



AN INVESTIGATION INTO POSSIBLE PRODUCTION SCHEDULING TECHNIQUES IN THE MANUFACTURING INDUSTRY, A CASE STUDY OF GBL AND ALSTOM

Dr. Lalita Mishra

Guest Lecturer, Govt. MLB.PG College of Excellence, Gwalior [M.P.].

Abstract

Production scheduling is one of the key points for the manufacturing industry. The production scheduling is really essential part of the production. Production scheduling helps company to their productivity as well as to gain competitive advantage in the market. This study focuses on the possible production scheduling techniques to and find out how effective production scheduling technique improves productivity of the company.

The hypothesis was proposed on the basis of the problem that the production scheduling technique is ineffective in terms of the productivity and efficiency of the production. Open ended and close ended questions were used to collect data. During analysis, initially the data was transcribed and the write up was arranged as per the stores researched. The responses were then analyzed as per proposed hypothesis.

The answer concluded with the interesting finding that the effective production scheduling technique Like PRIMAVERA or integration of the SAP and PRIMAVERA could increase the efficiency and productivity of the company.

1. Introduction

In recent years we have observed extreme technological changes in the manufacturing industries. In the past few years manufacturing industries have faced intense competition within the manufacturing sector with issues such as rapid management change, abridged Product life cycle, higher needs of the quality, rapidly technological changes, ever-increasing expectations from customers as well as growing options for the raw materials and the manufacturing process (Harmann 2007). The biggest issue confronting manufacturing organisations today is not just only the competition and adaptation to recent business environmental changes, but also how to enhance competitive advantage. To accomplish this competitive advantage organisations have started to be more concerned about the manufacturing systems, (Bahnaier 2001). The majority of the manufacturing organisations were found insufficiently able to respond in terms of production scheduling, manufacturing planning as centralised system and control.

Background of Gujarat Borosil LTD

The Borosil group involves two different companies in which Borosil glass works limited and Gujarat Borosil Limited. Borosil glass works Limited is market leader in the producing of laboratory glassware and microwavable kitchenware in India whereas Gujarat Borosil Ltd is India's only manufacturer of low iron textured solar glass. Gujarat Borosil Ltd (GBL) started in 1994 by the Borosil group at Bharuch, Gujarat, India. GBL uses the Pittsburgh process to produce sheet glass. The furnace of the GBL has capability to produce 230 ton sheet glass per day with ranging from 3mm to 12mm thickness. This sheet glass nationally uses for various architectural and domestic appliances. GBL has got 115 different dealers around the India to distribute its sheet glass. (Borosil Group, 2011)

GBL has recently introduced low iron textured solar glass by establishing low ironed patterned glass furnace. It has capacity to produce 150 ton per day high transmission glass which is used in the solar industry. This new manufacturing unit has top quality European equipments. The customer of this glass products are spread all around the world. The recently established process and plant is only of its kind in India and has developed to keep in specifically cope up with the fast growing solar industry around the world. (Officially website of Borosil Group and secondary source)

ALSTOM at a glance

Alstom is a global leader in providing transport infrastructure, power generation and transmission. Alstom operates in 70 countries and has got more than 96,000 man-powers around the world. The company's 2009/10 sales were more than 20 billion Euro. Alstom has been allied with India for almost one century. Alstom India has given a boost to the Indian manufacturing industry since 1910, and is also associated with build up of the Indian economy. Alstom in India provides engineering project management, and supplies of power generation equipment. Alstom India is majorly involved in supplying in railway transport equipment and technology solutions. Alstom is been listed on India's Bombay stock exchange and national stock exchange. Alstom in India has manufacturing units in 4 locations and has more than 4,000 employees. Alstom fully believes in and is also committed to providing clean and environmental friendly products and technology solutions. (Official website of the Alstom and secondary source)



Research Questions

The questions would be divided in two small different questions which would finally answer the main question of measure of effectiveness of production scheduling technique.

1. What are production scheduling techniques?
2. How to improve and make effective production scheduling technique?
3. What are the recent innovations like computer based PRIMAVERA software in the production scheduling techniques doctrine?

