Improving Supply Chain Activity Using Simulation

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Abstract— The discovery through computational modeling and simulation has become the third pillar of science, alongside theory and experimentation. As computational power increases, simulation has gained in importance and has become a major research area, where highly parallel computation is utilized. In this dissertation, we have performed the simulation by selecting a single machine which is involved in manufacturing the highest number of products. Data are collected for all the processes involved in the manufacturing processes and an input modelling analysis is been done for the data collected. After the analysis is completed, a simulation model is constructed using ARENA which involved all the manufacturing process using the simulation tools. With the help of the simulation tools we will be able to identify activities causing the bottlenecks and delays in the entire manufacturing processes. Similarly, this simulation can be carried out for each and every machine of the company so that we can identify the bottlenecks and delays. As a result, the bottlenecks and delays can be reduced and the entire supply chain can be improved. This paper aims at combining supply chain management and simulation – to give an overview of both areas and shows how supply chain management can profit from simulation and also to identify the delays and bottlenecks in the overall manufacturing process. Lastly, a sample of how a supply chain can be optimized, in the simulation development suite ARENA.

Keywords: Bottlenecks; delays; special process; lead-time

I. Introduction

A. Supply Chain Management

SUPPLY CHAIN MANAGEMENT is a process-orientated, integrated approach to procuring, producing and delivery products to customers. Is has a broad scope that includes sub-supplier, supplier, internal operations, trade customers, retail customer, and end users. It also covers the management of material, information and funds flows. Supply chain exists in both service and manufacturing organizations, although the complexity of the chain may vary from industry to industry and firm to firm.

Supply chain management is concerned with the efficient integration of suppliers, factories, warehouses and stores so that merchandise is produced and distributed:

- In the right quantities
- To the right locations
- At the right time

Effective supply chain enables you to make informed decisions along entire supply chain from acquiring raw materials to manufacturing products to distributing finished goods to the customers.

II. Literature Survey

A. Review of Literature

Literature study was carried out first within the subject and then followed by a brief empirical research. As one part of the project was to map out the activities, process documentation was formed based on the empirical research.

Martha C. Cooper, Douglas M. Lambert, Janus D. Pagh, (1997) described that Practitioners and educators have variously addressed the concept of supply chain management (SCM) as an extension of logistics, the same as logistics, or as an all-encompassing approach to business integration. Based on a review of the literature and management practice, it is clear that there is a need for some level of coordination of activities and processes within and between organizations in the supply chain that extends beyond logistics. We believe that this is what should be called SCM. This article proposes a conceptual model that provides guidance for future supply chain decision-making and research.

Keah choon tan (2001) described that over the past decade, the traditional purchasing and logistics functions have evolved into a broader strategic approach to materials and distribution management known as supply chain management. This research reviews the literature base and development of supply chain management from two separate paths that eventually merged into the modern era of a holistic and strategic approach to operations, materials and logistics management. In addition, this article attempts to clearly describe supply chain management since the literature is replete with buzzwords that address elements or stages of this new management philosophy. This article also discusses various supply chain management strategies and the conditions conducive to supply chain management.

III. Methodology

This chapter summarizes the working structure of the different processes followed by research methods that are chosen for the study in order to make sure high quality and reliable results.

A. Working Structure and Methods

The study started with searching different theory of referrers in the areas of material supply, manufacturing system. To know the different process of material supply and manufacturing systems in the machine shop and outsourcing process, a detailed observation was carried out from the material receiving area till final assembly in the plant. The observation carried out with the assist from concerned personnel's in logistics, production planning centre (PPC) and quality department and also discussion was carried out about the overall manufacturing processes.

With the consultation of manufacturing and logistics personnel's, an empirical study was carried out by selecting different target components and machines. The

selected components include all category of material supply and the manufacturing processes so that it is able to represent the whole picture of the factory.

B. Data Collection

In this project, data collection was carried out through different methods. The majority of the data are collected through company internal data base search and existing documents. Different formal and informal interviews with concerned personnel were carried out in order to verify the accuracy of the collected data. Process study was conducted for the data are not available.

