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IMPLEMENTATION CONSIDERATIONS FOR SOFTWARE SYSTEMS FOR PRODUCTION PLANNING, SCHEDULING AND CONTROL

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A DISSERTATION SUBMITTED TO THE
FACULTY OF ENGINEERING,
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ABSTRACT

This dissertation deals with implementation of software systems for production planning, scheduling and control.

It attempts to explain why Materials Requirements Planning (= MRP) systems have become so popular all over the world in the last couple of years.

Further, an attempt is made to judge the success of a MRP implementation in general, and in the U.S.A. in particular.

Notwithstanding an entire chapter is devoted to a survey, aimed at determining the success of MRP in S.A.; which investigated why and how companies implemented MRP, as well as the benefits which they achieved.

The dissertation investigates the reasons for the failure of a high percentage of MRP implementations, and highlights factors which determine failure or success.

Special consideration was given to the peculiarities of the S.A. companies and their environment.

A concept is developed which allows the structuring of the implementation process in a simple and logical way, containing the most important factors, tasks and methods for a successful MRP implementation.

Many different ways of implementation can be formed through the combination of the methods explained. The last chapter puts forward possible predictions of how MRP will develop in the next 10 to 20 years.

DECLARATION

I declare that this dissertation is my own, unaided work. It is being submitted for the degree of Master of Science in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other University.

.....

JOSEF KLEEBINDER

16th day of NOVEMBER, 1983

ABBREVIATIONS

APICS	American Production and Inventory Control Society
BOM	Bill of Material
CEO	Chief Executive Officer
C-Factor	Core Factor
COC	Climate of change
CRP	Capacity requirements planning
D-factor	Dependency factor
E-method	Elementary method
E-task	Elementary task
SAPICS	South African Production and Inventory Control Society
MD	Managing Director
MPS	Master Production Schedule
MRP	Material Requirements Planning or Manufacturing Resource Planning
OC	Order Control
SFC	Shop Floor Control

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CHAPTER 1

INTRODUCTION

1.1 The development of MRP from an Order Launching technique to MRP II

MRP evolved in the 1960's under the name "time series planning" or "time phased requirements planning".(1)

At that time it only was an order launching method. When it became more widely used it got the name "Material Requirements Planning".

With the increase in computer capabilities, it became possible to break the time phasing down into weekly time periods and run weekly rescheduling calculations. Only in the early 1970's did the need for a valid MPS become apparent. With this as the driving force, MRP developed its precision and time-phasing, which made the calculation of valid priorities of planned and released orders possible, into a scheduling tool.

The next major step towards MRP II was the utilization of feedback information from the plant and purchasing, allowing for the control over the execution of plans. Herewith "Closed loop MRP" was borne (see figure 1-1).

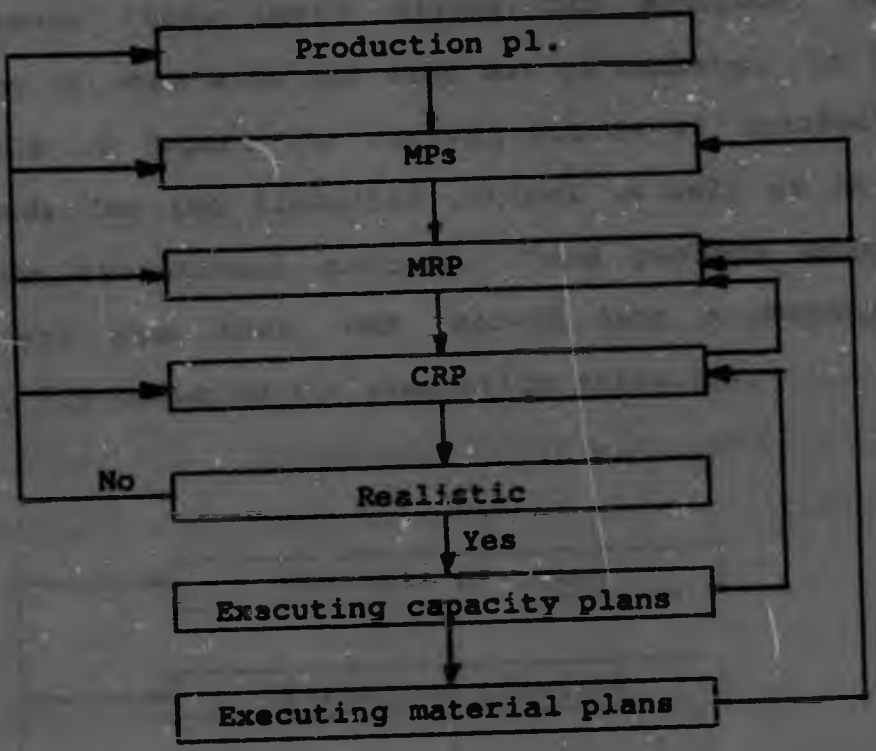


Figure 1-1: The closed loop Diagram (2)

The final step of MRP, when it developed tc MANUFACTURING RESOURCE PLANNING (abbreviated: MRP II) was made between 1977 and 1980.

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(1) Apics Dictionary: Preface, APICS 1980

(2) Wight, O.: MRP II, p.52, O. Wight Publications 1982

MRP II ties the "Closed loop" MRP system and the financial system together. This results in a powerful

management tool, which allows for everybody in the company to work with the same set of numbers. It is now possible to report the current status of manufacturing in Rands for the financial control as well as in units for the operational control. "And perhaps even more important than that, MRP evolved into a company game plan", (3) owing to its simulation abilities.

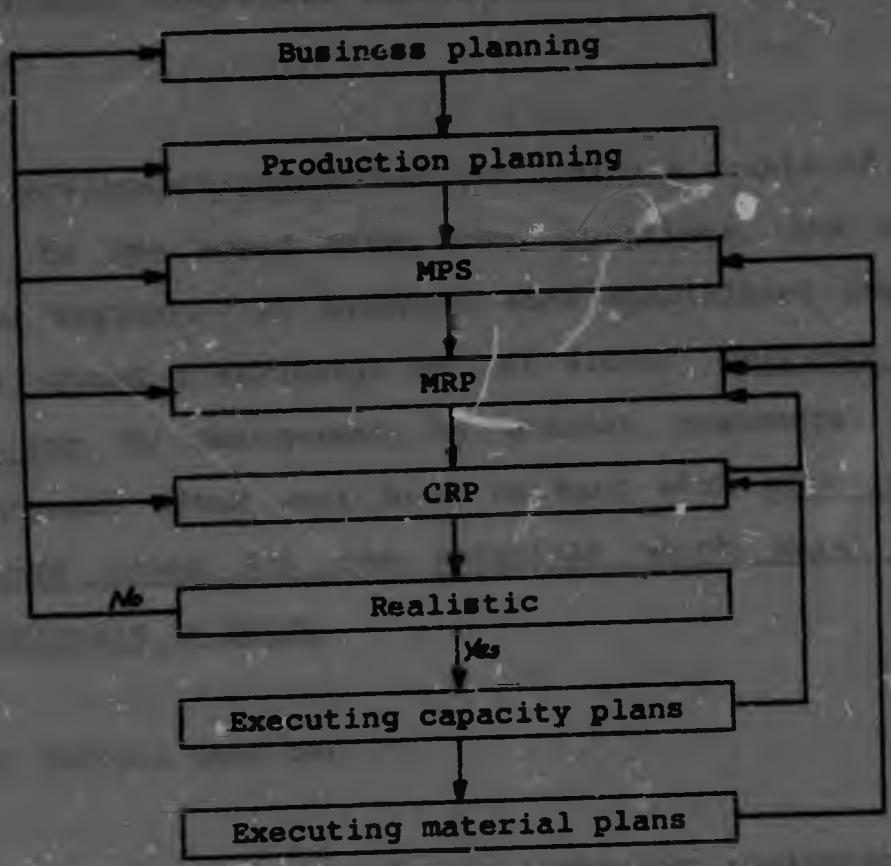


Figure 1-2: MRP II Diagram (3)

1.2 Is MRP a "today's" necessity?

1.2.1 Economical factors

During the last 10 to 15 years, European and American companies put a lot of emphasis on rationalization within the workshop, leading to the development and later to the widespread usage of very powerful, numerically controlled machine tools with high cutting speeds.

This development approached its limits a couple of years ago. In the world wide economic crises, the market became tighter. It demanded more specialized products which caused a shrinkage of lot sides. Delivery times were cut by Management to attract customers. This development often went hand in hand with often longer delivery times for raw materials which were raised dramatically in price.

These factors lead to:

1) inefficient usage of high technology equipment;
2) owing to high interest rates, to unbearably high stock carrying costs;

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(3) Wight. O: MRP II, p. 58, O. Wight Publications 1982.

---

3) the need for a tool which:
   (a) cures the above stated problems (factor 1 and 2), and
   (b) automates the "non-physical" tasks within the production process;
4) the search for an instrument which enables management to "foresee" future problems, and to give, when required, more correct and up to date information; i.e. an instrument which enables it to manage better.

Another important factor, especially for S.A. (but to a smaller extent, also valid for all other industrialized and semi-industrialized countries) and therefore separated from the others, is a lessening in productivity increase (productivity defined as "Output per hour worked"), together with an unproportionally high increase in labour costs.

This "phenomenon" was reported in 1977 by the "U.S. Council of Economic Advisors".

The productivity increase for the States was 4,1% in 1976 and 2,0% in 1977. The increase in unit labour costs within these 2 years was 6,4%. The supplement to the Financial Mail, 16 September 1983, stated the following (4):

> While productivity increased over the last decade in the U.S. by 1,5%, 1,3% in the U.K., and 3,0% in Japan, it rose only 0,3% in S.A.

The article further states that S.A. is not in the process of catching up, but "that we are slipping further behind", and "what's worse, we are paying people 18% - 20% more for producing less".

All these facts above, plus some less important ones (e.g. increasing amount of paperwork...), did not lead to the development of MRP itself. (MRP started, as mentioned in Chapter 1.1 in the early 60s.), but fostered its usage over the years and lead to an MRP-boom which started around 1970 in the U.S., around 1975 in Europe, and 1981-1982 in S.A. The growth rate is exponential everywhere, owing to the factors stated above and to the breathtaking benefits, which were widely published in the past.

1.2.2 Benefits of MRP

These benefits can be read in every information brochure of hard/software vendors as well as in many books and articles. e.g.: (Copics [IBM]; Mgmt overview p.09/20, Justification).

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(4) Financial Mail 1609083. Manpower report (supplement). Article: "Productivity please", p.21.

- Reductions in inventories of finished goods, components, raw materials, tools, etc.

- An improvement in customer service. Fewer late orders, more realistic confirmation of delivery dates, faster delivery, shorter lead times, faster response to customer inquiry, etc., all should contribute to a better competitive position.

- Better utilization of production facilities. A slight increase in manpower and machine utilization can generate very large savings.

- A reduction in work-in-process inventory, resulting in shorter manufacturing lead times and less shop congestion.

- Higher productivity and quality through direct computer control of production activities.

- Better utilization of services directly supporting production, such as maintenance, tools, materials handling, and stores operations. Small decreases in these costs will contribute significantly to profits.

- Less handling of data. The need for paperwork creation and control is dramatically reduced.

- More realistic planning of manpower capacity levels, which will reduce overtime costs as well as idle time.

- Reductions in material shortages and in most of the resultant expediting.

- More accurate assessment of true product costs and determination of those factors causing cost trends.

- A reduction in the time lost because of production meetings to determine order progress and priority. The order priority system can easily be adjusted to meet changing needs, and the system helps ensure that the change is applied consistently.

- A reduction in purchased material costs because buyers have more time to spend in negotiating lower prices or seeking more reliable sources of supply.

- A significant reduction in the amount of systems effort spent on maintaining and changing old computer programs when new systems are implemented.

- The elimination of redundant system date. Everyone is basing decisions on the same set of data.

- Better utilization of a manager's time. He sees just the exception notices he has specifically designated as important, although further details are available immediately on request.

- More awareness of planning risks, more accurate forecasts, and more current information, resulting in better decisions.

- Reduction in a number of types of fluctuation through reduction in information processing delay. The smaller the fluctuations, the smaller the buffers needed to absorb them.

Table 1: Benefits from MRP (5)

This table can be considered to be a fairly complete summary of potential MRP benefits.

The following list, which shows the "typically achieved" benefits, makes it clear why so many companies saw MRP as a panacea and decided to implement it.

Benefit areas	Typically achieved		
	O. Wight(6)	T.L. Gaza(7)	R. Brookes(8)
a) Inventory reductions	20% - 35% (- 150%)	20%, 40%	Similar statements to points (a) to (p)
b) Less risk of inventory shortage	not quantifiable, but no class A or B user has noticed shrinkage		
c) Improved cash flow	Receivables reduced by 10 days or more		
d) Better financial planning	not quantified		
e) Productivity increase of direct labour	area: fabrication 5-10% assembly 25-40%	5% - 15%	
f) productivity increase of indirect labour	not quantified, but up to 25% less stockkeepers, expeditors, clerks, truckers		
g) Reduced overtime	50% - 90%	60%	
h) Improved quality control	not quantified		
i) Purchasing cost reduction	5%		
j) Customer service increase	95%	95%	
k) Better customer information	not quantified		

Benefit areas	Typically achieved		
	O. Wight(6)	T.L. Gaza(7)	R. Brookes(8)
l) more effective management	not quantified		
m) Teamwork	not quantified		
n) More effective supervision	not quantified		
o) Better quality of life	not quantified		
p) Reduced WIP		20% - 40%	
q) Lead time decreased			- 70%
r) Slipping performance			Not quantified. Constant shippings throughout the month

TABLE 1.1

Summary of typical benefits achieved

Ad "Improved quality of life"

Although not quantifiable, this area is considered to be the biggest MRP benefit by class A and B users.

1.2.3 Costs of MRP

These benefits are very convincing. The costs of installing and running such a system are stated in Table (1.2).

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(5) IBM form GH 30-0239, p.69-70.

(6) O. Wight: MRP II unlocking America's productivity potential. O.W. Ltd Publications, 1981, reprinted 1982, p.75-120.

(7) T.L. Gaza: Gaining and retaining management commitment. Paper held at Apics Conference, Los Angeles, October 1980.

(8) R. Brookes: How to implement successfully. Paper held at a SAPICS breakfast session, Johannesburg, July 1983.

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a) Costs of hard/software and DP personnel.
b) System running costs.
c) Time for education and training.
d) Restructuring of: BOM
Inventory records Routings
Work Centre data
e) Rearranging the shop floor to accommodate closing the stockroom.
f) Time needed by the project team and their departments executing project tasks.
g) Professional guidance.

TABLE 1.2

Cost components

Very little is stated in the literature about costs. The writer's own MRP survey (see Chapter Three), provided little information on these aspects. Only the system's running costs are occasionally reported, which vary between 1/2% and 1 1/2% of the inventory turnover. This alone, however, cannot be considered as a variable which reflects the success of an implementation.

John Cirecolo (9) gives more detailed information. He considers that:

if hard/software costs = 100%, then the
remaining costs will be = 140%

The 140% consists of:

- costs of education (40%)
- cost of structuring and improving BOMS (45%)
- Inventory accuracy (40%)
- Other activities (15%)

Similar figures were stated in the Datamation Magazine (10). There, the remaining costs are considered to be 144% of the hard- and software costs.

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(9) John Cirecolo: Education - A Luxury or Necessity, p.4. O.W. Publications, 1982.

(10) Datamation Magazine, p.21-25, February 1980.

1.3 Summary

Chapter One brought a short overview of the development of MRP, from an order launching method, to manufacturing resource planning. It stated the reasons which led to a MRP boom all over the world, as well as the benefits which were achieved and the costs that were entailed.

Considering everything said, we must deduce that MRP is a today's necessity. Therefore, the question today is not "can we afford to buy an MRP system?", but "can we afford not to buy one?"

CHAPTER 2

SUCCESS OF MRP IMPLEMENTATIONS

2.1 How to measure "success"

In the literature we find the following methods for measuring the success of MRP implementation:

(a) "The success of the system can be measured by the extent to which the formal system (= MRP) is able to replace the informal one". (1)

(b) The success of the system can be measured by the extent to which "the formal system can supply management with timely and accurate information". (2)

(c) Oliver Wight's ABCD classification [here in the modified form used in an Apics survey in 1981 (3)]:

(c1) Class A

Closed loop system, used for priority planning and capacity planning. The master production schedule is leveled and used by top management to run the business. Most deliveries are on time, inventory is under control, and little or no expediting is done.

(c2) Class B

Closed loop system with capability for both priority planning and capacity planning. In

this case, the master production schedule is somewhat inflated, top management does not give full support, some inventory reductions have been obtained, but capacity is sometimes exceeded, and some expediting is required.

(c3) Class C

Order launching system with priority planning only. Capacity planning is done informally with a probable inflated master production schedule. Expediting is used to control the flow of work, a modest reduction in inventory is achieved.

(c4) Class D

The MRP system exists mainly in data processing. Many records are inaccurate. The informal system is largely used to run the company. Little benefit is obtained from the MRP system.

(d) The ABCD checklist (4):

Technical	YES	NO
1. Time periods for master scheduling and material requirements planning are weeks or smaller.	—	—
2. Master scheduling and material requirements planning run weekly or more frequently.	—	—

3. System includes firm planned order and pegging capability. ___ ___
4. The master schedule is visibly managed, not automatic. ___ ___
5. System includes capacity requirements planning. ___ ___
6. System includes daily dispatch list. ___ ___
7. System includes input/output control. ___ ___

Data Integrity

8. Inventory record accuracy 95% or better. ___ ___
9 Bill of material accuracy 98% or better ___ ___
10. Routing accuracy 95% or better. ___ ___

Education

11. Initial education of at least 80% of all employees. ___ ___
12. An ongoing education program. ___ ___

Use of the System

13. The shortage list has been eliminated. ___ ___
14. Vendor delivery performance is 95% or better. ___ ___
15. Vendor scheduling is done out beyond the quoted lead times. ___ ___
16. Shop delivery performance is 95% or better. ___ ___
17. Master schedule performance is 95% or better. ___ ___

18. There are regular (at least monthly) production planning meetings with the general manager and his staff including: manufacturing, production and inventory control, engineering, marketing, finance. — —

19. There is a written master scheduling policy which is adhered to. — —

20. The system is used for scheduling as well as ordering. — —

21. MRP is well understood by key people in manufacturing, marketing, engineering, finance, and top management. — —

22. Management really uses MRP to manage. — —

23. Engineering changes are effectively implemented. — —

24. Simultaneous improvement has been achieved in at least two of the following three areas: inventory, productivity, customer service. — —

25. Operating system is used for financial planning. — —

(e) The amount of benefits which the different companies achieved.

They are stated, either in percentages of <u>positive</u> or <u>negative</u> improvements.

- "Positive" means increase, e.g. +5% productivity

- "Negative" means decrease, e.g. -35% inventory or in achieved levels, e.g. 98% customer service level in the last x weeks (month).

2.2 Criticisms of the different methods noted

The first two ways are not suited to measure success, because neither contains both:

1. variable(s) which are exactly and easily measurable, and
2. objectives against which the achievements can be measured.

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(1) Peterson, L.D. Design considerations for improving the effectiveness of MRP. Production and Inventory Management, 1975, v.16,n.3, p.48-68.

(2) Burlingame, R: Key to successful computerization of the materials management system. Ind. Eng. v.14, n.4, April 1983.

(3) Anderson, J., Schroeder, R., Tupy, S., White, B., A study of Implementation and Practice. p.14, Apics publications, 1981.

(4) O. Wight: MRP II unlocking Americas productivity potential. p.455, O. Wight Publications, 1982.

2.2.1 Criticism of way (a)

Way (a) does not state objectives explicitly, but it implies that for a formal system to be successful it must completely replace the informal one.

The objective therefore would be "100% replacement of the informal system". But it does not give any indicators which help to measure the percentage of replacement.

2.2.2 Criticism of way (b)

Way (b) ties the degree of success to the amount of timely and accurate information which the system can supply.

The objectives are therefore to supply management with "100% timely and accurate information".

The measurement variables are:

- accuracy, and
- timeliness of the information provided.

But they are neither easily nor exactly measurable. (e.g. Inaccuracy of information provided is only noticed when problems arising can be traced back to this source.)

They can, like the "degree of satisfaction" in the survey (Chapter Three), be used as simple indicators of the possible success. For this they are well suited.