Using the case study of GBL and ALSTOM (as case comparison) these questions will be investigated. Thus more specifically to the case studies:

4. What can be learnt from GBL and ALSTOM for production scheduling techniques?

Hypothesis

To establish the researcher’s proposal of the effective production scheduling technique would lead to the profitability and competitive advantage to the organisation a hypothesis has been planned. As per the same hypothesis the organisations who have effective production scheduling technique can gain advantage. The satisfied customer would come back for the future purchase and also probably recommends to other about the product. Thus the revenue of the company automatically increases and it lead to increase the profitability of the company.

H ₀ : (Proposed hypothesis)	An integrated Production Scheduling software (e.g. PRIMAERVA) will better assist firms in gaining effective competitive advantage than a Standalone production scheduling software (e.g. SAP with PP module)
H ₁ : (Null hypothesis)	A Standalone production scheduling software (e.g. SAP with PP module) will be better than a an integrated Production Scheduling software (e.g. PRIMAERVA) in gaining effective competitive advantage)

2.Literature review

Manufacturing is a process, to produce a quality and valuable goods by use of machines, labours and tools. Badiru, (1996) states: “Manufacturing is the act of making something through deliberate processing from raw material to the desired object, usually with the use of machinery. This act encompasses several functions that must be strategically planned, organised, scheduled, controlled and terminated. A manufacturing cycle includes such functions as forecasting, inventory control, process planning, machine sequencing, quality control, decision analysis, production planning, cost analysis, process control facility layout, work analysis, and a host of others. These are all functions that fall within the planning, organising, scheduling, and control functions of project management”. The GBL is a mass manufacturer of the sheet glass and it has a capacity of producing 230 ton sheet glass per day with the variety of thicknesses.

To understand and to investigate the possible production scheduling techniques in the field of the manufacturing organisations, there are various traditional and modern production scheduling technique that has been reviewed. The literature review also explains the latest improvements and innovations of production scheduling techniques like SAP based production planning and PRIMAVERA which is purely designed to focus on the production planning, scheduling and control. The main intension of the whole literature review was to establish proper understanding of effective production scheduling techniques, case study and to link the research being carried out.

To assemble an appropriate finding the suitable research methodology is necessary to follow. Whichever the research methodology is followed by the researcher it is crucial to define formation of the study. The next section thus will explain the methodology that will be carried out in this dissertation.

3. Methodology

Research strategy

Research strategy is a section in which the researcher identifies the possible strategy of the research. The research strategy defines the further study of the research, and makes a particular frame to the strategy. According to Saunders, Lewis and Thornhill (2009) “Some of the strategies are dependent on the deductive or inductive approach. However, often allocating strategies to one approach or the other is unduly simplistic. In addition it is mentioned that no research strategy is inherently superior or inferior to any other. Consequently, what is important is not the label that is attached to a particular strategy, but

whether it will enable one to answer the particular questions There are several strategies of research that have been identified as per the basis of the research which are;

The brief overview of the different strategies is discussed in the following table;

Experiment	<ul style="list-style-type: none"> Mainly use in the natural sciences. Experiments are taken to check difference between two variables. Tends to answer how and why questions. Description of theoretical hypothesis.
Survey	<ul style="list-style-type: none"> It is a deductive approach More popular in business and management research. Tends to answer who, what, where, how much, and how many. Exploratory and descriptive research.
Case study	<ul style="list-style-type: none"> Engages an empirical investigation. Opposite of the experimental strategy. Tend to answer why, what and how.
Action research	<ul style="list-style-type: none"> Precisely focuses on action Mainly promoting change in the organisations. Tends to be useful for how questions.
Grounded theory	<ul style="list-style-type: none"> It is an inductive approach. Basically helpful in predicting and explanation of behaviours. Generates data by number of observations.
Ethnography	<ul style="list-style-type: none"> It is also an inductive approach. It is a naturalistic strategy. Very time consuming strategy.
Archival research	<ul style="list-style-type: none"> Uses data from administrative documents. Questions of research are focused on the past and changes over time to be answered.

