Production Rescheduling For the Manufacturing Industry Centred On the Possibility of Delivery

Prafulla K Swain[1], Mr. Irfan bashir[2]
[1]Department of Management, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar, Odisha
[2]Department of Management, Sanskriti University, Mathura, Uttar Pradesh
Email -[1] prafullaswain@soa.ac.in, [2]irfanbashir@sanskriti.edu.in

ABSTRACT

Contract Manufacturers (CM) typically plan production taking into account the needs and constraints of each customer. One downside of this strategy is the difficulty in assessing its overall production schedule, especially when urgent production rescheduling is required. The lack of communication and coordination between CMs and customers imposes the rescheduling of output is focused on observations from planners. The real-time plan execution monitoring is indispensable to guarantee the commitment to production (on time and quantities of products). If production disruptions occur, steps must be taken to realign the production schedule and delivery plan, thereby preventing or minimizing any consumer frustration. This paper introduces a new conceptual model for the rescheduling of contract manufacturing output based on the evaluation of the delivery risks to customers, including alignment of the production schedule with the customer delivery commitment. The model was implemented and tested using real ability knowledge, using a simulation-based technique.

Keywords
Contract Manufacturer (CM), Conceptual Model, Contract Manufacturing Service (CMS), Production Rescheduling, Simulation

Article Received: 10 August 2020, Revised: 25 October 2020, Accepted: 18 November 2020

Introduction

Contract manufacturer (CM) industry does not have its own brand for end customers who are contracted to produce parts (printed circuit boards, subassemblies and others) or even the entire brand-owning company product. The contract stipulates that CM goods must be supplied according to changeable demand [1]. Compared with the finished goods industries, this form of organization has a limited profit margin, so having good Production Planning Control (PCP) is important.

Planning is the field of the company that directs all other areas of the business to attain the commitment agreed with the customer. This is responsible for the control of production, the Master Production Schedule (MPS), and the execution of schedules. Timing method is one of the most critical decision-making processes in the industries[2]. The real-time plan execution monitoring is indispensable to guarantee the commitment to production (on time and quantities of products). If production disruptions occur, steps must be taken to realign the production schedule and delivery plan, thereby preventing or minimizing any consumer frustration.

The companies are currently interested in creating value for customers, especially in terms of improving lead time, delivery systems, product quality and reliability.[3] It is common for CMs to have a clear production plan for each company and for each company (work cells) some small or large companies have dedicated teams and resources. One common downside of this kind of organizational structure is the difficulty of evaluating general plant capacity, particularly when urgent rescheduling of production is required due to unexpected downtimes in production.

In Industry 4.0, products and services are linked by automated and self-optimized network applications like distribution without human interference, thus allowing autonomous decisions by system elements. Industry 4.0 viewpoint literature review of production scheduling looks at gaps in rescheduling approaches, incorporating supply chain data into scheduling and shipping decisions, among other factors . Smart systems need reference models to understand the clear definition of concepts connecting real-time data availability with automated monitoring, and simulation may reflect complex environments and perturbations.

Following the trend of Industry 4.0, this work aims to incorporate production running information into CM and inventory consumption into customers in order to determine the risks that may arise from changes in the CM schedule on the consumer [4]. Accordingly, an assertive rescheduling can take place automatically (without planner intervention) if there is a hazard in the deliveries negotiated with the customer and the two companies receive the information at the same time.

This paper introduces a new conceptual model to recommend a rescheduling of output based on assessment of the distribution risks to customers. The model's key contribution is to take customer information to assess the need for production rescheduling in the CM sector, combining all networks, the factory and customers [5]–[7]. This mechanism should be linked flexibly, allowing for automation and self-optimisation without human interference, so that the system can make autonomous decisions. The conceptual model was developed based on the experience of the authors in CM organisation, and the model was then applied and validated using a simulation-based technique using actual power.

Literature Survey

Production Rescheduling:

Rescheduling principles for production are already discussed in some studies: "Rescheduling is the method of modifying an established production schedule in response to delays or other adjustments." "Rescheduling is the procedure for restoring a production plan that is disrupted by unforeseen delays. Rescheduling is a method of creating a new operational schedule when an unexpected interruption occurs. "Significant adjustments in activity trigger Output Rescheduling, which are not originally scheduled but are required due to inevitable circumstances, which may be triggered by instability from external business or internal output environments.

Manufacturing processes are complex, and rescheduling occurrences of output are normal, since manufacturing operations are not normally flawless. The key factors that can trigger manufacturing disruptions are: machine breakdowns, increased order priority, arrival of rush orders, cancelation of orders, alteration of order, quality issues, reworking of goods, delay in delivery time, unavailability of the operator and materials not available.