2.2.3 Criticism of way (c)

A more useful aid for measuring success is to compare the system and the achievements with the ABCD-class criteria.

The criteria are:

1. The degree of complexity of the system.
2. The quality of the MPS.
3. The degree of usage of the system by top management.
4. Customer service level.
5. Degree to which inventory is controlled.
5. Amount of expediting necessary.

The objectives for a class A-user are:

1. A closed loop system.
2. A levelled MPS which
3. is used to run the business.
4. Most deliveries are on time.
5. Inventory is under control.
6. Little or no expediting is done.

The ABCD-classification is useful, but not specific enough and too dependent on the subjective judgement of the evaluator to be considered as an instrument for measuring success. (e.g. most companies think that they run the business with their MRP-system, even when they don't have a valid MPS and no formalized MPS-policy.)

Most of these imperfections are overcome by the

2.2.4 Critics of way (d)

ABCD-checklist

It contains 25 criteria of which most are exactly measureable. The objectives are stated either as percentages or verbally. The verbal objectives are specific enough to measure the achievements against them. The only critics that must be made, but which would not be valid in many industralized countries, concerns criterion #11.

In S.A. it is very unlikely that 80% of all employees can be educated. In some types of industry which employ the better educated, it will be possible to achieve this target; in others many of the workers will have problems in comprehending the MRP-principles.

The priority of this high percentage rises when the company decides to use the decentralized way for capturing feedback data. Even then, 80% seems to be much too high for S.A. companies. (50% should be sufficient.)

2.3 The success profile (under the different measurements) in the past

It must be said that MRP success in the past was rather poor.

In the U.S., according to:

1. Burlingame (4), only 25% of MRP implementations are successful, whereby only 10% are due to commitment

to the part of top management. The remaining 15% are considered to be successful by pure luck.

2. O. Wight (1981) (5)

   Class A : 50 - 75 comp.

   Class B : 200 - 300 comp.

3. Apics survey (1981) (6)

   Class A : 9,5%

   Class B : 29,1%

   Class C : 48,5%

   Class D : 13%

4. T.L. Glaza

   "Although the success rate is improving, most observers place success between 10% - 30%."

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(4) Burlingame, R: "Key to successful computerisation of the materials management system". Ind. Engineering. v.14, n.4, 1982.

(5) Wight, O: MRP II, p.454, O. Wight Publications, 1982.

(6) Anderson, J. et al.: MRP, p.14, Apics Publications, 1981.

In S.A. Leigh Douglas asked companies to rate themselves according to O. Wight's ABCD-classification.

The results were:

Class A : 14% (2 respondents)
Class B : 29% (4 respondents)
Class C : 36% (5 respondents)
Class D : 21% (3 respondents)

All respondents used "home grown" systems. It is highly likely that the fatherly feelings of the respondents towards their system made them rate it better than it is. The sample is also too small to draw valid deductions about MRP success in S.A.

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(7) Glaza, T: Gaining and Retaining Management Commitment. Paper presented at the 23rd Apics conference, Los Angeles, 1980.

(8) Douglas, L.: "Production Management Survey in S.A.", p.135. Thesis for MBA, UCT, 1982.

2.4 Summary

This chapter presented and judged the quality of 4 ways for measuring the success of a MRP-system

implementation. Two of them were found unable to do this. Only one way, the ABCD-checklist, could satisfy the requirements.

Paragraph 2.3 showed the success of MRP systems in the past for the U.S.A. and S.A., which was rather poor in both countries.

In the U.S.A. only, 9,5% of the companies responding to an Apics survey rated themselves as class A users.

From my survey (Chapter Three), in opposition to the results of L. Douglas, I dare to deduct that there is currently no class A user in S.A. The number of B class users will be between 3 and 7.

CHAPTER 3

MRP IN SOUTH AFRICA

3.1 Introduction

The objective of this dissertation is to develop guidelines for successful MRP implementation. These guidelines should be applicable in various types of industry and must therefore be of general character. One way to develop them is to investigate how successful companies attacked the problem "MRP" and, through comparison of their ways, locate success factors and problem areas and to filter out generalities of the implementation process.

The prerequisites for doing this are:

1. to locate successful companies, and
2. to visit them and see how they did "it", or even better, how they would do "it" now, if they could start again.

This chapter addresses basis requirement #1.

3.2 Study methodology

3.2.1 The Research Method and the sample

After considering several ways to locate successful MRP users, a questionnaire survey seemed to be best suited

for achieving the research objectives, despite the low response rate in most cases.

A questionnaire survey is the best approach to obtain maximum information at minimum expense provided that that questionnaire is well structured and the time needed for completion is not too great.

The addresses of MRP users were obtained either from the various hard/software suppliers, or from the chairmen of user groups.

120 companies all over S.A. were contacted. They use the following MRP software:

Comet	(Nixdorf)
Comserv	(Amaps)
Copics	(IBM)
Forman	(Formation)
IMCS	(NCR)
MANCOS	(PERSEUS)
MAPICS	(IBM)
MM 3000	(HP)
MS 80	(GRS)
OMAC 29	(ICL)
PCS	(Burroughs)
UNIS 90)	
UNIS 1100)	(Sperry-Univac)

The companies belong to the following types of industries:

- Metal Working (Machinery, Fabricated Metals)
- Electrical/Electronic
- Transportation (Transportation equipment)
- Pharmaceutical
- Miscellaneous (including furniture, printing, textile, other manufacturers).

The sales of the companies (only 12 responses to this question) ranged from Rm 8 to RM 375, whereby the second number exceeded the other ones by far.

The average sales figure is:

$$\bar{X} = 61,2 \text{ Rm}$$

The standard deviation:

$$s = 102 \text{ Rm}$$

After the elimination of this extremely high sales figure, the average and standard deviation is:

$$\bar{X} = 32,6 \text{ Rm} \qquad s = 25,9 \text{ Rm}$$

3.2.2 The Questionnaire

The questionnaire addressed two different levels of the company hierarchy.

Questionnaire #1 was designed for project leaders (MDs, MIS Managers, DP Managers, Production Managers, etc), whereas #2 aimed for Foremen and Buyers.

The main reason for this was to compare the estimates on "degree of satisfaction". A larger difference between these estimates also indicates a lack of information flow from the firing-line to the top.

The objectives of questionnaire #1 were to gather information on the:

- success of MRP implementations and the benefits received;
- reasons for and initiator(s) of MRP research within the companies
- implementation process;
- extent of computerization;
- success factors;
- problem areas;
- costs of MRP.

Questionnaire #2 addressed the fields:

- User involvement
- Education and training;
- Success as judged by people as the firing-line;
- Impacts of MRP on their job.

These areas are also used as chapters for the presentation of the results of the statistical analysis.

3.2.3 Data Analysis

The respondent sample of 49 companies (response rate = 41%) was divided into 4 groups according to their stated "degree of satisfaction":

(a) The whole sample
(b) group #1
(c) group #2
(d) group #3

Group #1 consists of companies which reported:

start success $\leq$ 40%, and
end success $\leq$ 50% degree of satisfaction

Group #2 consists of companies which reported:

start success $\leq$ 60%, and
end success $\geq$ 85% degree of satisfaction

Group #3 consists of companies with:

start success $\geq$ 60%, and
end success $\geq$ 85%

and of companies with

start and end success $\geq$ 80% degree of satisfaction

The number of companies in the different groups are:

Group #1 : 7 companies
Group #2 : 5 companies
Group #3 : 8 companies

The statistical analysis was conducted on an HP-85 computer using the "General statistic pack" as the software.

3.3 Success of MRP implementations and benefits received

Owing to the correlations of different factors and "success", it was necessary to discuss this area as the start of the statistical analysis.

"Success" was addressed in the manager-, as well as in the buyer/foreman questionnaire. A subjective estimate for the success at the "start" of the system's running and one for "now" was requested. The variable used for estimating success was the "degree of satisfaction" of the respondents.

(The small number of respondents on the questions concerning benefits made it impossible to use them for the measuring of success; the "degree of satisfaction" correlates with the amount of benefits received and therefore can be used for grouping and analysing the responses.)

Tables 3.1 and 3.2 contain the responses to the question "degree of satisfaction".

	MANAGER											
	Average			Group 1			Group 2			Group 3		
	X	s	n	X	s	n	X	s	n	X	s	n
st	46,5	24,3	35	27,15	18	7	54	17,1	5	77,8	10,1	8
no	70,5	23,2	36	38,3	19,4	6	85	9,3	5	89	6,0	8
I	24,0			11,15			31			11,2		

TABLE 3.1
Degree of satisfaction stated by managers

	BUYER, FOREMAN			MANAGER		
	SAME SAMPLE					
	X_1(%)	S_1(%)	$n_1=n_2$	X_2(%)	S_2(%)	X_1-X_2
st	72,3	21,2	11	54	20	18,3
no	63,3	23,1	12	74,5	15,4	-11,2
I	-9			+20		

TABLE 3.2
Degree of satisfaction stated by buyers and foremen

It is remarkable that:

1. The degree of satisfaction reported by Buyers and Foremen is at the start, as an average, 18,3% higher, but now 11,2% lower than the one reported by managers.

2. Large improvements after a bad start are possible. (e.g. 31% in group #2.)

The amount of tangible benefits which were expected before and which were received after MRP implementation were investigated in question 12 and 13.

Table 3.3 contains the results of the analysis.

Kind of Benefit	X,s,n	Average		Group 1		Group 2		Group 3	
		e	r	e	r	e	r	e	r
% of Inventory reduction	X	21	17,75	22	50	18	12,6	23,1	40
	s	10	30,5	17,4	0	7,6	6,4	10,3	14,1
	n	29	12	5	1	5	3	7	4
% of Leadtime reduction	X	16,5	11,5	40	30	10		17,5	20
	s	8,9	18,5	0	0	0		5,0	7,1
	n	16	7	11	1	2	0	4	2
% raise of customer service level	X	21	28,5	16,6	5	15	45	24,6	24
	s	16,7	25,5	95,8	0	7,1	0	28	21
	n	24	10	3	1	4	1	7	5
% raise of productivity in workshops	X	16,4	13,5	10		15	12,5	11,4	15
	s	11,1	9,1	0		10,8	3,5	5,5	0
	n	16	47	1	0	4	2	5	2
% decrease in expedited orders	X	24,75	6,0	40		5	5	25,4	42,5
	s	25,5	40,15	0		0	0	31	24,75
	n	12	5	1	0	2	1	5	2

TABLE 3.3

Benefits expected before and received after MRP implementation

<u>It is remarkable that:</u>

1) Only few group #1 companies responded to these questions.
2) Group #3 companies received higher benefits than expected (with the exception of customer service).