Source: Saunders, Lewis and Thornhill (2009)

As per the nature of the study, the research strategy could be taken for detailed and crucial investigation of the selected topic. The strategy of the research entirely depends on the how the researcher would be able to solve the previously identified problem.

Data collection tools

<i>Data collection tool</i>	<i>Reason</i>
<i>Interviews</i>	A non-standardised, semi-structured interview is essential in my research in order to understand the meanings that participants ascribe to various phenomena. Since this research will adopt an interpretivist epistemology, the interviewees may use the words or ideas in a particular way and the subjective nature of the discussion may push the interview in an area previously not thought of.
<i>Case study</i>	Although case study is defined as a strategy for doing research as discussed in the previous section, but it can also be used as a tool to synthesize the documentation gathered from cases as evidences and essential corelation of such data is immensely useful. In that context, the researcher has used case study as a tool along with Interviews thus giving the feel of a triangulated approach towards the study.

Data collection and Findings

Introduction

In this chapter researcher will give details of the data collection according to methodology mentioned in previous section. This chapter provides an overview of the interview of Mr. Sorabh Singhani, manager at GBL, and the interview of Mr. Hardik Suthar at ALSTOM. The semi-structured questions were used because of the qualitative nature of the research. The questions used in the interview were open ended, not the close ended. The open ended question would allow interviewee to describe and explain to as per the opinion.



4.1 Interview with GBL

The following are the major findings which are taken from the interview with the manager of GBL:

Question: To investigate the scheduling technique used at GBL, the question was asked to the manager what scheduling software was within GBL? If so, what software does the firm use?

Answer: The manager of GBL replied the firm uses scheduling technique to plan their production, namely SAP.

As mentioned in the literature review section SAP is mainly focused on ERP (Entrepreneur Resource Planning), and by this the organisation support their whole business. SAP has different application and by this applications company maintains their overall business. For the production planning SAP has a PP (Production Planning) module. Although Scheduling Planning software are used one can argue SAP is not specialise software for production planning and scheduling.

Question: to find out if the company following any scheduling rules, the question was asked whether the firm knows what type of scheduling rules are used in the company (i.e. FIFO, critical ratio, etc.)?

Answer: The manager answered in the affirmative. GBL follows the scheduling rule and which is FIFO. The FIFO is a rule which is generally used in the organisation. The FIFO means First in First Out. On the basis of the FIFO Rule Company prioritise the order with the purpose of delivery.

Question: To discover how frequently the company creates new schedule, how often is a new schedule generated?

Answer: the response was on this question was in the GBL the new schedule generates regularly as company receives order from the customers.

Question: to find out if the GBL performs rescheduling the question was raised, if the manager could schedule/ reschedule very quickly, how often would you do this?

Answer: The manager answered in the affirmative that they reschedule quite often. The respondent has explained the reason behind that when in the production if the same features of the order received from the company. Company tries to minimise the efforts and energy, thus to do that the company adds the other order to the running order. So, by doing this the company produces the two orders at the same time whilst the company saves energy and efforts in order to produce a fresh order.

Question: if the company faces any problem while doing rescheduling the question was asked to the manager whether he foresees any problem with rescheduling too often?

Answer: To answer this question respondent wasn't seemed very happy regarding the rescheduling of the production. Whenever they perform the rescheduling, it creates numbers of challenges for the planning team. The challenges are in terms of setup, stability, and confusion to the operators. And the major challenge the respondent has mentioned was the software. In the SAP based software there is not direct tool to do reschedule for the other order. The planning team have to perform many calculations and have to solve algorithms. So this indicates indirect positive response from the respondent about the ineffective scheduling technique of the GBL. Consequently, if this sign proved correct, it would lead to sustain proposed hypothesis of the researcher.

Question: To find out the performance of the scheduling technique in GBL, the question was asked how the manager would rate his scheduling system in terms of the company's performance.

Answer: The manager responded that the result of the Scheduling Technique was unsatisfactory.

Question: To explore the reasoning of the above question the question was asked, please describe reasoning for rating on performance measure of the company.

