

Manufacturing Logistics Workshop: A Summary of Research Directions

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Abstract: A workshop sponsored by NSF on Manufacturing Logistics was held on May 29-30, 1997 at Lehigh University, Bethlehem, Pennsylvania. Over 100 researchers from universities and industry attended the workshop. After lively discussion and many debates, a research agenda for Manufacturing Logistics was defined. In this paper, we summarize future research directions in manufacturing logistics identified at the workshop.

Organization of the Workshop: The two-day workshop began with presentations representing perspectives from Government (Geroge Hazelrigg from NSF, Donald O'Brien from DLA), Industry (William Jordan from GM Research Lab), Academia (James Rappold/John Muckstadt from Cornell), Industry/University research collaboration (Warren Powell from Princeton), and software development (Randall Sadowski from Systems Modeling). These talks were followed by four breakout sessions lead by Robin Roundy (Cornell), Randall Sadowski, Warren Powell, and William Jordan. The breakout leaders summarized the group recommendations in the final presentation. The topics of discussion in each group were identical.

1. What is the scope of Manufacturing Logistics?
2. What is the current status of Manufacturing Logistics in industry? What is the current status of academic research in this area?
3. What challenges and opportunities are posed by Manufacturing Logistics? What are the long-term needs? What are the main recommendations for future research directions?
4. Through what mechanisms can university and industry collaborate on Manufacturing Logistics research?
5. What are the topics that arise from the group discussion which deserve further discussion in the future?

In the following, we summarize some important findings of the workshop. A detailed report summarizing finer points of these recommendations is currently being prepared. The report will be published in a technical journal for maximum circulation. The slides used in all group presentations and a summary presentation is available for viewing on the world wide web at the following address: <http://www.lehigh.edu/~inime/nsfws.html>

The Scope of Manufacturing Logistics: Manufacturing Logistics refers to all planning, coordination and support functions required to carry out manufacturing activities. It starts at the point where end-item customer demands are determined, and the point they are fulfilled. A narrow and a broad view of Manufacturing Logistics were identified at the workshop. The narrow view included the planning, scheduling and control of all activities resulting in the

processing, movement and storage of inventory. The broad view included integration across multiple manufacturing facilities, integration between manufacturing and other corporate functional areas such as sales, marketing and engineering design, and integration with logistical functions such as transportation, warehousing and distribution. Major problem classes of Manufacturing Logistics were identified as the design, planning and control of product, systems, operations, information and people.

Summary of Future Research Directions: The following research topics were identified as both intellectually important and relevant to industry needs in the next decade.

Supply Chain Management: Research topics in this area were categorized into *system design issues*, *planning and control issues* and *modeling and analysis issues*. Main topics included selection, location and characterization of assets, structure scheduling and other production information system over extended chain of suppliers, coordinating the communication of demand information in the supply chain to encourage rapid responses.

Managing Uncertainties in Logistics Systems: This includes designing systems that are robust to uncertainty, and planning and control under uncertainty. Main topics include tools for designing flexible and robust systems, managing shortened product life cycles, and explicitly incorporating people and incentive issues.

Information and Data Management: This includes topics such as data management, data verification, methods where data is communicated and shared, determining which information is needed for what decisions, and general issues of data accuracy, data mining and data aggregation.

Design and Analysis of Real Time Systems: This refers to systems that plan continuously rather than periodically and includes design of real time control systems for production planning, scheduling, sourcing and distribution.

Rapid analysis and prototyping of logistics systems: Industry problems change quickly, thus it is necessary to develop approaches that analyze and prototype systems rapidly and provide practical solutions. This includes models, representations and languages that facilitate rapid prototyping.

Product development and design: Managing product variety and product mix, product design according to market and resource needs, and design simplifications.

Design of Decision Structures: Evaluate various decision framework designs in a logistics system. For instance, hierarchical vs. distributed decision structures, aggregation/disaggregation methods, collaborative or multi-agent decision systems, etc.

Developing an experimental methodology for manufacturing logistics: It was recognized that solid empirical work with real data and test cases is extremely important. This includes developing real-world or standardized databases for testing and experimentation, benchmarking and case studies, documenting best practices and the use of reference models.

People Issues in Manufacturing Logistics Systems: The importance of “people issues” was a reoccurring theme during the workshop. Research is needed to account for human performance in logistics system design, to better understand the roles of metrics, incentives and preferences of human decision makers, and to incorporate human insight and expertise into the overall system.

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