To question #2 : "Where do you see MRP is helping you most?", the following statements were made:

Number of respondents = 49

Number of statements = 101

Average number of statements per company = 2,06

Number of statements per company of group 1 = 1,71

Number of statements per company of group 2 = 3,00

Number of statements per company of group 3 = 2,37

	Average		Group 1		Group 2		Group 4	
	% of Statements	% of respondents who made this statement	% of Statements	% of respondents who made this statement	% of Statements	% of respondents who made this statement	% of Statements	% of respondents who made this statemetn
1) Inventory								
Bring down inventory	27	57	34	58	20	60	26	62,5
Improve inventory control	6	12						
Decrease of shortages	6	12	8	14		20		
Decrease of write offs	2	4	8	14				
Improved utilization of warehouse capacity	1	2						
Purchasing in time	1	2						

Inventory	43	39	50	86	20	80	26	62,5
2. <u>Production</u>								
Increase in quality of planning	11	25	26	43	16	40	17	37,5
Increase of productivity	5	10			16	40	5	12,5
Reduction of lead times	3	6	8	14			5	12,5
Better shop floor scheduling	4	6						
Time reduction	1	2						
Running to schedule	1	2						
Production	25	51	34	57	32	80	32	75
3. <u>Management</u>								
Better all around control	6	13			20	60	5	12,5
Increased reaction to changes	4	8						12,5
Better communication	3	6						
Improved cost control and lower costs	1	2						
Improved projection of cash flow requirements	3	6			14	20	5	12,5
Simulation tool	1	2	8	14				
Change of management style from subjective to objective	1	2					5	12,5

	Management	19	39	8	14	34	80	20	50
4.	Increased customer service level	12	25	8	14	20	60	17	35,5
5.	Other Higher accuracy of data base	1	2,0	0	0	0	0	5	12,5
	of		206		171		300		237

TABLE 3.4

Tangible and intangible benefits received by the companies

3.4 Reasons for and Initiator(s) of MRP research

The questions -

#1:

"What made you decide that you needed MRP (give symptoms of problems, or if the decision was made elsewhere, note who made it)".

and

#7:

"Who initiated this research within the firm?"

were used for investigating this area. The responses are shown in Table 3.5 for question #1 and in Table 3.6 for question #7. The influence of the initiator on start- and end success is shown in Table 3.7.

% = % of this problem when compared to the sample m = 57

r% = % of respondents, who stated this problem m = # of statements

n = 49

n = # of respondents to question 1

		Average		Group 1		Group 2		Group 3	
		%	r%	%	r%	%	r%	%	r%
1.	Inventory								
	High inventory	21	24,5	30	42			33	62,5
	Not the right stock at the right place and time	7	8					7	12,5
	Bad inventory control	5	6	10	14				
	Too many shortages	3,5	4						
	Inventory	36,5	42,5	40	33	0	0	40	75
2.	Production								
	Too many late deliveries	14	16,5	10	14	20	20	28	50
	Bad production planning	7	8	10	14			20	37,5
	Bad capacity planning usages and control	3,5	4						
	High WiP	1,75	2						
	Production	26,25	30,5	20	17	20	20	42	87,5
3.	Management								
	No production feed back	1,75	2			20	20		
	Costing	3,5	4						

	Inability to forecast requirements	1,75	2			20	20		
	Reduction of time and number of mistakes of industrial labour	1,75	2			20	20		
	Too long reaction time on forecast changes	7	8	20	28				
	Management	15,75	18	20	51	60	60	6	0
4.	Growth								
	Complexity of product mix and/or structure	3,5	4			20	20	7	12,5
	High volume of paper-work for stock and production control	1,75	2						
	Growth	5,25	6	0	0	20	20	6	12,5
5.	Others								
	Need for a new formal system	7	8	10	15			7	12,5
	Decision made by headquarter	7	8						
	Consultant recommended it	1,75	2	10	14				
	Started with financial system	1,75	2						
	Others	17,5	20	20	66	0	0	12	12,5
	of		117		141		100		187,5

TABLE 3.5

Reasons for MRP implementation

Number cf respondents : 44
Number of statements : 58

Iniation	Average %	Group 1%	Group 2%	Group 3%
Data processing	27	14	20	37,5
Marketing				
Others	25	43	20	25
Engineering	4,5			
Production	16	14	20	12,5
Top Management	57,5	57	80	75
Average number of statements				
Average number of initiators	1,3	1,3	1,4	1,5

TABLE 3.6
Initiator(s) of MRP research within the companies

		Start success	End success
Top Management	n	20	20
Initiated	$\bar{X}$	52,9	77,4
Project	S	22,3	15,1
Others	n	13	13
Initiated	$\bar{X}$	41,3	65,4
Project	S	24,6	25,6

TABLE 3.7
Influence of the initiator on MRP success

It is remarkable that in:

Table 3.5: 1) No group #3 company stated problems in "management", but they
2) reported many in "Inventory" and "Production".

Table 3.6 1) The low score of "Production" in all groups, and the
2) high score of "top management" in groups #2 and #3.

Table 3.7 The considerably higher start and end success of MRP when "top management" initiated the research. (+11,6% for start success; + 12% for now-success.)

3.5 Implementation process

The questions of this paragraph concerned:

1) The information phase
2) The set up of project
3) The number of modules and implementation sequence
4) Education and training
5) The implementation time
6) The cut-over approaches.

3.5.1 Information phase

Question #5: "Where did you obtain information on implementing MRP systems?, and

Question #10: "Where did you obtain information on where to purchase, the costs, and specifications of the necessary hard/software?"

covered this paragraph.

The responses to question #5 are shown in Table 3.8.

Number of respondents : 93
Number of statements : 68

Average company 1,6 statements

Source of Information	Average Company %	Group 1 %	Group 2 %	Group 3 %
Consultants	23	27	50	23
Other companies	13	20	12,5	8
Sapics	12	13	12,5	8
Videos, books, seminars	32	33,5	12,5	45
Hard/software vendors, head office	20	6,5	12,5	16
Number of statements per company	1,6	2,1	1,6	1,85

TABLE 3.8

Sources of information on implementation of MRP used by the respondents

It is remarkable that:

1) The group with the lowest success rate reported more "sources of information" than the two others.
2) Consultants are strongly represented in group #1.
3) Group #3 companies used extensive: Videos, books and seminars.

Table 3.9 contains the results of question #10.

Number of respondents : 43
Number of statements : 65

r% = % of respondents making this statement

Source of information	Average (r%)	Group 1 (r%)	Group 2 (r%)	Group 3 (r%)
Hardware vendor	56	42	60	57,5
Software vendor	18,5	28		25
Consultants	23,5	56	20	25
Other companies	16	28	20	37,5
Others:				
a) Head Office	18,5			
b) Own investigation	7	14		25
c) Others	11,5	14	20	-
Average number of sources per company	1,51	1,82	1,20	1,75

TABLE 3.9

Source of information on hard/software and costs.

Remarkable is.

1) The very high presence of "consultants" in group #1, and
2) "other companies" and
3) "own investigation" in group #3.

3.5.2 Set up of the project

The objective of this question was to investigate:

1) how formal or informal S.A. companies handle the MRP project, and
2) the influence of the different approaches to handling the projects on success, implementation time, overtime, etc.;
3) who or which department held the responsibility for the project.

Table 3.10 shows to what extent the different implementation approaches were used by the respondents.

		n	%
a)	Formal project with full-time project leader	5	20
b)	Less formal project	12	46
c)	Individual assigned responsibility	8	30
d)	Others	1	4
		26	100

TABLE 3.10
Set up of the project

Remarkable is:

The rather informal handling of the project (76%).

The influence of the different implementation approaches (a to d) on various factors are shown in Table 3.11.

		IMPLEMENTATION APPROACH			$\bar{X}$ (a) minus	
		a	b	x	$\bar{X}$ (b)	$\bar{X}$ (c)
Start success	n	5	5	4		
	$\bar{X}$ %	59,5	40	50	19,5	9,5
	S	28	18,7	21,6		
End Success	n	5	5	3		
	$\bar{X}$	10	62	87,5	52	77,5
	S	22,3	78,5	25		
% overtime needed	17	5	5	5		
	$\bar{X}$ %	10	62	87,5	52	77,5
	S %	22,3	78,5	25		
Kept Timetable	n	4	0	0		
	%	80	0	0		
Not kept	n	1	5	4		
	%	20	100	100		

TABLE 3.11

Influence of implementation approach on various factors.

Remarkable is:

The strong influence on:

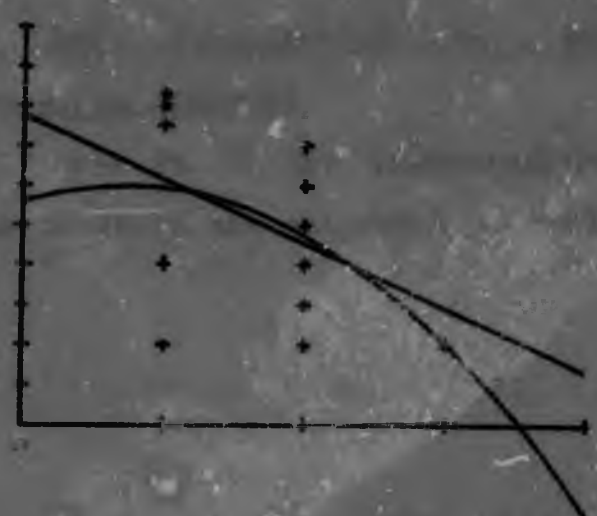
1) start success (approach [a] users reported a start success, which was 50% higher than that of approach [b] users);
2) the percentage of overtime needed (approach [b] users reported 5 times, approach [c] users nearly 8 times more overtime (as percentage) than approach [a] users);
3) the ability to keep to the planned time-table.

The influence of the implementation approach is further illustrated by Figure 3.0.