Answer: the Company uses the SAP's PP module for planning the production of the company which is not very effective for the company. The company facing numerous problems related to the scheduling such as rescheduling, not proper tracking of the running production. As the researcher has mentioned in the literature that SAP is not specialised software to entirely plan for production. SAP has a different module, which communicates each other rather as an integrated software platform. As such this affirms some aspects of the proposed hypothesis, that an integrated Product Scheduling software increases competitive advantage for the firm.



Question: to discover the importance of the production scheduling for the company the question was asked, is scheduling perceived as beneficial to the company? Why or why not?

Answer: the response to this question was generally good. The production scheduling is beneficial for the company because it improves the performance measure. The scheduling actually controls movement of the production on the floor. The production scheduling play a vital role to improve the overall performance of the company in regards of increased output, improved on time delivery and also improved balancing of the production line. This particular point of view of the respondents indirectly agrees with the researchers proposed hypothesis which is effective production scheduling can improve productivity of the organisation and it could achieve competitive advantage.

Question: to investigate the challenges of the existing scheduling technique the question was asked what is the biggest challenge that the company faces with scheduling?

Answer: The respondent mentioned the biggest challenge for the company faces is over-production or under-production. Because of the ineffective production scheduling sometime the company produces more than required order or at times it is less than the required order. From the response of the respondent with regards to this problem, the researcher realised that there is a problem at GBL and hence it is an opportunity to effectively implement a new Product Scheduling technique. .

Question: To explore the opportunity of the other scheduling technique the question was asked what feature would the respondent add to the company's software?

Answer: the respondent has replied this question very positively that if he could, he wants to add some sort of tracking feature and the graphical representation of the running production. The respondent explained that if a problem occurs in the Production Scheduling software, once the production is resumed, they could not work out how much more to produce to fulfil the daily quota.

Question: To check the willingness of the effective production scheduling technique the question was asked about the implementing a purely and specialised production scheduling technique in the company.

Answer: The instant response on this question was negative. Respondent said that these kinds of decision are taken place in the top management and to implement new system in the company obviously cost more. The answer from the respondent was reasonable. But the respondent was affirmative about the implementing specialise scheduling technique within the company. The reason behind such questions was to find out if the respondent instantly willingness of the effective scheduling technique or not.

From the interview with the GBL it is noted that respondent was aware of the scheduling technique of the company. So the first aspect of the proposed hypothesis was clear by this interview. The other aspect of the proposed hypothesis to implementation of the effective and specialise scheduling technique the respondent was unwilling but the he was happy to consider the same. Next will be the detail of the interview with the ALSTOM.

4.2 Interview with ALSTOM

The following are the findings which are taken from the interview with the operation planning engineer of ALSTOM:

Question: To find out the actual production of ALSTOM, the question was asked how the actual production done at ALSTOM?

Answer: The operation planning engineer has explained the production about ALSTOM as follows: in ALSTOM there are several types of job shop working in parallel. The different job shops are working as they are assigned to do their particular tasks. These different job shops have their own and particular time duration that has to be fulfilled, as they are responsible for it. As from the answer it is clearly identify that in ALSTOM there are several job shops working in parallel.

Question: To determine the particular technique of the ALSTOM, the question was asked whether they are using any scheduling techniques?

Answer: For scheduling production, ALSTOM uses PRIMAVERA computer based software. PRIMAVERA is computer based software which uses the pre-loaded data from their central server. As per the requirement of the particular project, the operation planning team feed data into PRIMAVERA, and PRIMAVERA automatically designs the schedule of entire project.

Question: To discover the working of the adapted technique, the question was asked how practically does PRIMAVERA work?

Answer: Once the data feeds into PRIMAVERA, it differentiates different tasks and jobs as per the requirement. Primavera generates the various paths of the tasks. These different paths also include the critical path. PRIMAVERA also develops different bars, so as per the duration of the various tasks and availability of the machines, production of the project moves to the final finished product.

Question: Once the production scheduling has been done, how the production team start working on the schedule?

Answer: The respondent gave his response to this question saying once the entire production schedule is done as per the availability of the floor and machines, the production team starts their sequence of the desired product.

