



Managing uncertainty in ERP-controlled manufacturing environments in SMEs

S.C. Lenny Koh^{a,*}, Sameh M. Saad^b

^aManagement School, University of Sheffield, 9 Mappin Street, Sheffield S1 4DT, UK

^bSchool of Engineering, Sheffield Hallam University, City Campus, Sheffield S1 1WB, UK

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Abstract

This research examines how and to what extent uncertainty disturbs the SMEs in the manufacturing sector, which plan and schedule their production using MRP, MRPII or ERP system, and proposes to apply a business model to manage uncertainty. This environment is termed the ERP-controlled manufacturing environments. A comprehensive literature review found that various buffering and dampening techniques have been used to tackle uncertainty. The results of which show consistent late delivery performance, reinforcing that there is a clear shortage of knowledge and guidance on how to tackle uncertainty, particularly in these SMEs. In this study, a business model that enables diagnosis of underlying causes of uncertainty is applied through a questionnaire survey in order to identify the types of underlying causes that are more likely to result in late delivery. The survey results provide the SMEs with a reference on the underlying causes of uncertainty that must be tackled with higher priority. Simulation modelling and experimental study of the underlying causes of uncertainty on late delivery based on a real case study verify and validate this suggestion.

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1. Introduction

Traditionally, Material Requirements Planning (MRP) and Manufacturing Resource Planning

(MRPII) systems are used by large enterprises as a production planning and scheduling tool. Over the last 10 years, a new system has evolved from these systems, namely the Enterprise Resource Planning (ERP) system. These types of systems are now seen as an enterprise wide integrated information system. In an enterprise context, their main aim is to provide information to/from finance, accounting, sales, marketing, planning,

*Corresponding author. Tel.: +44 1144 222 3395;
fax: +44 114 222 3348.

E-mail addresses: s.c.l.koh@sheffield.ac.uk (S.C.L. Koh),
S.Saad@shu.ac.uk (S.M. Saad).

production, purchasing, human resource, logistic and distribution so that the entire organisation process from receiving a customer order, to manufacturing, and final delivery is structurally and systematically handled by the system. In a production context, their main aim is to produce a reliable Planned Order Release (POR) schedule in order to meet the delivery due date.

Whatever system is chosen, it must be capable of performing within an uncertain environment. Uncertainty, in this context, is defined as any unpredictable event that disturbs the production process in a manufacturing system that is planned by MRP, MRPII or ERP system (Koh and Saad, 2003a). Some researchers referred to uncertainty as a form of disturbance (Lindau and Lumsden, 1995; Frizelle et al., 1998; Saad and Gindy, 1998). Regardless of the terms that it is being referred to, overall, these researches examined a variety of buffering or dampening techniques to minimise the effect of uncertainty.

The big ERP system vendors include SAP, BaaN, ORACLE, JDEDWARDS, and PeopleSoft. Boston-based Advanced Manufacturing Research predicted that the ERP market would reach USD69 billion by 2003, at an estimated compound annual growth rate of 32% (Angerosa, 1999). Customer expectations for shorter delivery lead-times, greater agility, improved quality and reduced costs have made the application of an appropriate MRP, MRPII or ERP system a significant determinant of survival for many manufacturing enterprises. It must be noted that the production planning logic in MRPII and ERP is based on the MRP release logic in an MRP system (Enns, 2001; Miltenburg, 2001; Koh and Saad, 2003b). Therefore, the POR schedule generated from either of these systems is indifferent from one to the others.

One of the main drivers of the emerging trend of manufacturers in Small and Medium-Sized Enterprises (SMEs) implementing such system is the need to compete in the Business-To-Business (B2B) and the Business-To-Consumer (B2C) markets. To compete in these markets, MRP, MRPII or ERP system plays a significant role in production planning and scheduling. They are the back office applications to process customer order

and to plan and ensure materials and resources are available to meet these orders so that they could be delivered to the customers on time, at the right quantity and at acceptable quality. Many large enterprises have already utilised such system for their B2B and B2C business activities. However, the adoption of these systems for production planning and scheduling in SMEs is still at its infancy stage (Muscatello et al., 2003) where many advanced features, e.g. material allocation used in conjunction with production planning, in ERP have not been explored and SMEs use ERP mainly for its finance/accounting functions.

We used the definition from the Department of Trade and Industry (DTI) UK to define our SMEs' sample, which includes SMEs that have less than 250 employees and excludes micro SMEs that have less than 10 employees. The supply chain competitiveness between supplier and customer relies on how effective and efficient the order and information is being handled between the parties in the supply chain. In the B2B markets, many SMEs are now have to be able to provide a level of service that is compatible with their corporate customers. Those SMEs that could provide such a level of service would have a competitive advantage in winning the supply contract.

The implementation cost of such system is very high, and thus it is difficult to justify to SMEs the costs and benefits of the systems. To cater for the need of these SMEs, many midrange and less complex systems have been developed, e.g. Alliance/MFG—Exact Software, MFG/PRO—QAD, WinMan—TTW and All-in-One—SAP. In conjunction of using such system as a planning and scheduling tool, many SMEs combine this with other production planning and control concept, such as Just-In-Time (JIT), Optimised Production Technology (OPT) and finite capacity scheduling to control the flow of materials and manage utilisation of resources. This combinatorial technique shows that MRP, MRPII or ERP might be a good planning system, but they might not be a good control system. Managing uncertainty effectively and efficiently requires a well balanced planning and control because one must understand which uncertainty to tackle and how to

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