Usually schedules are produced specifically for each customer in contract manufacturing service enterprises. Furthermore, several more organized factories have dedicated planner work cells. In this way, considering all lines and all clients, it is very difficult to determine where the greatest challenges and potential opportunities lie. Based on its experience (with clients, in-process models and line configurations), the Planner negotiates changes in delivery schedules when production rescheduling is required, and decides adjustments in the schedule of the running day [8]–[10]. Developing systems that can synchronize and coordinate information between consumers (inventory consumption) and CMs (production execution) is important in order to achieve a better rescheduling of output to fulfil the targets for both businesses.

Methods of addressing a scheduling problem have been studied for a long time, and several types have been used to describe them: traditional, knowledge-based, distributed resolution, right-shift rescheduling, heuristic, multi-agent, active scheduling, case-based reasoning, restrictive scheduling, artificial intelligence techniques, stochastic scheduling, and robust optimization.

Many scheduling problems are complex, large-scale, non-linear, and unpredictable, and belong to the NP-hard optimization problem class. Consequently, when analytically modelled, optimal solutions are either not calculable or only in long computational times. To reduce these issues, Sobaszek proposed an intelligent scheduling system that uses data input to create a reliable schedule, minimizing the likeliness of rescheduling requirements. Robust plan, however, can need to find more capital to prevent losses with few downtimes.

Simulation Approach:

Simulation is a tool for measuring and evaluating stochastic and dynamic processes, such as production systems. Complex systems can be tested or built using simulation-based techniques, allowing simulation models to predict the effect of changes in an existing system or predict a new system's operating output. Modelling and simulation is one of the most effective ways of coping with interactions based on approaches in complex real-world systems.

Simulation software can model much of the actions of the real-structures, but the simulation packages have drawbacks when it is important to model sophisticated human decision-. To make the simulation model more effective and reliable, computational support methods incorporated with the simulation should be used. Frantzén implemented a novel scheduling and real-rescheduling system which integrates a simulation-optimization model with the shop floor database using data from the current state of the system.

The suggested rescheduling method in this research is focused upon two authors ' professional experience. Without a simulation model that can predict the operational efficiency of a new system, it is difficult to persuade industry personnel about a new process architecture. So, a simulation model will validate the conceptual model of output rescheduling proposed in this study. Without human interference, it is supposed to provide an automation and self-optimisation mechanism (autonomous machine decisions), Nonetheless, due to the limitations of the simulation tools, the use of a computational support tool is required to optimize the entire solution proposed.

Conceptual Model

Contract Manufacturer: schedule information and production execution:

In the contract manufacturing industry it is common for each customer to have an individual schedule. This conceptual model suggests a single schedule for all customers, which will allocate the schedule according to preferences and capacity constraints on all lines. The plan execution must be tracked in real time, which predicts the outcome of the output at the end of the day. This block performance has to notify the balance between the production schedule and the production performed for each section. Fig. 1 shows Conceptual Model of Production Rescheduling Based On the Evaluation of Delivery Risks to Customer.

