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SCHEDULING THE FACTORY OF THE FUTURE—
RESULTS OF A RESEARCH PLANNING SESSION

by

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REPORT OF THE WORKING GROUP ON STRATEGY AND POLICY
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Working Group participants:

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INTRODUCTION

As a part of the overall meeting, the working group met on Thursday afternoon, March 14, 1985, 1:30-4:30, to discuss issues and concepts, and to develop a research agenda for strategy and policy in manufacturing.

There were three other working groups, addressing the subjects: Manufacturing Systems; Distribution; Production and Scheduling. The strategy and policy working group therefore first defined its own scope to be at a level which addressed the integration of these several functions, and the establishment of Corporate-level objectives still principally concerned with manufacturing. Thus, the research proposed should provide interface between top corporate business policy and strategy, and the manufacturing implementation of these strategies and policies.

SCOPE

The scope of interest of this Working Group was strategy and policy for the manufacturing-related decisions of management. It was assumed that general corporate objectives are already defined (e.g., what business are we in); and that a general product line had already been selected for manufacturing implementation. Given these inputs, various levels and functions of Corporate management are required to develop strategy and policy for manufacturing. This paper suggests research questions, the answers to which should be of help in making these decisions.

As top corporate management develops facility and operational plans, it naturally seeks to do the following:

- Top down planning to scope out manufacturing options
- Top down analysis to estimate what would be the results of these options compared to planning goals involved in manufacturing-related policies
Integration of the viewpoints and types of decisions to be taken by various levels, and functions, of management involved in manufacturing-related issues.

The degree to which a manager must be involved in manufacturing-related strategy and policy depends on how closely he is related to the manufacturing function, and what level he occupies in the corporate enterprise. General managers and high level functional managers must include manufacturing facilities and operations as a part of their strategy. Lower level managers are only involved in manufacturing if they have strategic responsibilities for some component of the product. Thus, people even relatively low in the manufacturing function must set policies for their operations which relate to manufacturing. Financial, sales, and marketing people will be less involved directly in manufacturing strategy.

The Working Group used the following list of typical titles to illustrate whose decisions it must target:

- General Manager of a business
- Corporate business planning staffs
- Manufacturing management down to a relatively detailed level
- Product Engineering manager
- Product Marketing manager
- VPs of Finance and Sales

The types of decisions on strategies and policies faced by these managers, combined with some ideas for research approaches, define our proposed research agenda. Typical decisions are illustrated in the next section.

**TYPES OF DECISIONS**

We will categorize the types of manufacturing decisions made by key corporate management as follows:

- Integration of activities across functions and between levels of management to next corporate goals
- Tradeoffs required between business factors related to manufacturing
- Information requirements and the flow technical and business of information, policies, and incentives
- Analysis procedures to evaluate the costs and benefits of alternate strategies and options
- Methods of communicating goals across the enterprise to obtain the best understanding and participation.

Some examples of decisions, in these categories, follow.
Integration

- Selection of production system with performance to match management criteria
- How to specify the locations and uses to which business and operational information and data will be put in operating the business
- Vertical Integration - e.g., long-term strategic "make vs. buy"
- Division of processes and products between plants
- Allocation of facilities offshore, including rational methods of handling the qualitative risks of foreign politics, exchange, etc.
- Procurement - Strategic decisions concerning length of contracts, vendor redundancy, etc.
- Production and final inventory strategy - Make to contract order, or make to level of inventory, level loading of facilities, etc.
- Positioning of stocks - corporate strategy on at what stage in production, what location strategic defensive stocks should be maintained
- Selection of channels of distribution for the product, and its strategic implications for the manufacturing and distribution facilities.

Tradeoffs

- Small vs. large manufacturing facilities
- Alternate process design and its impact during product life cycle
- Weighting factors for quality, vs. price, vs. level of service
- Allocation of markets to different plant locations, by product
- Approaches for rational tradeoffs between product segmentation vs. standardization
- Tradeoffs between capital investment, system inventory, and level of service
- Tradeoffs in inventory control policies - Just-in-time; replacement; log size, etc.

Analytical Procedures

- How to estimate product cost so that effects of specific plant investment options are explicitly reflected in product cost, e.g., cost allocation approaches for facility costs, in system terms
- Measurements for factory control, e.g., productivity; work in process - what measures are needed, and how to calculate them from data that can be actually measured
Assessment of risk in new manufacturing technology.

**Communication of Goals**

- What communication programs will be needed to inform people of a new manufacturing plan - management, employees, community, investors, etc.
- What system of measurements and incentives should be used for each level and function of manager, to assure that the common corporate goals are pursued by each.

**KEY PROBLEM AREAS AND RESEARCH ISSUES**

Based on the above considerations, and on the decisions to be made by corporate management, the following research areas were identified:

- Design methods for world-wide product sourcing, including effects of
  - rapidly fluctuating currencies
  - tariff differentials, rapidly changing
  - political risk in foreign countries
- Acceptance testing techniques for manufacturing systems
- Division of processes between plants - interplant movement, coordinated with intraplant schedules
- How to make cost estimates and cost allocation to allow tradeoffs between plant investment, work in process, service
- How to plan facilities under dynamic changes in market (possibly driven by product evolution and product life)
- How to specify the software and hardware capability required for information and communication systems given the production system and goals
- What is the best use to make of the large amounts of information now available; with what user interface will it best be presented
- What kind of data is needed to control the FMS
  - for quality
  - for emergency/reconfiguration
- Product design and standardization - tradeoff between marketability, producibility, maintainability, cost
- Cost of complexity in product structuring
CONCLUSIONS

It seems clear that algorithms and software systems for use by corporate level management to integrate the set of factors which must be considered to make broad manufacturing policy and strategy, are still in a primitive state. There are some promising starts to an integrated manufacturing planning support system; however, there are many complex issues to be addressed.

Research in these areas should be most profitably by groups with considerable breadth and perspective on the large-scale issues of corporations. The issues to be addressed are complex and include some extremely important qualitative factors. It seems likely that large, complex, integrated software systems will be required to make an impact. These should be prototyped in a context where they can be tried out on real corporate problems, through large consulting firms or in corporations which are sympathetic to these goals but will be critical of any results which do not make sense on their own.

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