

An integrated and intelligent DSS for manufacturing systems

Dursun Delen^{a,*}, David B. Pratt^b

^a*Department of Management Science and Information Systems, William S. Spears School of Business,
Oklahoma State University, 700 N. Greenwood Avenue, Tulsa, OK 74106, USA*

^b*School of Industrial Engineering and Management, College of Engineering, Architecture and Technology,
Oklahoma State University, Stillwater, OK, USA*

Abstract

There is no room for error in making managerial decisions in today's global business environment marked by mergers, acquisitions, and increasing economic instability. In order to succeed in this ever so demanding, fast pace business environment, managers need integrated and intelligent information systems capable of supporting them throughout the decision-making lifecycle, which starts with structuring a problem from a given set of symptoms and ends with providing the information needed to make the decision. In this manuscript, we report on a collaborative research effort whose aim has been to fill this need by developing novel concepts and to demonstrate the viability of these concepts within an advanced modeling environment.

© 2005 Elsevier Ltd. All rights reserved.

Keywords: Intelligent decision support; Structured problem; Automated tool selection; Manufacturing systems modeling; Base model; Expert systems

1. Introduction

Today's highly competitive, fast pace business environment makes it an absolute requirement on behalf of the managers to continuously make the best decisions in the shortest possible time. The notion of 'learning from mistakes' has left its place to 'one strike and you're out' reality. That is, there is no room for error in making managerial decisions in this global environment marked by mergers, acquisitions, and ever-increasing economic instability. Success (or mere survival) depends on quickly aligning the organizational resources towards meeting (and exceeding) the actual (and perceived) needs and wants of the customer. In order to succeed in such an unforgiving environment, managers need integrated 'intelligent' decision support systems (DSS) that are capable of using a wide variety of models along with data and information resources available to them at various internal and external repositories.

In this paper, we report on the up-to-now results of an advanced modeling research project.¹ The main goal of this project has been to develop novel concepts and necessary technologies to make decision support systems (DSS) readily accessible to practitioners and decision makers. To the best of our knowledge, to this date, this research is the only one to attempt to conceptualize, design and develop a comprehensive approach to intelligent and integrated DSS for manufacturing managers. Most other studies (similar to the one reported herein) limit themselves to a specific manufacturing system problem (e.g. scheduling, product design, layout, procurement, maintenance, etc.) or to a specific modeling and analysis tool (simulation, queueing, Petri nets, etc.), and therefore lack in addressing the real needs of the decision makers in a feasible manner.

The main contribution of this research (to the body-of-knowledge in general and to the manufacturing systems modeling in specific) is that it advances the state-of-the-art in model-based decision support systems by addressing the most commonly pronounced shortcomings of the traditional methodologies including lack of model reusability (Mize, Bhuskute, Pratt, & Kamath, 1992; Pratt, Farrington, Basnet, Bhuskute, Kamath, & Mize, 1999), lack of

* Corresponding author. Tel.: +1 918 594 8283; fax: +1 918 594 8281.
E-mail address: delen@okstate.edu (D. Delen).

¹ This research project has been receiving funding from NSF, OCAST and AT&T Foundation since 1992.

integration of models to real world (Dalal, Kamath, Kolarik, & Sivaraman, 2004; Delen, Dalal, & Benjamin, 2005), and lack of model utility/accessibility (Beynon, Rasmeyuan, & Russ, 2004; Delen, Pratt, & Kamath, 1996). First, most decision models have been viewed as single purpose, throwaway efforts. They are built from scratch to address a particular problem or question, and then are often discarded with no thought given to additional use. This single-use, throwaway mentality of decision modeling is very expensive, time consuming and wasteful. Second, the models are isolated from the environment that they represent, portraying a static depiction of the system, specific to the problem being analyzed, lacking the much needed integration with the organizational data/information sources, which are mostly dynamic in nature. Third, lack of usability/accessibility of decision models by non-modeling specialists has limited their widespread usage and value. In order to address these shortcomings we have developed several novel concepts (e.g. base model concept, separation concept, tool independent model representation concept, knowledge-based expert advisors) along with a prototype software implementation where the viability of these concepts are measured as part of the advanced modeling environment.

Fig. 1 illustrates our vision of the decision-making life cycle for manufacturing systems managers. As shown, decision makers are constantly exposed to problems and opportunities (as is the case in many business environments nowadays). In order to solve these problems and/or take advantage of the opportunities, they have to make decisions, which may result in changing the manufacturing system.

In doing so, they have to be *effective* (making the correct decisions) and they have to be *efficient* (making them in a timely fashion). Therefore, manufacturing managers need all the help they can get to make the best possible decisions in the shortest possible time. This is where the need for a new generation of information systems emerges: DSS that are capable of supporting decision makers throughout the decision-making life cycle starting from problem definition and going all the way to results interpretation.

In this study, we designed and developed an integrated software environment (and its prototype implementation) for an intelligent decision support system for manufacturing systems (IDSS-MS), capable of providing help to managers throughout the decision making life-cycle, which includes (1) structuring a problem from a given set of symptoms, (2) once the problems is structured, determining the best analysis tool (i.e. model type) to address the problem, (3) automatically generating the executable models specific to the structured problem, (4) conducting the analysis, and (5) providing the results back to the decision maker in an easily understandable format.

The remainder of the paper is organized as follows. Section 2 gives a brief review of the related literature and places this research in its respective place. Section 3 introduces the architecture of the proposed solution and explains the innovative concepts underlying the architecture. Section 4 explains the software implementation and development of the knowledge bases. Section 5 summarizes the validation process and the usability issues. The paper ends with Section 6 where the concluding remarks and further research directions are identified.

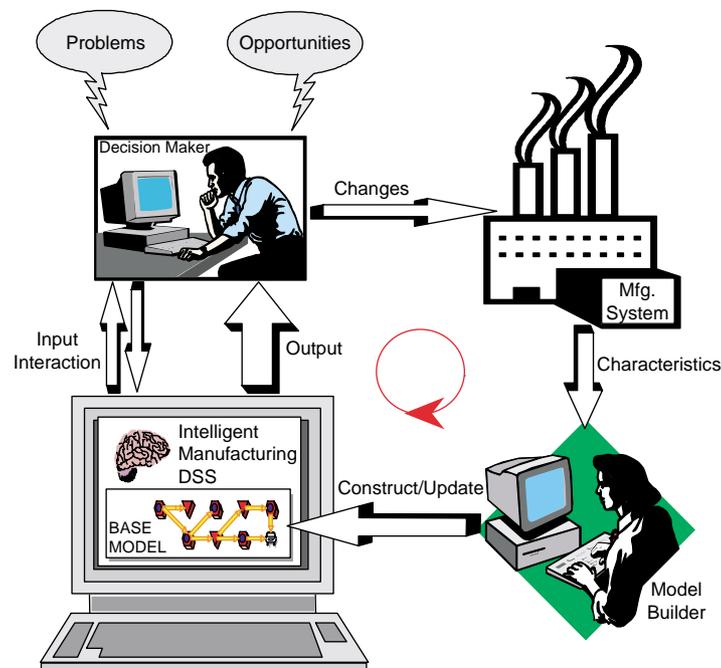


Fig. 1. Manufacturing systems decision making life-cycle.

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات