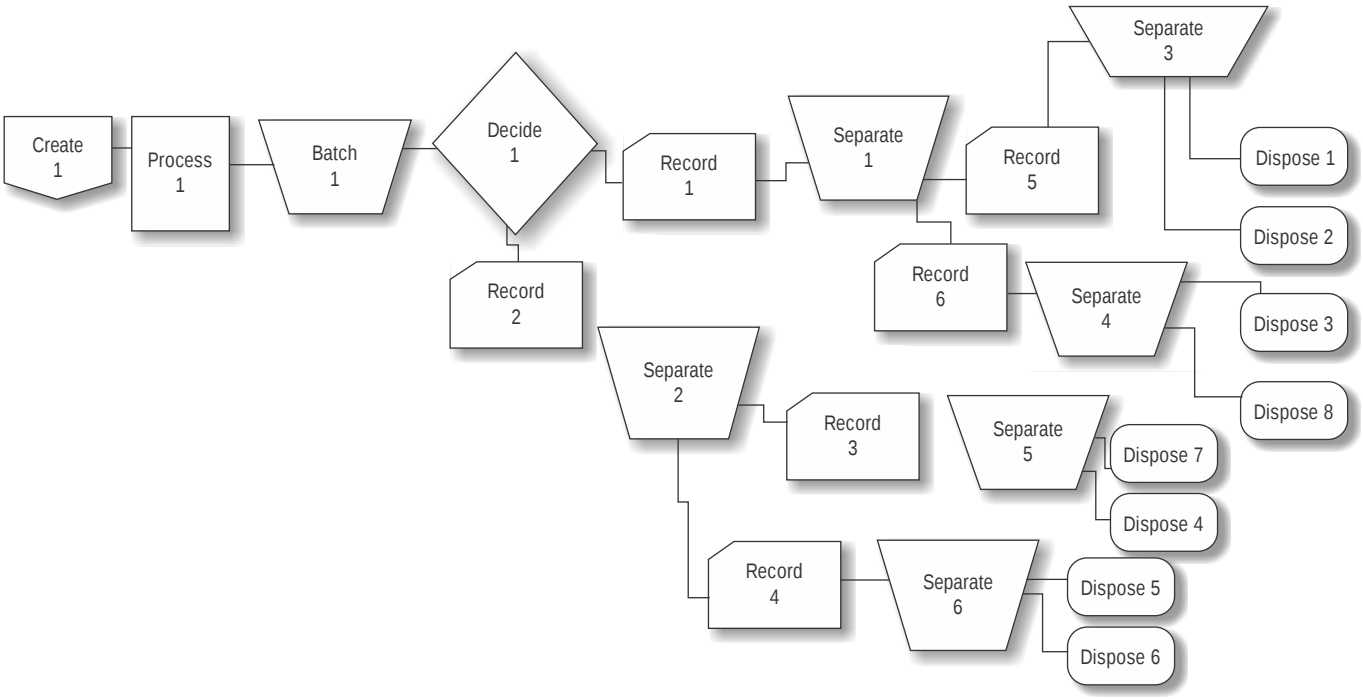
Simulation is done by ARENA software, since it is easy to apply and we do not need expert consultancy to handle it for any change. The

