

Design of Advanced Manufacturing Systems

Models for Capacity Planning
in Advanced Manufacturing
Systems

Andrea Matta and
Quirico Semeraro
Editors



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Models for Capacity Planning in Advanced Manufacturing Systems

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Design of Advanced Manufacturing Systems

Preface

Since manufacturing has acquired industrial relevance, the problem of adequately sizing manufacturing plants has always been discussed and has represented a difficult problem for the enterprises, which prepare strategic plans to competitively operate in the market. Manufacturing capacity is quite expensive and its exploitation and planning must be carefully designed in order to avoid large wastes, or to preserve the survival of enterprises in the market. Indeed a good choice of manufacturing capacity can result in improved performance in terms of cost, innovativeness, flexibility, quality and service delivery. Unfortunately the capacity planning problem is not easy to solve because of the lack of clarity in the decisional process, the large number of variables involved, the high correlation among variables and the high level of uncertainty that inevitably affects decisions.

The aim of this book is to provide a framework and specific methods and tools for the selection and configuration of capacity of Advanced Manufacturing Systems (AMS). In particular this book defines an architecture where the multidisciplinary aspects of the design of AMS are properly organized and addressed. The tool will support the decision-maker in the definition of the configuration of the system which is best suited for the particular competitive context where the firm operates or wants to operate.

This book is of interest for academic researchers in the field of industrial engineering and particularly indicated in the areas of operations and manufacturing strategy. Also we think that the content, even if it is very technical in some sections, is helpful for those managers who want to know, and possibly to use in practice, a reference architecture for the strategic capacity planning problem in manufacturing.

The first chapter provides a complete view of the capacity planning problem and describes the reference architecture in which enterprise should plan their manufacturing capacity in the long term. This chapter focuses on structuring the main problem in many hierarchical sub-problems, each one described in detail by specifying the type of decision the firm

has to make and the nature of information that is available at the moment of the decision. The following chapters contain the decision models this book proposes to support managers in the capacity planning problem, from the decision on the type of manufacturing systems to adopt to their detailed configuration in terms of resources (machines, buffers, transporters, etc.). Given the organization of the volume, the reading of Chapter 1 is particularly suggested in the reading of the book.

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Chapter 1

A FRAMEWORK FOR LONG TERM CAPACITY DECISIONS IN AMSS

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Abstract Investment in Advanced Manufacturing Systems has a strategic impact that can affect the long term competitiveness of enterprises improving the ability of firms to create new markets, introduce new products, and to react quickly and effectively to competitors. Since the available methodologies to support strategic decisions are not easily applied, firms are in the unpleasant position of evaluating strategic decisions without any practical tool that is able to estimate the value of each specific action and its consequences at the strategic level. The aim of this chapter is to provide a reference framework for the selection and configuration of Advanced Manufacturing Systems. In particular, a framework is proposed in which the different aspects and evaluations that are involved in long term capacity planning are properly organized.

Keywords: Advanced Manufacturing Systems; capacity planning; technology choice.

1. Introduction

In recent years a relevant change has developed in manufacturing systems technology. Such change has been mainly due to the introduction into the market of new equipments able to combine microelectronic and programmable devices within mechanical machines. The so-called Advanced Manufacturing Systems (AMSs) are a result of such a revolution. At the moment different architectures of Advanced Manufacturing Systems are available: some of these architectures are well known and tested like flexible transfer lines, flexible manufacturing cells, flexible