Rescheduling Activities in Face of Disruption in House Hold Goods Manufacturing Supply Chain

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ABSTRACT

A case study from the household goods manufacturing industry is presented in this paper. The manufacturing system consists of parallel machines to make three varieties of products with different processing time. Order cancel, raw material delay and entry of the returned goods from the after sales service network are considered as disruptive events and delivery performance, average delay and waiting time of the products are selected as performance measures. Hybrid right shift-left shift rescheduling method was applied to evaluate the performance measures. Longest processing time, shortest remaining time and longest remaining time priority rules were followed for sequencing the jobs. The objective of the work is to study the influence of the priority rules and disruption on performance measures. Contribution of this paper is to make the rescheduling activity in the multi-product parallel machine environment under multiple disruptions. These findings will be useful to the industry personnel to handle the disruptions without spoiling the delivery promise.

KEYWORDS

Delivery Performance, Disruptive Events, Parallel Machine System, Priority Rule, Right-Left Shift Rescheduling, Supply Chain

INTRODUCTION

In the current decades, the manufacturing industries are struggling to retain the existing customers and also to get new customers. The dynamic nature of the customer behavior and their increased expectations from the manufacturers are forcing the enterprises to be watchful. Customization of manufacturing system also makes more complication in the production planning and execution activities (Kamrani et al., 2012). Today’s customer is not ready to wait on the queue for receiving their product/service. Manufacturing the products with outdated technology is associated with huge risk of obsolescence. Globalization, on line shopping and development of communication technology has increased the business competition (Rönnbäck et al., 2007). Manufacturing the goods with competitive price is also essential in addition to quality, time to market, after sales service and productivity (Thomas et al., 2012). Enterprises need to focus on every single aspect of the above-mentioned challenges and design their business structure to overcome the issues. Supply chain management is a tool to manage all the issues associated with manufacturing the products and delivering the products to their customer. It is nothing but the networking and managing the various business entities like supplier, customer, transporter, warehouse, retailer and distributor to fulfill the customer need (Chopra & Meindl, 2007). A supply chain should be designed in such a way that, integrating all units and monitoring the activities
of each unit to face the challenges of the business. The supply chain should have agility to manage the technological changes and variation in the products. Hence, the success, growth and survival of the enterprises highly rely on the effective supply chain activities.

The real time manufacturing industries may not have reliable production schedule due to the disruptive events from various entities. Event management system of the supply chain will identify the disruption and regenerate the production schedule to face disruption. Rescheduling is an unavoidable activity in the manufacturing system due to the events from various units. The common disruptions occurring in the manufacturing lines are machine break down, entry of new jobs, order cancel, variable delivery time, uncertain processing time, uncertain due date, equipment maintenance, raw material delay, raw material shortage and tool breakage (Rahmani & Heydari, 2014). The rescheduling may also be triggered for the events like unreliable machine (Sabukcuoglu & Karabuk, 1999), job rework entry (Liu & Zhou, 2013), machine and tool limitation (Zeballos et al., 2010) and stochastic processing time (Juan et al., 2014). Rescheduling is nothing but revising and regenerating the production schedule to overcome the uncertainties (Hyeonjoh et al., 2001; Vieira et al., 2003) presented the definition of the rescheduling and developed a frame work for understanding the various rescheduling strategies, policies and methods used in different manufacturing system. According to the framework, the rescheduling strategies are classified in to dynamic and predictive-reactive strategies. In case of periodic rescheduling, the schedule revision activity will be performed as per the time horizon. However, the disruptive events are not considered in this schedule. Event driven scheduling is initiated, whenever, the disruptive events occurred in the system. The schedule is revised to absorb the impact of the disruption (Aytug et al., 2005). Hybrid rescheduling policy is nothing but, the schedule is regenerated at the time of rescheduling period and disruption occurs in the manufacturing system. It is a combination of periodic and event driven rescheduling strategies (Vieira et al., 2000). Robust rescheduling, right shift rescheduling, partial regeneration and complete regeneration are important methods applied to the rescheduling. Huang et al., (2013) used Drum-Buffer-Rope (DBR) rescheduling method for solving the scheduling issues in the mixed line production system. Zakaria & Petrovic, (2012) followed the reshuffle and non-reshuffle rescheduling methods for the flexible manufacturing system. Sabuncuoglu & Karabuk, (1999) discussed different types of dispatching heuristics including modified due date, shortest processing time and most work remaining for rescheduling the jobs. Qi et al., (2006) applied right shift priority rule and left shift priority rule for disruption management in a single and parallel machine scheduling. The analysis shows that these scheduling practices are easy to understand and applied intuitively. Nadiah et al., (2012) conducted a case study with real time industry data. Shortest processing time, earliest due date and longest processing time are applied to reschedule the jobs. The numerical investigation shows that, the existing (FCFS) priority rule has poor makespan and excess inventories where as SPT rule yield good performance than other priority rule. Montana, (2005) conducted a comparative study on the schedule generated by combinatorial optimization and dispatch rules for on line rescheduling issues. Schedule predictability and time scale for scheduling problem change are considered as criteria to assess the performance of the schedule. The analysis of the study indicates that, the schedule generated by priority dispatching rule outperformed over the schedule created by combinatorial optimization process. Makespan, lateness, tardiness and stability are important measure to evaluate the rescheduling performance at the job floor. Among the various performance measures of the supply chain, the flexibility of the service system to meet the customer need is a crucial measure for the present trends of business system. The supply chain performance metrics for customer perspective includes on time delivery of goods, responsiveness to the rush order and delivery reliability performance (Gunasekaran et al., 2004). Delivery performance of the supply chain is measured in terms of delivery-to-request date, delivery-to-commit date and order fill lead-time (Stewart et al., 1995). It can be achieved by effective scheduling and rescheduling of the manufacturing system. Hence, the supply chain performance metrics for customer perspective is heavily depending on measuring and improving effectiveness of the scheduling/rescheduling methods (Bhagwat & Sharma, 2007).
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