Question: To find out about the maintenance of the existing production schedule, the question was asked how ALSTOM undertake preventive maintenance of the existing schedule?

Answer: The respondent has replied to this question that they continuously observe PRIMAVERA, and when the team find any slack or gap between two different tasks, the operation planning team undertake the maintenance of the particular job shop.

Question: To discover the monitoring of the existing production schedule, the question was asked how the operation planning team observe the schedule?

Answer: The monitoring of a particular job shop is all dependent on the supervisor of the shop floor. The supervisor of the shop floor has responsibility for monitoring the process every day, whether the production is running on time or not. The operation planning team also has responsibility for observing the different shops on a daily basis. On the basis of continuous observation by the supervisor and operation planning engineers, they also arrange a meeting with their superiors once a week.

Question: To find out the how planning team undertakes the problem, the question was made how they handle the problems of the existing production schedule?

Answer: The respondent has also mentioned in the earlier question that they arrange weekly meetings with their superiors. On the basis of continuous observation by supervisors and operation planning team members, with the help of PRIMAVERA software they identify problems before they actually occur. As per the identification of the problem, they try to stop any other shop which is not actually necessary for the production. As per the particular problem, the operation planning team tries to avoid disruption and also make changes to the non urgent jobs as per PRIMAVERA.

4.3 Summary of the Interviews

Topic of investigation	Question asked	Summary of the answer from respondents	
		GBL	ALSTOM
Product	What do you produced?	Sheet Glass	Hydro power equipments
Production type	Which type of production exists in your company?	Continues	Job shop
Production planning	Is production scheduling existing?	Yes	Yes
Production planning technique	Which production scheduling technique do you use?	SAP (PP module)	PRIMAVERA
Specialise technique	Is your production scheduling technique specialist to do so?	No	Yes
New schedule	How often do you schedule?	When new order comes	When new order comes
Reschedule	Do you foresee problem while reschedule?	Yes	No
Performance of existing technique	Are you satisfied with performance of scheduling technique?	Unsatisfied	Strongly satisfied
Important of scheduling technique	Is production scheduling important for company?	Yes	Yes
Problem in scheduling technique	What is the biggest challenge company facing with scheduling technique?	Not able to track and trace	There is not any big problem PRIMAVERA
Overall performance of production	How do you rate the overall performance of your production?	Unsatisfied	Strongly satisfied

As per the interview with the operation planning engineer the motive of the interview was achieved as responses was expected and it was in favour of the proposed hypothesis. The following section will explain how ALSTOM plans and control of the production by using PRIMAVERA as production scheduling technique. These data have been collected by the researcher from the informal conversation with the production planning engineer at ALSTOM.

4.4 Production scheduling at ALSTOM

Production scheduling is the most important factor in decision making and also has a valuable role in the manufacturing and the service industries. Scheduling deals with the proper sequence of the job, tasks, orders, and individual operations, as well as getting the right people to the right places for completion of jobs, operations, tasks and orders. ALSTOM is a well known and well organised manufacturing company. In case of delays to the finished product or delays in the manufacturing line, it would cause major damage to the company. ALSTOM is a technologically innovative company in the market. To reduce these kinds of the delays and give the best of their service, ALSTOM uses PRIMAVERA software for planning and scheduling the production.

For making a smart and valuable production planning, ALSTOM uses the PRIMAVERA software system for the scheduling and the planning of the production. PRIMAVERA is basically intelligent and smart computer software. This software is initially used in the huge manufacturing industries. PRIMAVERA is a software system which includes the preloaded in their database. On the basis of the database, PRIMAVERA plans and schedules the entire production. In PRIMAVERA, whenever the new data of the required production is added, the software automatically designs the planning and schedules of the proposed production. As the PRIMAVERA software gets the full data of the new proposed production, it designs the whole production plan as well as breaking down the small different jobs. It means it also schedules the small jobs which have to be completed several at the same time.