	A	B	C	D	E	F	G	H	I	J	K
1	DAILY ORDER	PART NUMBER	MACHINE	SET UP TIME (in hrs)	CUTTING TIME (in hrs)	SETUP & CUTTING TIME (hrs)	DEBURRING TIME (hrs)	INSPECTION TIME (hrs)	SP LT (days)	ASSEMBLY TIME(in hrs)	TOTAL(hrs)
2											
3	4	ASGRCS0001	VMC219	0	0	0	0	0.33	288	0.17	288.5
4	4	ASGRCS0002	VMC219	10	1.8	11.8	0	0.66	288	0.17	300.63
5	5	ASGRCS0003	VMC219	10	1.8	11.8	0	0.66	288	0.17	300.63
6	12	ASGRCS0006	VMC219	10	1.8	11.8	0.5	.58+.75	288	0.17	301.8
7	3	ASGRCS1014	VMC219	11	3.3	14.3	0	1.25+1.33	288	0	304.61
8	4	ASGRCS1032	VMC219	11	7	18	7.1	1.83	360	0.5	387.43
9	4	ASGRCS1052	VMC219	10	7.3	17.3	7.1	1.5+1.75	288	NR	315.65
10	4	ASGRCS1053	VMC219	10	7.3	17.3	7.1	1.5+1.75	288	NR	315.65
11	4	ASGRCS1054	VMC219	10	7.3	17.3	7.1	1.5+1.75	288	NR	315.65
12	4	ASGRCS1055	VMC219	10	7.3	17.3	7.1	1.5+1.75	288	NR	315.65
13	4	ASGRCS1033	VMC219	11	7	18	7.1	1.83	360	0.5	387.43
14	45	ASRGCS1056	VMC219	3	1.5	4.5	0.29	0.25	648	0.08	653.12
15	25	ASGRCS1058	VMC219	3	4	7	1	0.33	576	0.08	584.41
16	0	ASGRCS1059	VMC219	8	6	14	0	0.41	648	0.08	662.49
17	50	ASGRCS1062	VMC219	2	0.3	2.3	0.35	.41+.5	288	0	291.56
18	50	ASGRCS1063	VMC219	2	0.3	2.3	0.35	.41+.41	288	0	291.48
19	0	ASGRCS1061	VMC219	6	3.26	9.26	0.5	1.5+1.75	0	0	13.01
20	4	ASGRSS0029	VMC219	0	0	0	0	0	288	0	288
21	60	ASGRSS1007	VMC219	2	0.2	2.2	0.25	0.166		0	2.61
22	60	ASGRSS1008	VMC219	3	0.3	3.3	0.25	0.25	288	0	291.8
23	45	ASGRSS1009	VMC219	4	0.3	4.3	0.25	0.33	648	0	652.88
24	45	ASGRSS1011	VMC219	3	0.3	3.3	0	.5+.5	360	0	364.3
25	150	ASGRSS1014	VMC219	1	0.1	1.1	0.17	0.25	576	0	577.52
26	0	ASMCAS1001	VMC219	6	8	14	0	.5+1.75	360	NR	376.25
27	2	ASMCAS1002	VMC219	6	8	14	5.4	.5+1.75	360	NR	381.65
28	2	ASMCAS1003	VMC219	6	8	14	5.4	.5+1.75	360	NR	381.65
29	2	ASMCAS1004	VMC219	6	8	14	5.4	.5+1.75	360	NR	381.65
30	2	ASMCAS1005	VMC219	6	6	12	5.4	.5+1.75	360	NR	379.65
31	2	ASMCAS1006	VMC219	6	6	12	3.58	.5+1.75	360	NR	377.83
32	2	ASMCAS1007	VMC219	6	6	12	3.58	.5+1.75	360	NR	377.83
33	2	ASMCAS1008	VMC219	6	6	12	3.58	.5+1.75	360	NR	377.83
34	2	ASMCAS1009	VMC219	6	6	12	3.58	.5+1.75	360	NR	377.83
35	2	ASMCAS1010	VMC219	6	6	12	3.58	.5+1.75	360	NR	377.83
36	2	ASMCAS1011	VMC219	4.5	4.5	9	3.58	.5+1.75	360	NR	369.83

Table 3.1: Data used in Analysis and Simulation

IV. MODELLING

In this chapter simulation models are classified - it will determine that supply chains belong to the category dynamic, discrete, stochastic. Dynamic, discrete, stochastic models will be examined as well as the simulation development process necessary for development.

Simulation models are the base of simulations. They could be physical or logical and are done in different ways, to suit the circumstances. It could be possible to physical simulation and test a system, e.g. building a Starbucks in-house, have an online voting system, or traffic lights to control the traffic driving onto a highway. In comparison though, some systems are too big or critical to play with; a flight control system or emergency room protocols. The physical system could not be there yet: an underground parking lot, which needs to fulfill service and profitability criteria and still needs to be built.

In this process, modelling is done with the help of the data obtained from the results which we have found out at the time of identifying the different probability distribution. The results obtained are recorded and for each process a suitable diagram has been chosen according to the process. After the diagram has been chosen, the obtained data is entered for each of the diagram chosen for the process. Then the diagram has been linked to each other as per the flow of the manufacturing process.

The diagrams (blocks) are arranged in a proper manner according to the flow of the manufacturing process as shown in below:

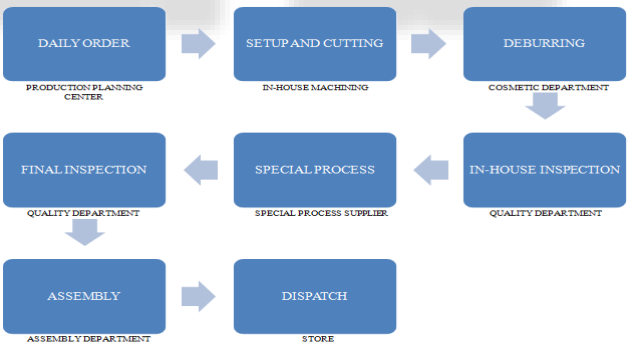

Fig. 4.1: Block Diagram of the work flow model constructed

V. RESULTS

In result, maximum time involved in the overall manufacturing process has been utilized in the outsourcing process i.e. the special process. As in special process the products has to be sent to the special process supplier where the processes are carried out and again sent back to the company. Also the products are to move on a batch basis, so they have to keep on hold as the batch is not completed. As a result of all these waiting and transportation the maximum time of the overall process has been utilized in the special process.

