
Preface

Globalisation is pushing manufacturing companies toward a more distributed production approach. Indeed, corporate manufacturing firms are spreading their production all over the world in order to stay close to the customers, while medium manufacturing firms organise themselves in networks in order to scale their production to a global level.

This tendency is putting a lot of stress on production planning. Indeed, the more distributed production facilities are, the more difficult and complex production planning becomes. Both multi-plant facility and manufacturing networks require to be coordinated in order to reach effectiveness and efficiency required by the competitive arena.

Most of the production planning tools, such as Advanced Planning and Scheduling (APS) tools, are designed to manage a centralised production, *i.e.* a production that is accomplished in a single plan. When it comes to managing a network of plants or a manufacturing network, the application of APS tools becomes complex, since the complexity of the planning problem scales up and most of all, because the necessity to recollect data from different sites in a centralised planner causes several problems of data consistency and updating.

This is the reason why, in managing production networks, decentralised production planning tools have been recommended by researchers and industrial managers. Indeed, decentralised production planning has several positive outcomes when it comes to managing production networks: a) data management is easier and more trustworthy; b) production planning systems are more robust, scalable, reliable; c) as a result production planning activities are easier and more reliable.

However, distributed production planning has some drawbacks: a) production planning outcomes are considered less efficient than centralised production planning outcomes; b) coordination among the different entities involved in production planning activities needs to be properly designed; c) properly commercial tools are not available yet.

This book concerns the above-mentioned issues. It faces the production planning problem in complex and very structured manufacturing firms such as those involved in the semiconductor industry. The book presents research work answering major issues dealing with decentralised production planning; in particular, for the considered research context it shows:

- How to structure and organise decentralised production planning for a complex multi-national corporate;
- How to organise business processes among the decentralised entities involved in the production planning process;
- Which kind of methodological tools can be used to obtain a reliable, effective and efficient cooperative production plan;
- Which kind of technology can be used to develop a distributed cooperative production planning system;
- A benchmark analysis showing how the proposed approach and methodologies allow obtaining realistic production plans in the considered research context.

Very briefly (a more detailed outline of this book is given at the end of Chapter 1), the book is organised as follows: Chapter 1 introduces the research problem and the research context with reference to the state of the art; Chapters 2 and 3 provide respectively an overview of Game Theory and Negotiation Theory which are the methodological tools used to build cooperative production plans in a distributed environment; Chapter 4 presents an overview of the Agent Theory that is the technological tool suggested to develop a distributed production planning tool; Chapter 5 presents our approach for organising and structuring a distributed production planning system in a complex environment such as the semiconductor industry. Chapters 6 and 7 present the methodological approach suggested to reach a cooperative production plan in distributed networks such as described in Chapter 5. Specifically, Chapter 6 presents the methodological approach for planning production at medium-term level, and Chapter 7 at plant level. Chapter 8 presents the integration of the methodological approach presented in Chapters 6 and 7 in order to show how the proposed algorithms integrate with each other in order to provide a consistent production planning tool; finally, Chapter 9 presents the conclusions of the research developed in the book.

I wish to thank all the researchers who have been involved in this project. Special thanks go to Dr. Pierluigi Argoneto who, with his Ph.D. work, has allowed us to develop a consistent and unitary body of methodological approaches for planning production in production networks.

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Production Planning in Production Networks

Models for Medium and Short-term Planning

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