Figure 3.0: sample size : = 14.

degree of regression: = 2 linear regression

R-square: = 0,204 R-square: = 0,183



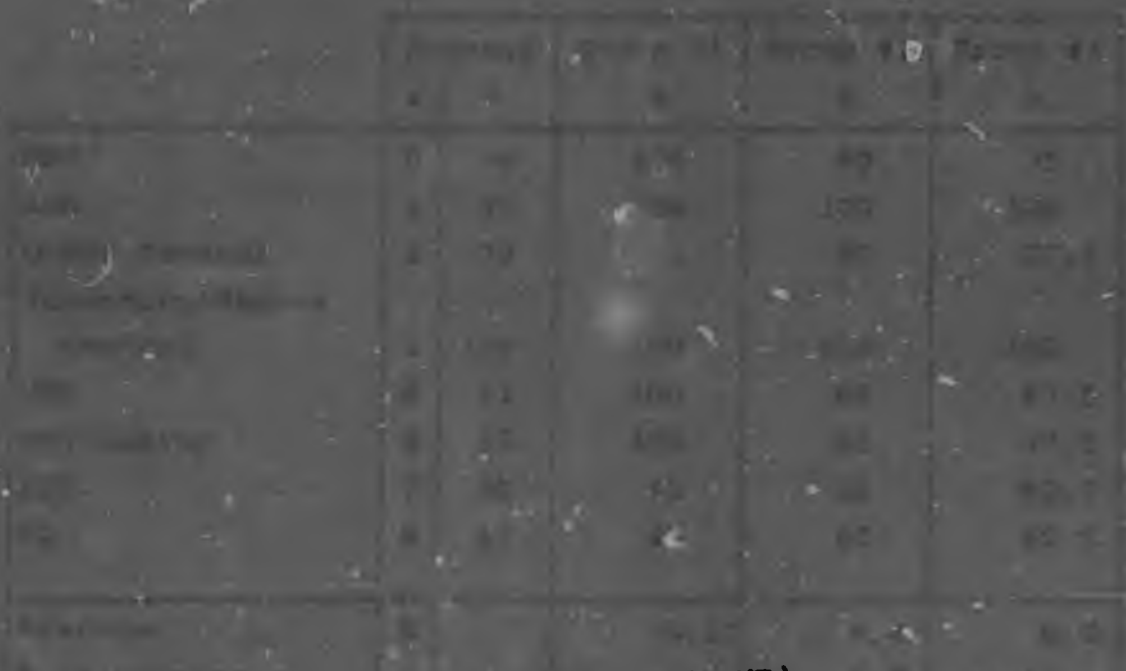


FIGURE 3.0 (p47)

Influence of the implementation approach

on start success of the MRP system

3.5.3 Number and distribution of modules and implementation sequence

The question #3 and #4 of the questionnaire addressed this area. The findings are collected in Table 3.12.



FIGURE 3.0 (p 47)

Influence of the implementation approach

on start success of the MRP system

3.5.3 Number and distribution of modules and implementation sequence

The question #3 and #4 of the questionnairs addressed this area. The findings are collected in Table 3.12.

s = implementation sequence

	Average		Group #1	Group #2	Group #3
	s	%	%	%	%
MPS	5	64	100	80	75
BOM	1	92	100	100	100
Order Control	3	70	71	80	87,5
Inventory/Stores Control	1	100	100	100	100
MRP	6	81	100	80	87,5
Purchasing	4	55	100	80	37,5
SFC	7	36	43	60	62,5
CP	8	40	43	40	62,5
Average	X		6,15	6,4	6,0
# of modules	s		1,5	1,7	2

TABLE 3.12
Modules and their implementation sequence

Remarkable is:

1) The equalness of the different groups in the numbers of modules implemented.
2) The high number of modules installed (many functions integrated)
3) The usage of "SFC" and "CP" to a larger amount only in group #3.
4) The low score of "Purchasing" in group #3.

The deduction, based on the nearly equal number of implemented modules in the different groups, that success of the system is relatively independent of the size of the system (but dependent on how well it is

operated), and is verified by the following regression analysis.

Figure 3.1: Sample size: = 35
degree of regression: = 3
R-square: = 0,011

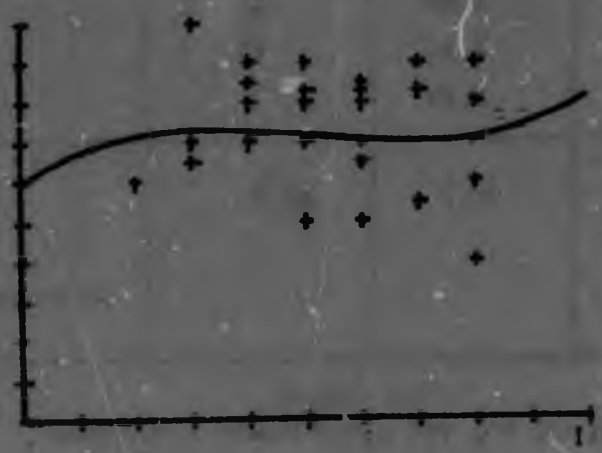


FIGURE 3.1

Influence of the number of modules on success

Table 3.13 shows who carried the responsibility for the project.

Number of respondents : 45
Number of statements : 92

Responsibility	Average %	Group 1%	Group 2%	Group 3%
Production	58	28,5	80	62,5
Marketing	4,5		20	12,5
Engineering	32	14,5	20	25
Data Processing	44,5	28,5	80	37,5
Top Management	42	28,5	60	75
Others	35	28,5	20	50
Consultants	7	28,5		
Average number of statements = Average number of functions responsible	2,04	1,57	2,80	2,65

TABLE 3.13
Department responsible for the project

Remarkable is:

1) The increase of "top management" from 28,5% in group #1 to 75% in group #3.
2) The low score of "Production" in group #1.
3) The high score of "Data Processing" in group #2.
4) The high score of "Consultants" in group #1.
5) The low number of functions involved in group #1.

Investigation of the influence of the number of functions involved in the implementation process on the success of the MRP system led to the following result:

Figure 3.2: sample size: = 34
degree of regression: = 3
R-square: = 0.144

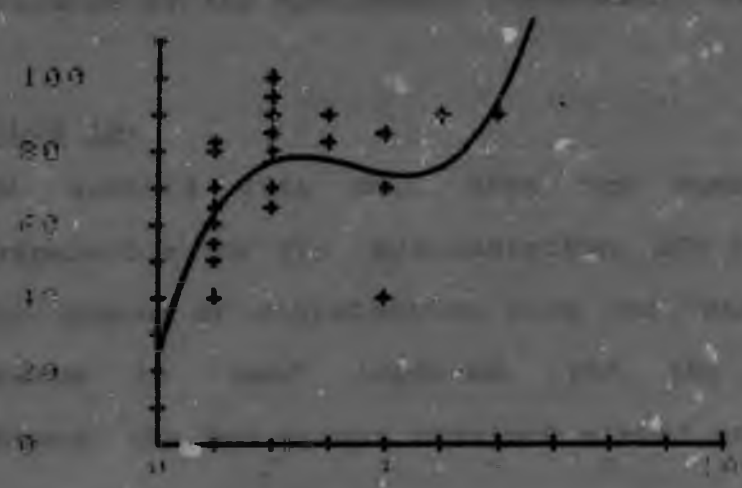


FIGURE 3.2

Influence of the number of functions on the success of the implementation.

It is therefore very unlikely that the # of functions involved in the inplementation process influences the success of the system.

The impact of top management was also investigated.

Table 3.14 contains the results.

		Start Success	Success now	Improvement
Top management was responsible for implementation	n $\bar{x}$ s	14 57,9 21,7	13 81,3 16,2	23,4
Others were responsible for implementation	n $\bar{x}$ s	20 41,9 23	21 66,4 20,85	24,5

TABLE 3.14

Influence of top management involvement on success

Remarkable is:

1) The success rate was, when top management was responsible for the implementation, 20% higher.
2) The degree of satisfaction from the "start" of the system to "now" improved, but the difference between the two groups remained almost unchanged.

3.5.4 Education and training

To investigate this point, managers were asked how the external and internal education and/or training was conducted.

Foremen and Buyers were asked about the quality of these programs.

Tables 3.15 and 3.16 contain the results of the manager questionnaire.

A) Number of respondents : 22
Number of statements : 27

r% = % of respondents making this statement

External Source	Average (r%)	Group 1 (r%)	Group 2 (r%)	Group 3 (r%)
Head office personnel	14	14	25	37
Consultants	13	14		
Seminars	13	14		
Hardware vendors	59	29	75	37
Videos	18		25	13
Average number of sources stated	1,17	0,71	1,25	0,87

TABLE 3.15

External sources used for education

B) Number of respondents : 23
Number of statements : 23

Internal Source	Average (r%)	Group 1 (r%)	Group 2 (r%)	Group 3 (r%)
Project Manager	21	14		50
Data Processing	44	29	75	
Headoffice, inhouse schoo	13	14		
Line Managers	4		50	
Video	9			12,5
Consultant	9			12,5
Average number of sources stated per company	1,00	0,57	1,25	0,75

TABLE 3.16

External sources used for education

Remarkable is:

1) The high usage of the "Project manager" in group #3, and of
2) "Data processing" in group #2 for internal education.

Foremen and Buyers responded the following ways:

- 22% said they received sufficient education and training;
- 78% said it was not sufficient;
- Again 22% thought that better education and training would not have made their job easier after the cutover, whereas;
- 78% held the contrary opinion.

A linear regression analysis showed a strong correlation between education and training, and success of the MRP system.

3.5.5 Implementation time

The implementation time is dependent on the number of modules installed.

Splitting the sample up into the 3 success groups and again according to the number of modules would have resulted in too low a number of companies in each of the groups.

Therefore either success group or module group was used for this paragraph.

The results of the questions concerning the planned and needed implementation time, the start success, the "success now" and the percentage overtime needed, are stated in Table 3.17.

		Success		Imple. time		%
# of modules	X,s,n	st	now	pl	needed	Overtime
(8)	X	54	70	22,8	27,8	21
	s	24	21	9,7	13,2	34
	n	10	8	10	10	10
(7)	X	55	70	27	31	varied
	s	28	18,5	4	6,5	too
	n	2	3	3	3	much
(6)	X	42	76	16,3	23	62,5
	s	14	14	4,5	13	118
	n	8	8	7	6	6
(5)	X	47,5	60,3	20	26	57
	s	31	31	10	9	84
	n	7	7	7	7	7
(2), (3) & (4)	X	49	78	16	20	23
	s	25	13	6,5	6	42
	n	8	8	8	6	8

TABLE 3.17

Success, implementation time and amount of overtime needed, vs. # of modules

Remarkable is:

1) Again, neither start nor end success is dependent on the number of modules.