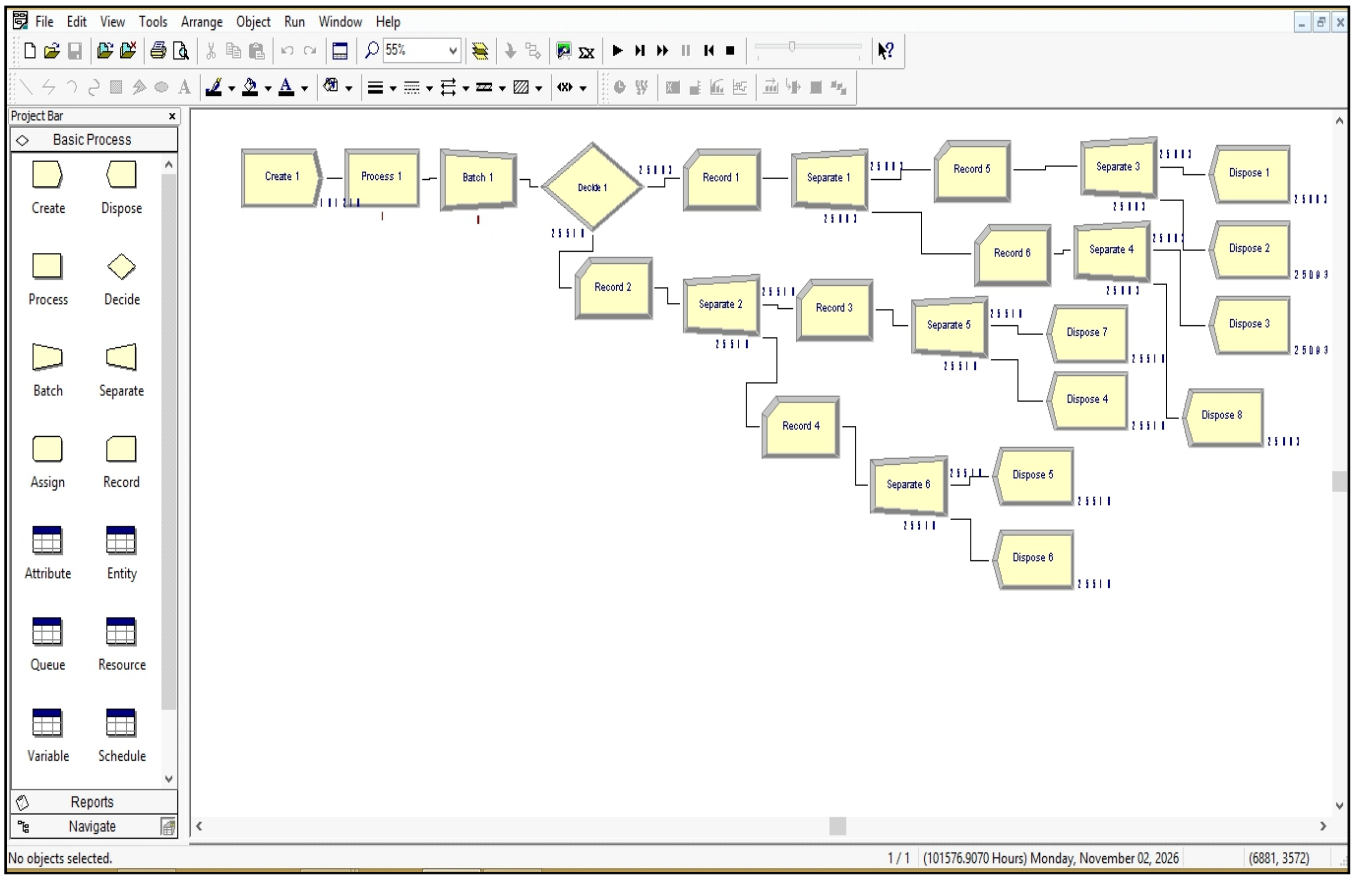
technical expertise involved in such a simulation is also not very high. In order to validate this methodology we have sampled a logistic firm, which is supplying spare parts of automobiles to different markets. The company is working under contract of a major automobile producer in India. It has a logistics section from where the spare parts are distributed from the manufacturer to the service stations through different supply nodes. A virtual logistics model is developed for this mid level logistics firm and is used to simulate the model for future decisions and continuous monitoring. The model generated is used to predict the level of fluctuations well before they actually magnify themselves.

Model Developed

The model shown in figure 1 indicates the virtual representation of the logistics firm. The model is prepared by physically visiting the firm and then the system is studied over there. It has been found that the manufacturing unit manufactures the spare parts and then they are finally prepared for usage after checking and this is shown in the process block named spare parts. The overall efficiency is increased by dispatching them in batches and then the batch block is shown in the diagram. The system introduced a very good approach that is exactly the alterego of the real system. The batch is released to the decision box where the batch is separated to two different logistics nodes. The record boxes are designed to take into account the amount of transactions. The overall separators are put at each of the record nodes and in this way the series of separators are kept. The separators are kept at disposal which represents the final market nodes.

Figure 1: The ARENA simulation model in flowchart form and simulation screen for the case study of logistics unit





Data interpretation -

The simulation is run for over 1,00,000 hours and the parameters are judged at the each junction. The parameters are shown in figure 2.