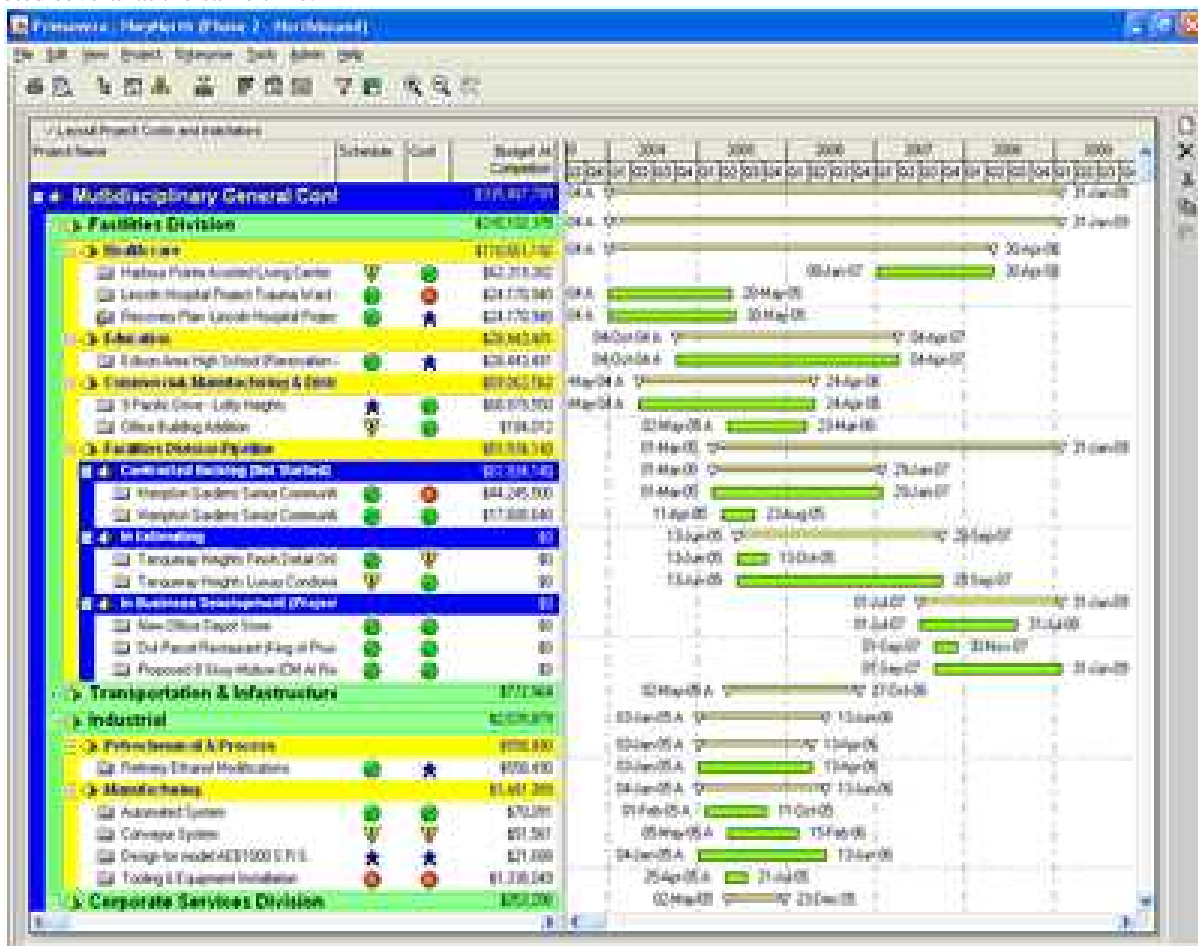


Figure: PRIMAVERA Planning and Scheduling
 Source: image adapted from projstream project solution website.

The figure shows the PRIMAVERA production planning and scheduling. This PRIMAVERA production planning and scheduling software basically works based on the network diagram. As shown in the above figure, it indicates the different bars and the nodes of the particular tasks.