2) The implementation time exceeded the figures recommended by Darryl Landvater and Oliver Wight (1) by far.

Investigating the ability to keep to timetable (similar to 3.5.2, but using the success groups instead of implementation approach) led to the following Table:

	Average	Group 1	Group 2	Group 3
Timetable:				
kept	18 = 44%	1 = 14%	3 = 60%	7 = 87,5%
not kept	23 = 56%	6 = 86%	2 = 40%	1 = 12,5%
% Overtime needed:	1 2 3			
$\bar{X}$%	31,8 80 171	82	35	25
s%	15,4 79 402	68	21,2	
n	11 18 19	6	2	1

For "Average are three different $\bar{X}$, and n.
For $\bar{X}1$ only overtime %-s smaller than 100 were taken into consideration.
For $\bar{X}2$ only overtime %-s smaller than 1000 were taken into consideration.
For $\bar{X}3$ the one % amount exceeding 1000 (= 1800) also was considered. This figure was not considered in all other calculations.

TABLE 3.18

Ability to keep the plan of the different success groups

---

(1) Wight, O.: MRP II, p.472, O. Wight Ltd Publications, Inc. 1982.

The module groups (7 & 8) modules and (5 & 6) modules were united and the following regressions between:

1) start success and
   - o implementation time planned
   - o implementation time needed
2) end success and
   - o implementation time needed were conducted.

For group (7 & 8), the dependency of start and end success on the percentage of overtime needed was investigated.

The following tables show the results. The ones of "Implementation time planned" were not sensible. The Y-value always is "success", the X-values are "Implementation times needed (in month)".

Module-group (7 & 8):

Figure 3.3: sample size: = 11
degree of regression: = 2
R-square: = 0,407

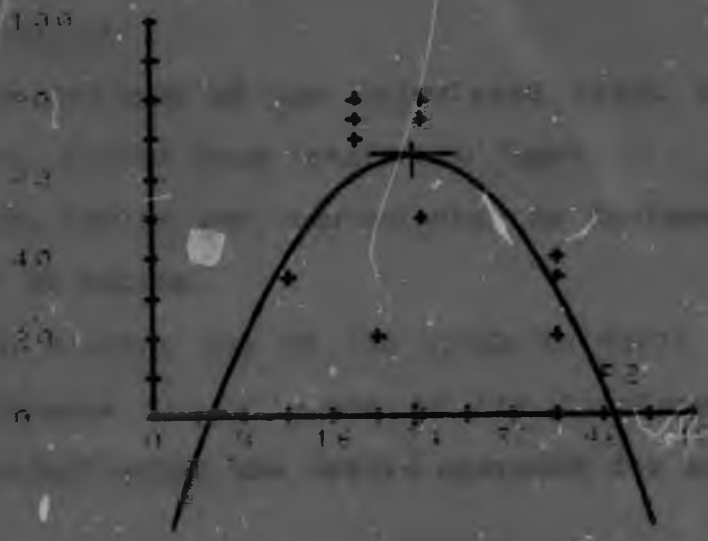


FIGURE 3.3

Regression with degree 2 of "Implementation time needed" and "start success"

Figure 3.4: sample size: = 9

degree of regression: = 2

R-square: = 0,133

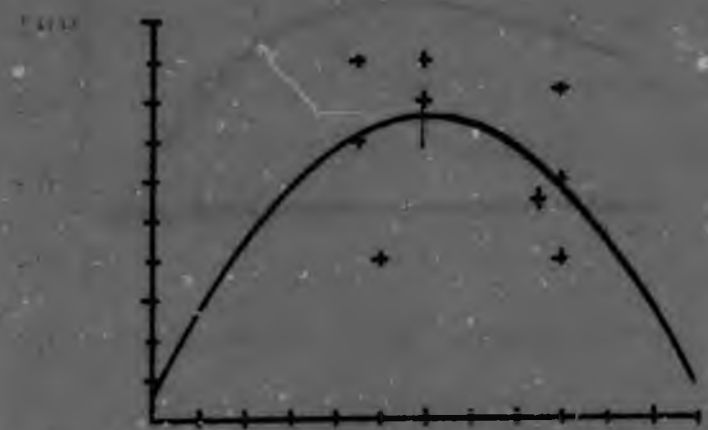


FIGURE 3.4

Regression with degree 2 of "Implementation time needed" and "success now"

Remarkable is:

1) The maximum of the calculated graph improved only very little from "start" to "now".

2) Both maxima are reached with an implementation time of 24 months.

3) The flatter top of the graph in Table 21 shows the decrease in influence of the "implementation time needed" after the system operated for some time.

Module group (5 & 6)

Figure 3.5: sample size: = 13
degree of regression: = 3
R-square: = 0,106

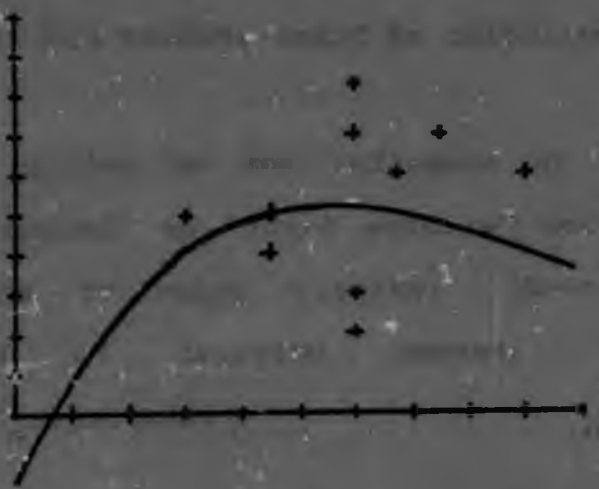


FIGURE 3.5

Regression with degree 3 of "implementation time needed" and "start success"

Remarkable is:

1) The flat top of the graph.
2) The maximum success is achieved with implementation times between 16 to 24 months.

The results of the regression of "Implementation time needed" and "success now" were the following:

Linear regression :

sample size: = 11 : R-square: = 0,003

Regression of degree 2 and higher:

sample size: = 11 : Matrix was instable.

Remarkable is:

1) The responses on "Implementation time" varied between 10 and 40 months, on "success" between 0% and 90%.
2) No sensible results could be calculated.

The investigation on the influence of the amount of "overtime needed" on "start success" and "success now" brought the following results: (X-values are the percentages of overtime needed; Y-values the "successes" reported.)

Figure 3.6: sample size: = all respondents: = 31

degree of regression: =2

R-square: = 0,303

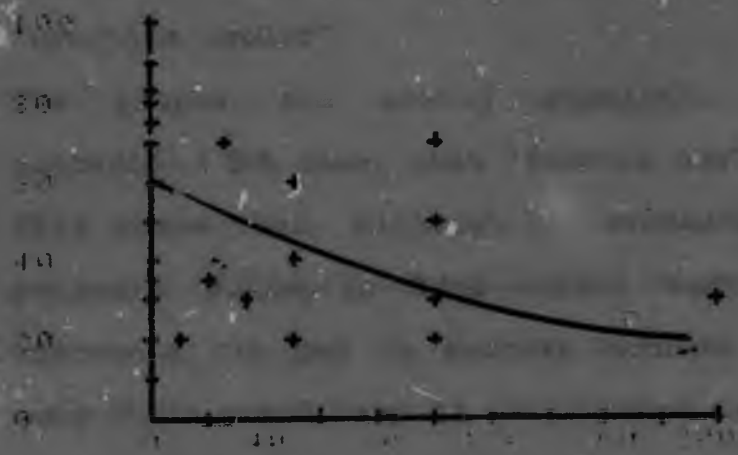


FIGURE 3.6

Regression with degree 2 of "percentage of overtime needed" and "start success"

Figure 3.7: Sample size: = 31
degree of regression: =2
R-square: = 0,368

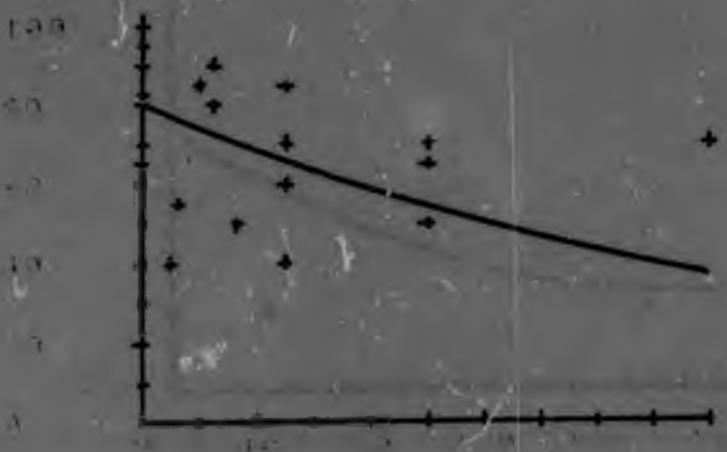


FIGURE 3.7

Regression with degree 2 of "percentage of overtime needed" and "success now"

Remarkable is:

1) "Start success" and
2) "Success now" are dependent on the amount of "overtime needed"
3) The graphs are nearly parallel, with "start success" ± 20% lower than "success now".
   This means that, although improvements of 20% were possible, companies which needed overtime could not eliminate the gap in success between them and the ones which could keep to the planned timetable.

The investigation for the different module groups brought the same results.
e.g. Module-group (7 & 8).

Figure 3.8: sample size: = 11
degree of regression: = 2
R-square: = 0,491.

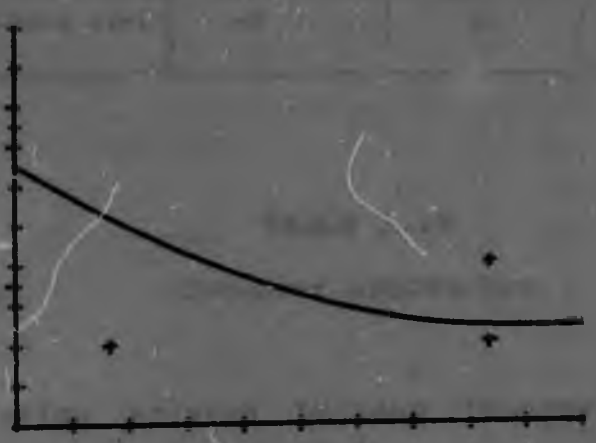


FIGURE 3.8

Regression with degree 2 of "percentage overtime needed" and "start success"

3.5.6 Cut-over approach

Three cut-over approaches are used today. They are:

a) MRP and the manual system work parallel for some time;

b) the "cold turkey" or "big bang" approach;

c) the "pilot approach".

