# advances in production management systems

edited by
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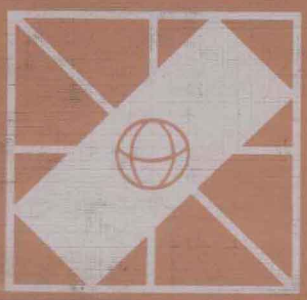

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# *ADVANCES IN PRODUCTION MANAGEMENT SYSTEMS*

## *Production Management Systems in the Eighties*

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Proceedings of the IFIP WG 5.7 Working Conference on
Advances in Production Management Systems – APMS "82"
Bordeaux, France, 24-27 August, 1982

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## Production Management Systems in the Eighties

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# FOREWORD

Production Management is certainly one of the oldest functions in Production but also one of the most complex because of the integration of various aspects : technical, economic and social.

Nevertheless the new economic context compels companies to computerize Production Management. According to this new situation, researches and new developments in the field of Production Management become necessary with a strong link between academic and practical sides.

In 1978, the Working Group 5.7 "Automation of Production Planning and Control" was created in IFIP (International Federation for Information Processing). The professional origin of the members of the W.G. 5.7 is a good illustration of the previous principle.

The first activity organized by the W.G. 5.7 was a workshop in Trondheim in September 1980, chaired by the chairman of the W.G.5.7 : A. Rolstadas.

The conference APMS 82 "Advances in Production Management Systems" which is the support of this book, was the second activity organized by the W.G. 5.7 and the first international conference. The conference was sponsored by IFIP, AFCET (Association Française pour la Cybernétique Economique et Technique), by the GRAI Laboratory of the University of Bordeaux 1 and by a local non profit organization, ADETAA (Association pour le DEveloppement des Techniques d'Automatisation en Aquitaine). This conference attracted 280 participants from 24 countries.

This book includes the papers presented during the conference and the discussions which have followed every presentation.

These papers may be classified into four themes :

- Design of control systems : the main presentations deal with :
  - . design methods,
  - . analysis of decisions and connection between decisions in the main functions of the plant (inventory control, scheduling realtime monotoring...),
  - . influence of social environment,

- Design of information systems :
  - . design methods and conceptual models,
  - . data acquisition in production,
  - . how to improve the man/machine dialog ?

- Implementation of automated production control systems, examples of applications in small and medium size plants, in the automotive industry,

- Flexible manufacturing systems in a very broad field, the main subjects were :

. use of simulation techniques in the design of manufacturing systems,
. how to control such FMS
. examples of implementation.

In addition to these topics the book includes the state of the art in production of management presented from various points of view : K. TAKEDA from Japan, A. ROLSTADAS from Norway, J.R. KING from England, E. HAUTZ from Germany and G. DOUMEINGTS from France.

Now the W.G. 5.7 is well established and the work done, certainly, will favour the development of Production Management particularly in developing research, improving the relation between research and industry and in spreading the techniques. Therefore, every year, the W.G. 5.7 organizes workshops (in 1983 in Vienna (A) and in 1984 in Copenhagen (DK), usually in September) and the next APMS conference will be held in Budapest (Hungary) in 1985. This event will be a good opportunity to measure the progress made in the field of Production Management Systems.

W.A. CARTER
G. DOUMEINGTS

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ADVANCES IN PRODUCTION MANAGEMENT SYSTEMS
G. Doumeingts and W.A. Carter (editors)
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# STATE OF THE ART IN PRODUCTION MANAGEMENT SYSTEMS IN FRANCE AND U.S.A.

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Production Management Systems (P.M.S.) is the function which links the production with the management of the firm and coordinates the various manufacturing functions : process planning, assembly process, robotics, numerical control machine tools, quality control, etc...

The computerization of P.M.S. is recent because of the complexity of this function, which has various integrated aspects : technical, economic and social.

In this state of the art we will present first the realizations of Production Management Systems in France and U.S.A., then their lack of efficiency and finally the trends of the coming years.

## 1 - STATE OF THE ART IN PRODUCTION MANAGEMENT SYSTEMS

We focus our state of the art more on P.M.S. used in USA and France. As our Laboratory is an educational member of C.A.M.-I (Computer Aided Manufacturing-International) and a member of CAM-I's Factory Management Project and works in research, closely with industry, we may be able to draw on the state of the art on P.M.S.'s both in U.S.A. and France.