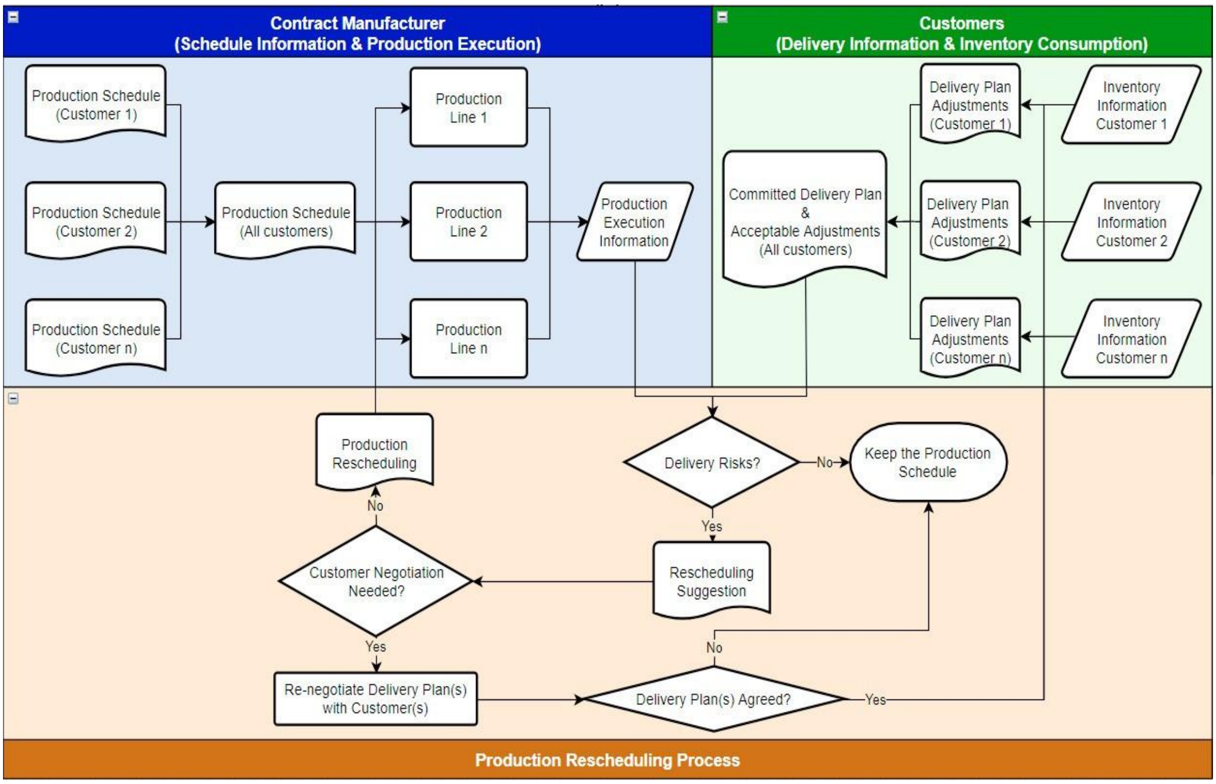

Fig. 1. Conceptual Model of Production Rescheduling Based On the Evaluation of Delivery Risks to Customer.

Customers: delivery information and inventory consumption

On the customer side, inventory usage would recommend appropriate changes to the delivery schedules to be contemplated by rescheduling proposal, just in case it is required. The statutory tolerances for the output amounts and delays should be taken into account. Do need to be aware of the dedicated implementation plan.

Production Rescheduling Process

This is the very heart of the conceptual model. Data on the manufacturing execution will be aligned with committed production plan. When delivery threats are not present, then the production schedule will be preserved. By comparison, if there is any production disruption with possible risks of delivery delays or even cancels of delivery, an autonomous production rescheduling will be suggested based on the capability reported by CM factory side in the system and the appropriate customer-informed changes to delivery plans. If the planned rescheduling modifications infringe contractual arrangements or do not fully remove the delivery risks (just reduce the amounts or delays), the CM production manager will be active in agreeing with the customer adjustments to the delivery schedule. When an arrangement occurs, the consumer changes the necessary modifications in the delivery plan and the flow is followed up again, unless the production schedule is retained and the responsibility is borne by the contract manufacturer industry.

Conclusion

In this research, a new conceptual model for contract manufacturing production rescheduling was introduced based on assessing the delivery risks to customers. A critical aspect of the conceptual model is the incorporation of information concerning output execution (on the CM side) and information on inventory use (on the consumer side). The proposal allows the machine to make autonomous decisions. Due to the lean culture of the business, the test case implementation, using real data, demonstrated a strong balance between scheduled and executed output. In the execution of distribution, however, gaps were found. Recommendations for future research include the use of computational tools to support this model's optimization (especially production process rescheduling block), testing autonomous decision-making, and integration with data feedback systems.

References

[1] M. Hahn and F. Keller, “Modeling human reading with neural attention,” in *EMNLP 2016 - Conference on Empirical Methods in Natural Language Processing, Proceedings*, 2016.

[2] J. Li and C. A. Floudas, “Optimal event point determination for short-term scheduling of multipurpose batch plants via unit-specific event-based continuous-time approaches,” *Ind. Eng. Chem. Res.*,

2010.

[3] M. Witkowski, S. Kacprzak, P. Zelasko, K. Kowalczyk, and J. Gałka, "Audio replay attack detection using high-frequency features," in *Proceedings of the Annual Conference of the International Speech Communication Association, INTERSPEECH*, 2017.

[4] M. Y. Petukhov, "On the Relevance of Implementation of the Automated System of Production and Supply Sheduling at Oil Refinery," *Autom. Remote Control*, 2018.

[5] I. H. Resource and R. Management, "Introduction to International Human Resource Management," *Hum. Resour. Manage.*, 2006.

[6] Z. Hamid, M. Muzamil, and S. A. Shah, "Strategic human resource management," in *Handbook of Research on Positive Organizational Behavior for Improved Workplace Performance*, 2019.

[7] S. H. Hengky, "Fundamentals of Human Resource Management," *Journal of Human Resources Management and Labor Studies*. 2013.

[8] A. Salehi, "Strategic human resource management," *Adv. Environ. Biol.*, 2013.

[9] R. De Jesus Nocêra, "Project Human Resource Management," in *The PMP® Certification Exam Study Guide*, 2012.

[10] А. Лифшиц and A. Lifshits, *Human resource management: theory and practice*. 2017.