The usage of the "pilot approach" has been recommended in many articles and books for several years. The extent to which S.A. companies used each approach is shown in Table 3.19.

Way of starting the System	Average		Group 1		Group 2		Group 3	
	n	%	n	%	n	%	n	%
Manual, & MRP, parallel	22	52	3	50	4	80	4	50
MRP only	8	19	1	13	1	20	2	25
Pilot approach	12	29	2	27			2	25
Sample size	42		6		5		8	

TABLE 3.19

Cut-over approaches

No correlation existed between "success" of the MRP system and the cut-over approaches.

3.6 Extent of computerization

The size of S.A. MRP systems was already discussed in paragraph 3.5.3.

Replanning was done by:

65% of the companies using regenerative, and

35% using net change systems.

Only 47% of the respondents stated the use of "cycle counting", while 6% used "automatic lot sizing".

(The sample size to these questions was 17.)

The responses to the questions concerning the computerization of certain areas and the extent to which these areas are integrated are shown in Tables 3.20 and 3.21.

	Computerization			
	Yes		No	
areas	n	%	n	%
Forecasting of end items	6	32	13	68
BOM	19	100	0	0
Inventory/Stock system	18	95	1	5
MPS	8	44	10	56
MRP	12	63	7	37
Order release	8	47	9	53
Purchasing	7	41	10	59
CP	1	6	15	94
Operation scheduling	3	19	13	81
SFC	4	24	13	76

TABLE 3.20

Computerization of different areas

Integration of	n	%
0% - 20%	4	29
21% - 40%	1	7
41% - 60%	2	14
61% - 80%	2	14
81% - 100%	5	36

TABLE 3.21

Integration of the various computerised areas

Remarkable is:

1) The low score in Forecasting, CP, Operation scheduling and SFC.
2) The high score of the modules which build up a basic MRP system.
3) The relatively low integration of the computerized functions ($\bar{X}$: = group 41% - 60%)

3.7 Success factors

In question 16 of the questionnaire, managers were asked to judge the importance of various success factors. The results are shown in Table 3.22.

n = sample size

i = importance stated (1...most important)

Factors	Average		Group 1		Group 2		Group 3	
	i	n	i	n	i	n	i	n
Top Management support	1	42	1	7	3	5	1	7
Education	2	45	5	7	1	5	2	7
Data Accuracy	3	44	2	8	1	5	4	8
Financial Resources	6	37	6	7	5	4	6	7
Continuity of Top Management support	4	45	3	7	4	5	3	7
Accountability specified	5	41	4	7	6	5	6	7
Sufficiont Design Involvement	7	37	8	7	7	4	5	7

TABLE 3.22

Importance of the various success factors

The influence of:

1) "Top management" on the success of the MRP project was proved by regression analysis in paragraph 3.4.

2) The set-up approach on success was shown in paragraph 3.5.2.

3) Education and training on success was shown in paragraph 3.5.2.

The influence of "Inventory record accuracy", as one part of "Data Accuracy" on success, is shown in Table 30.

The percentage of inventory discrepancy between the actual inventory level and that with which the computer operates are stated at the X-scale. The "success now" is stated at the Y-scale.

Figure 3.9 Sample size: = 25

a) linear regression

R-square: = 0,174

b) degree of regression: =2

R-square: = 0,236

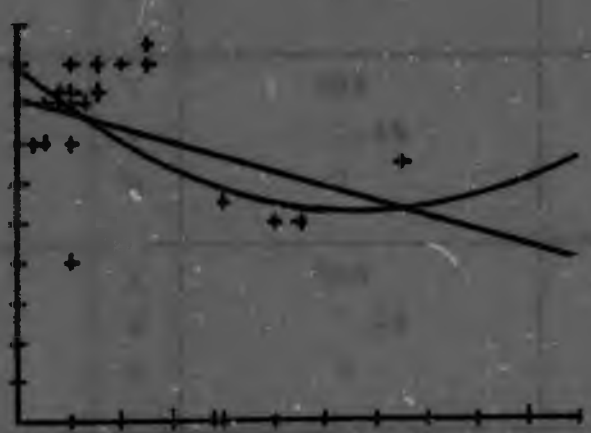


FIGURE 3.9

Regression analysis of "Inventory record accuracy" and "success now"

The level of inventory inaccuracy of the different success groups are shown in Table 3.23.

	Average	Group 1	Group 2	Group 3
X [%]	9,5	7,625	3,3	2,5
s [%]	13,4	4,0	2,0	1,8
n	30	4	3	6

TABLE 3.23
Inventory inaccuracy of the various success groups

The data accuracy of the most successful S.A. companies is shown in Table 3.24.

Accuracy of		Most successful S.A. companies	Level demanded by O. Wight
Inventory	X	94%	95%
	s	4,3%	
	n	9	
BOMS	X	98%	98%
	s	1,6%	
	n	7	
Routings	X	96%	95%
	s	7,4%	
	n	9	

TABLE 3.24
Inventory accuracy of the most successful S.A. MRP-users

Remarkable is:

1) Only a small percentage of inaccuracy (+/- 6%) does not affect success of the MRP system.
2) The most successful companies had reached the accuracy level demanded by O. Wight.

Another vital point for MRP success is the justification of the project.

The following table shows this:

Figure 3.10: sample size: = 34
linear regression
R-square: = 0,225
"1" on the X-scale mean "justification made"
"2" means "no justification made"
The Y-scale is the "success scale".

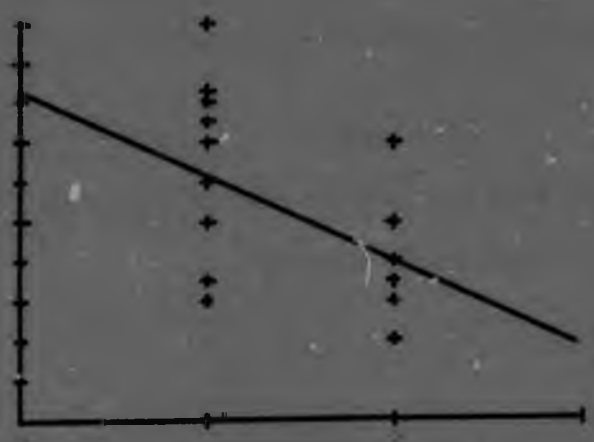


FIGURE 3.10

Correlation between justification and success

Owing to the low number of MRP implementations before 1981, no analysis of how the start success improved over the years could be made.

The respondents started with MRP implementation as following (sample size: = 16):

1975	:	1 company
1977	:	1 company
1981	:	7 companies
1982	:	7 companies

3.8 Problem areas

The companies were asked to stated, if applicable, which problems were responsible for not achieving the expectations and/or not keeping of the planned implementation time. The answers are shown in Tables 3.25 and 3.26.

i = importance stated (1 = most important)

n = sample size

Factors	Average		Group 1		Group 2	
	i	n	i	n	i	n
Lack of Top Management support	2	6	1	1		
Inadequate education	1	11	2	1		
Inaccurate data	3	11	1	3		
Human resistance	4	12	4	2	1	1
Lack of financial resources	8	4	1	1		
No continuity of Top Management support	6	8	1	2		
Accountability not specified	5	8			2	1
Insufficient design involved	7	6	3	1		
Software problems					1	1
Statements per company	3,47		2,75		2	

TABLE 3.25

Factors responsible for not achieving the expectations

i = importance (1 = most important)

n = sample size

Reasons for Overtime	n i	Average	Group 1	Group 2	Group 3
Basic data management	i n	1 12 = 51%	3 2 = 33%	1 1 = 20%	1 1 = 12,5%
Education & training	i n	2 14 = 59%	1 1 = 18%	1 1 = 20%	1 1 = 12,5%
Adaptation of software	i n	2 9 = 38%	4 4 = 66%	1 1 = 20%	
Testing of software	i n	2 6 = 26	5 2 = 33%	1 1 = 20%	
Lack of Top management commitment and others	i n	5 5 = 21%	1 3 = 50%		

TABLE 3.26

Factors responsible for not being able to keep to the planned timetable

Remarkable is:

1) The high number of respondents stating "inadequate education", "human resistance" and "inaccurate data".
2) The high percentage of software problems in Table 35.
3) That, apparently, companies still don't see the strong connection between "education" and "human resistance to change".
4) That failure of the system is caused by more than one factor.
5) That the same problems occur as in the U.S. and in Europe.

3.9 Costs

The information received on costs was so little that no sensible analysis could be performed.

3.10 User involvement

Two questions were put to foremen and buyers:

a) Was someone from management available to answer your questions regarding implementation?
b) Were you consulted about the layout and content of reports to be generated by the system?

The responses to these questions were compared to the "start success" and "success now".

The results are shown in Table 36:

Question (a) answer	Question (b) answer	X[%] s[%] n	Start success	Success now
Yes		X s n	52,9 22,3 21	77,4 15,1 20
No		X s n	41,3 24,6 13	65,4 25,6 13
	Yes	X s n	57,9 21,7 14	81,3 16,2 13
	No	X s n	41,9 23 20	66,4 20,85 21
Yes	Yes	X s n	61,8 19,3 11	85 11,4 11
No	No	X s n	43,9 25,9 11	67,5 26,5 11

TABLE 3.27

Influence of user involvement on success

Remarkable is:

1) "Start success" and
2) "Success now" are considerably lower when either one, or both, questions were answered with "No".
3) The highest "start success", and
4) "Success now" were achieved, when both questions were answered with "Yes".

3.11 Education and training

Education and training has already been discussed in paragraph 3.5.4.

3.12 Success as judged by people at the firing-line

This has already been discussed in paragraph 3.3.

3.13 Impacts of MRP on their jobs

Buyers and Foremen were asked to state the amount of time spent on specific tasks before and after MRP implementation.

The results are shown in Tables 3.28 and 3.29.