The network diagram is a popular medium for the graphical representation of the scheduling and planning method. The figure shows different arrows and nodes of the various tasks. Fundamentally, two types of network diagram are used in the planning and scheduling system, which are activity-on-arrow and activity-on-node. Any network diagram contains the main critical path. This critical path identifies the longest and the most critical task in the whole production system. In this kind of production scheduling, the critical path is the most important part of the scheduling. The reason for it being so important, is that if any delays occurred in the small path, it might not be a reason to worry, but if the delay is caused in the critical path, then it will affect the whole of the system of the production. So, in ALSTOM, by using PRIMAVERA, the production planning and scheduling are plotted on the network diagram.

4.5 Findings from the interview

4, 5.1 GBL

The interview with the GBL clearly indicates ineffectiveness of the production scheduling of the company. The company is facing issues regarding over-production or under-production frequently and it is also mentioned by the interviewee that it is because of the ineffectiveness of the scheduling. GBL uses SAP to support overall business of the company. As mentioned in the literature review SAP is focused on improving the production schedule of the overall business with the assistance of different modules. For maintaining production SAP has PP module to plan and control but SAP is not specialised software to plan and control for the production so it is not appropriate tool to be used in all situations.

As mentioned in the interview SAP does not show any graphical representation of the current production situation and also does not have the ability to track and trace current running production. Thus it has been considered that the production scheduling in the GBL is not effective.

4, 5.2 ALSTOM

As expected the data was come across from the respondent was very helpful and supportive to proposed hypothesis and also for this study. So, the ALSTOM uses the computer based software which is PRIMAVERA. PRIMAVERA is a purely dedicated and specialise software for the production scheduling planning and control. The PRIMAVERA has great feature such as execution of the running production, CPM shows the actual situation of the production, in addition to that the tracking Gantt chart clearly shows the graphical representation of the current production.

Furthermore in the PRIMAVERA one can easily track and trace the current production of the company. Because of the great features of the PRIMAVERA the production of the ALSTOM is smooth. Thus as from the proposed hypothesis the ALSTOM proves that the effective and specialise software base scheduling lead to a smooth and efficient production.

Summary

The purpose of the study is to collect data in which the researcher has undertaken the interviews with the two manufacturing companies. The data obtained from both companies is very helpful to this research work. The data gathered from GBL shows the company experiences problems through the scheduling technique and it leads to the overall productivity of the company. The data collected from ALSTOM shows that the production of the ALSTOM is running smoothly. The data indicates that the main reason of the smooth production is because of the PRIMAVERA production, scheduling, planning and controlling software. The integrated nature of the PRIMAVERA software allows companies to run more effectively and efficiently. As such, the researcher has discovered from the primary research that the result supports the initial hypothesis namely, companies benefit much more from the PRIMAVERA software because it is an integrated and dedicated production scheduling software. Compare this to the result from the first interview where the SAP ERP system only contained the PP (Production Planning) module – this was deemed to be insufficient and inefficient as a complete production scheduling software. The researcher thus recommends that companies, in order to gain maximum efficiency and effectiveness in production scheduling and planning to implement a complete software package such as PRIMAVERA.

5. Conclusion

Production scheduling is a very important and necessary part in manufacturing industries. Production scheduling includes the major part of the management, and it also requires much expertise to handle it. The manufacturing industries produce plenty of products at the end of the production system. The manufacturing units are also working with different projects at a time.



So the proper planned and developed planning and scheduling system should be building up to deal with the different projects.

Basically manufacturing is a process, to produce a quality and valuable goods by use of machines, labours and tools. Manufacturing requires proper planning, control and scheduling of the overall system to produce effective and efficient products. The major manufacturers also need to give priority to dispatching products to customers.

Production/operation is the main concern of any organisation, and it actually deals with the process of production. Therefore production/operation management requires more expertise resources as well as technological equipment to deal with. The basic fundament of the production is that adding the technology in to the raw material, and at the end comes up with the fashioned product. The production is classified into four types, which are job-shop production, batch production, mass production, and continuous production. The production type of the GBL is continues production and it has ability to produce 150 ton glass per day.

India is also very beneficial for the manufacturing organisations. The growth of the manufacturing industries also depends on the economic condition of the existing country. The country and manufacturing industries are both interlinked with their both growth. From the past few decades India is emerging and developing country in the world. So the overall success of the any manufacturing industry also boosts the existing economy of the country.

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