Figure 1 shows an overview of what Production Management System must be. At the top level we find Master Production Scheduling. This function acts as an interface between commercial forecasting and manufacturing function. Usually decisions are made for a long term horizon according to the orders horizon (one year).

The objectives of the function are to balance production capacities and customer orders (or forecast). We consider that there is an upper level (we call company level on a longer horizon : three or five years) where the investments of the manufacturing systems are defined.

To process the master production scheduling we need several types of information :

- orders information : customer orders or forecast orders,
- strategical information : given by the management of the firm, which allows us to determine the policies for inventory, subcontractors, etc... related to the investment of the firm,
- work centers : it is important to determine the main work centers of the manufacturing system, particularly the bottle neck work center, to study their load,

- Parts list : which describes the products and the components,
- aggregated routes : in agreement with the work centers defined previously, we determine the load and the lead time for each product,
- aggregated bill of material : to link the orders (forecast), finished goods and eventually the critical purchasing components,
- state of production : an aggregated state of production issued from the work-in-process recording allows reaction when the situation is not correct.

From this master production scheduling information, the Production Planning is completed which gives the load of each work center, the list of critical purchases etc... With this results the production manager is able to take decisions about inventory level, manufacturing activities...

The master production scheduling must be integrated with a simulation tool which must be designed according to the needs of the top level managers. The main requirement of this level is to work aggregated data, which is not the case for most of P.M.S.'s.

The second level is requirement planning. From the bill of material and from the orders (what is to be delivered) the system computes the gross requirements.

The horizon of this level is smaller than the previous level : it must be in agreement with the manufacturing cycle, so we get more precise and detailed information : we know the orders with more precision.

From the gross requirements and from information coming from work shop level (inventory, purchased articles, work-in-process) we compute the net requirements planning which gives the components to purchase and the components to manufacture. This function is usually called : Material Requirements Planning (M.R.P.).

The results of these computations will be used by the purchasing function and capacity planning for which decisions are made on a medium term horizon.

Then at the bottom of P.M.S. we find scheduling functions and manufacturing orders dispatching functions.

To complete the system, we have a data acquisition system which feeds the information system with work-in-process. All the filters are the interfaces between information and P.M.S. to adapt the data at the decision level.

What is the situation now about the use of such system by manufacturers ? More important, what is the degree of satisfaction of the users ?

The information has two origins and the conclusions are quite similar. The first is our contracts with industrial firms or software houses. The second is a study made in the United States by A.P.I.C.S. (American Production Inventory Control Society).

This study has been made with the collaboration of the University of Minnesota and involved 1700 societies, located in an industrialized area : Center, North and East of U.S.A. Out of 1700 companies, 679 answered and 64 % of them used computer for production control. The majority of answers issued from companies in which the type was discrete manufacturing.

The figure 2 gives interesting information about the level of automation function by function, and indicates whether the company uses or not M.R.P. (Material Requirement Planning).

We can deduce some conclusions from this table :

- MRP function improve the computerization of other functions,
- Computers are used mainly for bill of material control, inventory control, requirements, which obviously are the easiest functions to be computerized.
- The less computerized functions are : work-in-process control, work order scheduling, capacity requirement planning, order forecasting.

On Fig. 1 we have cross-hatched the field of the most computerized functions. When considering the French companies, we get the same results.

So our conclusions are that the higher level and the lower level of the P.M.S. are certainly less computerized : we note that the basic functions of those level are connected with planning, scheduling and data acquisition system. For planning and scheduling we note that decision making techniques prevail.

Now we can present some major deficiencies about Production Management Systems.

## 2 - DEFICIENCIES IN P.M.S.'s

We have determined five major points in P.M.S., which present serious deficiencies.

- methodology to design, to get specification and to implement P.M.S. ;
- data acquisition system at the workshop level ;
- scheduling ;
- computerized tools to make decisions at long term level functions are those in which decisions making are prevailing ;
- links with the other production functions.

### 2.1 - Methodologies to design, to get specification and to implement P.M.S.

Our experience in P.M.S.'s shows that there is a great lack in methodology in designing and in determining the specifications of the P.M.S. The main problem is to get the real structure of P.M.S., i.e. the links between all functions. The difficulties are the following :

- the complexity of the system with its various aspects : technical, economical and social,