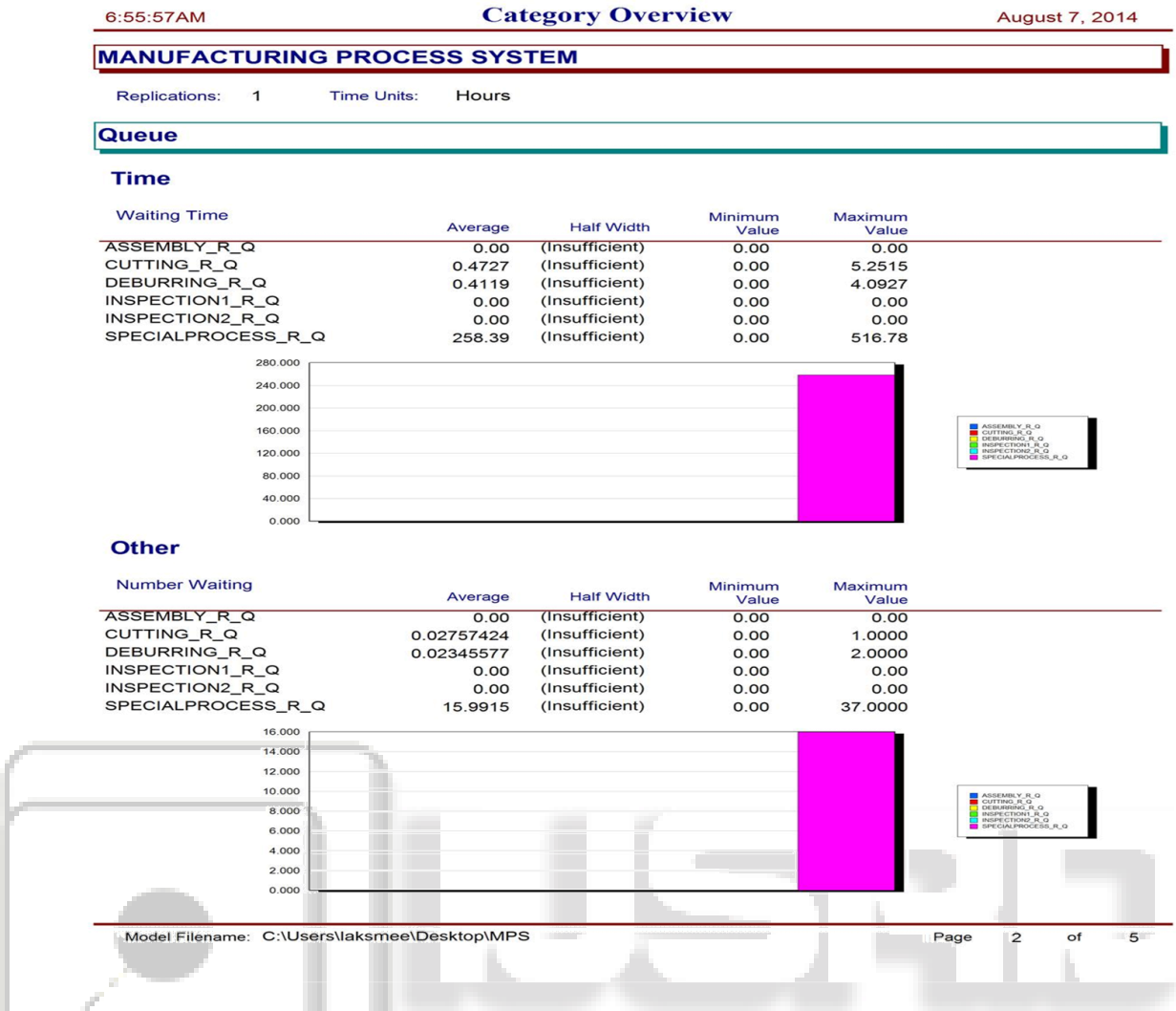

Fig 5.1: Simulation Result

VI. CONCLUSION

In this paper, we have considered one of the machines from the house which is involved in manufacturing maximum number of products from the main data. For this particular machine all the parts are listed out with all the process of manufacturing with their time.

In the simulation modelling, a simulation time of 720 hours (30days) have been taken where the output of the product is very low because of the time consumed in the special process (outsourcing). The time consumed in outsourcing process is very high as compared to the in-house process which results in a very low output of the product. So, a strong, efficient, supplier/sub-contractor relationship management is necessary to avoid this delay.

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