Figure 2: Output parameters after 1, 00,000 hours of simulation

Unnamed Project Replication:1

Replication:1 Start Time : 0.00 Stop Time : 101.576.91 Time Unit : Hours

Entity Detail Summary

Time

	NVA Time	Other Time	Total Time	Transfer Time	VA Time
Entity 1	0.00	0.00	0.50	0.00	0.50
Total	0.00	0.00	0.50	0.00	0.50

Other

	Number in	Number Out
Entity 1	303.655	303.654
Total	303.655	303.654

Category by Replication

Unnamed Project Replication:1

Replication:1 Start Time : 0.00 Stop Time : 101.576.91 Time Unit : Hours

Entity

Time

VA Time	Average	Half width	Minimum	Maximum
Entity 1	0.5002	0.000527929	0	2.9440

NVA Time	Average	Half width	Minimum	Maximum
Entity 1	0	0.000000000	0	0

Wait Time	Average	Half width	Minimum	Maximum
Entity 1	0.2492	0.00223545	0	11.1416

Transfer Time	Average	Half width	Minimum	Maximum
Entity 1	0	0.000000000	0	0

Other Time	Average	Half width	Minimum	Maximum
Entity 1	0	0.000000000	0	0

Total Time	Average	Half width	Minimum	Maximum
Entity 1	0.5036	0.002382244	0	12.1576

Other

Number In	Value		Minimum	
Entity 1	303.655		0	

Number Out	Value		Minimum	
Entity 1	303.654		0	

WIPt	Average	Half width	Minimum	Maximum
Entity 1	1.4935	0.005935530	0	12.0000

The average waiting time associated with the model is holding a constant value at a level of .49 is quiet constant value throughout the simulation. This tells us that while the other parameters (Shown in Figure 3)regarding the batch size are found to be feasible but the batches are needed waiting for being send and that is where the role of flexibility and coordination in the logistics can be found. Hence the model developed can be very well used to take strategic decisions regarding the logistics management.

Figure 3: Simulation results showing the production parameters

Entity

Time

VA Time	Average	Half width	Minimum	Maximum
Entity 1	0.5002	0.000527929	0	2.9440

NVA Time	Average	Half width	Minimum	Maximum
Entity 1	0.00	0.000000000	0	0.00

Wait Time	Average	Half width	Minimum	Maximum
Entity 1	0.2492	0.00223545	0	11.1416

Transfer Time	Average	Half width	Minimum	Maximum
Entity 1	0.00	0.000000000	0	0.00

Other Time	Average	Half width	Minimum	Maximum
Entity 1	0.00	0.000000000	0	0.00

Total Time	Average	Half width	Minimum	Maximum
Entity 1	0.5036	0.002382244	0	12.1576

Other

Number In	Value	Minimum
Entity 1	303666.00	0

Number Out	Value	Minimum
Entity 1	303664.00	0

WIPt	Average	Half width	Minimum	Maximum
Entity 1	1.4935	0.005935530	0	12.0000

Counter

Count	Value
Record 1	25,093.00
Record 2	25,516.00
Record 3	25,516.00
Record 4	25,093.00
Record 5	25,093.00
Record 6	

The other parameters in figure 3 shows that the WIP level, transfer of products and the records indicate that all of them have less variation and an average value which is quiet constant over all the record blocks numbering from 1 – 6. Hence it is quite clear that most of the proceedings can be fairly well controlled from this methodology in logistics. The simulation allowed us to take better decisions in advance. The strategic advances are most profitable in this fashion and since a number of distribution nodes are combined the central control is more accurate and comprehensive with this methodology.

Conclusion and Future Studies

This can be inferred from the above framework that most of the logistics units face problems of central control and they do not have resources for state of the art controlling software or consultancies. The major outcome of this study is development of such a framework in which all these functions are centrally controlled. The simulation results confirmed that due to high waiting time of the batches there is aneed for coordination in the chain. The simulation results proves that such asystem can be very easily implemented and due to the high level of simulation for over 1,00,000 hours it is possible to manage risks of the future very well. The output parameters not only validate our methodology but they also showed that production variations or fluctuations are very much controlled but the overall coordination is less and that is shown by the queue length of .49 and the records blocks shoed the same data. Hence the framework of combining the whole supply chain and then applying simulation proved a very effective module for reducing risk or uncertainty and also allows managers to take more strategic decisions.
In future more powerful simulators are needed to be developed. Mathematical equations can be introduced for each entity that can increase the accuracy of results. Tailor made models are needed for each of the industries and this is possible when there are huge number of working models already running. Hence the study is successful in validating the framework of combining the whole chain in a single simulation model and then analyzing the output parameters for accurate handling of fluctuations or risks involved in the logistics management.

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