Task	X[%] s[%] n[%]	Time spent before MRP	 after MRP	Change
Expediting	X	33,6	15,0	-18,6
	s	24,8	10	
	n	7	5	
Negotiations with vendors	X	25	31	6
	s	18,5	25	
	n	7	5	
Paperwork	X	15	24	9
	s	8,2	11	
	n	7	5	
Shortage meetings	X	13	5	-8
	s	6,7	0	
	n	5	3	

TABLE 3.28

Influence of MRP on the amount of time spent by buyers on the different tasks

Remarkable is:

1) The large improvements in the areas "expediting", "vendor negotiations", and "shortage meetings".

2) The increase in time spent for "paperwork".

Task		Time spent before MRP	Time spent after MRP	Change
Looking for material	$\bar{x}$	19,5	8	-11,5
	s	18,1	4	
	n	6	4	
Attending shortage meetings	$\bar{x}$	13,3	4,3	-96
	s	5,8	1,15	
	n	3	3	
Expediting	$\bar{x}$	35	16,25	-18.75
	s	14,1	9,5	
	n	5	4	
Planning emergency overtime	$\bar{x}$	8,4	3,3	-5,1
	s	5	2,9	
	n	5	3	
Shifting people around	$\bar{x}$	11,4	3,3	-8,1
	s	11	2,9	
	n	5	3	

TABLE 3.29

Influence of MRP on the time spent by foremen on the different tasks

Remarkable is:

The large improvements in all 5 points.

Another question asked was how much of the time saved was used for better managing.

The results are shown in Table 3.30.

Time saved spent on:		X[%]	s[%]	n
PLANNER	Vendor measuring	5	5	3
	Vendor selection	5	5	3
	Better negotiations	43,3	45,1	3
	Working with Engineering on standardization	15	22	2
FOREMEN	Additional education, training and supervision of people	17,5	3,5	2
	Better tooling supervision	2,5	3,5	2
	Improving production efficiency, solving process problems and installation of method improvements	30	14,1	2
	Providing required capacity and executing valid schedules	35	0	1

TABLE 3.30
Usage of the time saved through MRP implementation

Remarkable is:

1) The high percentages for "better negotiations" and "standardization", "better supervision", "solving production problems" and "capacity provision".

2) The large standard deviations.

One more question, concerning the usage of the computer printouts, was asked to investigate if the MRP system was really used by these people.

Even buyers and foremen answered:

- 5 or 46% of them use the printouts for making decisions;
- 4 or 36% used them partly for decision making;
- 2 or 18% did not use them at all.

The sample size is too small for a sensible analysis of the correlation between the usage of printouts and the success of the system.

Another question concerned the existence of "hot" or "shortage" lists. 8, or 80%, of the respondents (sample size: = 10) still worked with hot lists. Only 2, or 20%, had none.

CHAPTER 4

REASONS FOR NOT ACHIEVING THE POSSIBLE AND/OR EXPECTED BENEFITS

4.1 Introduction

Chapter 3 has already highlighted some of the most important factors for success and the most frequent problem areas. But it emphasised the symptoms more than the reasons.

This part of the discussion will deal with the most frequent causes for the failure of MRP systems.

These are:

1. The difficulty of the implementation process itself.
2. Unrealistic or no expectations.
3. Realistic expectations, but...

4.2 Reasons for failure of MRP

4.2.1 The difficulty of the implementation itself

The most important factor in MRP implementation is people. This was hardly recognized until the late 1970's; authors of articles and books concentrated entirely on the technical problems.

One exception is Dr. Josef Orliky (1), who wrote already as early as 1975 that "the problems (in implementing MRP) must be sought not in computer hard- and software,

but in people, their attitudes, habits and knowledge level".

Today the resistance of people towards the changes necessary is still one of the biggest problems in MRP Implementation. This was shown again in the survey conducted.

Different explanations of the occurrence of "human resistance" are:

(a) If only the human factor is of concern, resistance can be explained by using Maslow's "hierarchy of needs". The hierarchy of needs consists of 4 stages. The need for the elements on the next level, so Maslow's theory, arises only when the lower level needs are satisfied.

The influence of MRP on the different levels is shown in the following picture:



Figure 41 : Maslow's hierarchy of needs

ad level 2)

MRP changes the interaction of people. Communication links are cut off, while others are created. Therefore MRP has an interfering influence on established groups.

ad level 3)

MRP has an influence on the informal power circles of the employees.

ad level 4)

Different people receive satisfaction on the level of self-actualization from various fields (e.g. rushing down to the shop floor, shouting, and getting things done their way).

MRP can interfere here, and makes shifting of the sources of satisfaction necessary.

These interferences on the 3 highest levels explain why human resistance occurs.

J. Blasingame and J. Weeks (2) use the following criteria for explaining the difficulty of the change, incorporating more than just personnel reasons.

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(1) Orliky, J.: MRP - Material Requirements Planning, p.275, McGraw-Hill, 1975.

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1. Does the change effort involve multiple subsystems?
2. Does the change involve learning new techniques and assimulating new information.
3. In this change, are some members likely to perceive a loss in power or status?
4. Is the change complex?
5. Are the results of the innovation immediately visible?
6. Will the change make end results or performance more visible or measurable?
7. Is the change likely to require more than compliance; i.e. a high level of personal commitment?
8. Is the change high in tryability?
9. Is the change logical and tied to organization objectives?

Their conclusion was that, according to these criteria, MRP is "a large scope, very difficult change program at best".

L Kneppelt (3) shows the following picture and classifies MRP implementation to be "close to the top of the spectrum".

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(2) Burlingame, J., Weeks, J.: Behavioural dimensions of MRP change, Inventory and Production Management, p.82-85, 1st quarter, 1981.

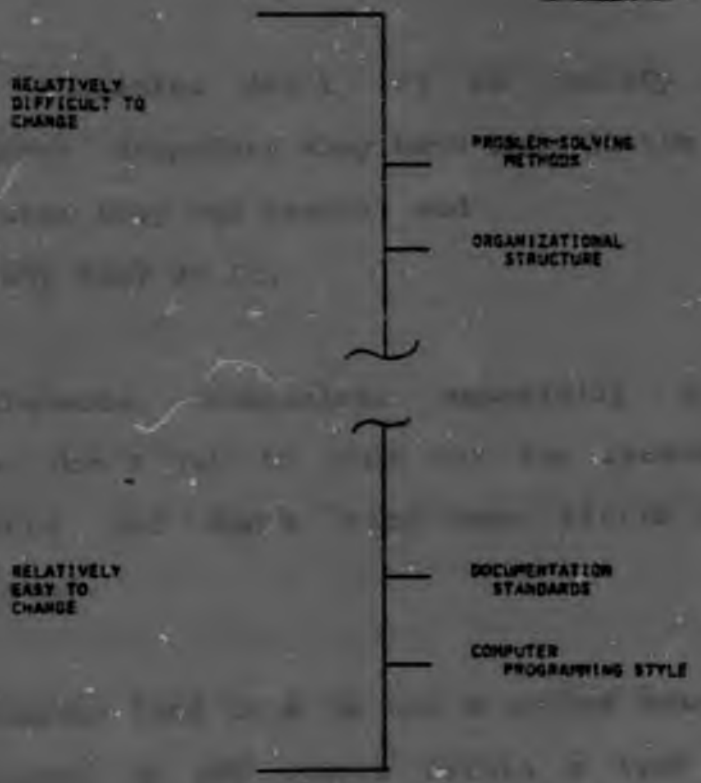


Figure 42 : Difficulty of changes (3)

Thus, in summary:

(a) MRP is a people system, and

(b) MRP success is relatively hard to achieve owing to the numerous difficulties involved in its implementation - as outlined above.

4.2.2 No, or unrealistic expectations

The survey has already shown some very interesting points.

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(3) Kneppelt, L.: Implementing Manufacturing Resource planning/Difficulty of the task. Production and Inventory Management Journal of APICS, p.67-68. 2nd quarter, 1981.

---

1. Many companies don't try to justify their MRP systems; therefore they have only little idea of:
   - o what they can expect, and
   - o why they do it.

2. Furthermore, companies, especially unsuccessful ones, don't try to find out the reasons for the failure and don't know how little they have achieved.

3. A company (and this is not a unique case) tried to implement an MRP system within a time span of 2 months; they needed 30.

Thus, management, which apparently has insufficient interest in MRP before the start of the system's implementation, must be blamed for all the abovementioned shortcomings. Furthermore, criticism must be levelled at the consultants and/or the hard/software supplier for not showing clearly enough the implications of this behaviour/attitude.

4.2.3 Realistic expectations, but...

This point contains by far the largest number of reasons, of greater or lesser importance, which often leads to the fiasco of many MRP system implementations. Very seldom is only one factor responsible for the failure of the system; nearly always some (≥ 3) factors work together.

We can divide these "stumbling-stones" into 5 groups. These groups are:

(a) Top management
(b) Education and training
(c) Data
(d) Hard/software
(e) Project management and project organization

In the following, these groups are split into subgroups which are explained in more detail. Every subgroup gets a unique number and a letter. The number is the reference number to the detailed explanation, and the letter indicates the possible impact of this subgroup on the system's success.

"H" stands for "could hurt"
"K" stands for "could kill"
"W" stands for "could wound"
the project.

ad a) Top Management

1 K) Top management support
2 H,K,W) Decision making
3 K,W) Not doing "homework"

ad b) Education and training

1 K,W) Timing of education and/or training
2 K,W) Content of education and/or trainin

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2 H,K,W) Decision making
3 K,W) Not doing "homework"

ad b) <u>Education and training</u>

1 K,W) Timing of education and/or training
2 K,W) Content of education and/or training

3 H,W) Presentation of education and/or training

4 H) Place of education and training.

ad c) Data

1 K) Part numbers

2 K) BOM

3 K) Inventory records

4 K) Routings

5 H,K,W) Work centre data

6 H) Lead times

7 H) Cost components

8 H) Others

The impact of data on the success varies considerably with the percentage of inaccuracy.

ad d) Project management and project organization

1 K,N) Setting up and organization of the project

2 W) Selection and assignment of people to the project.

3 H,W) User involvement

4 H) Analysis of the current situation

5 H,K) Resources.

ad e) Soft/hardware selection

1 H,W,K) Software and software vendor selection

2 H) Hardware and hardware vendor selection

3 H,W) Documentation

4 W,K) Software adaptation

Viewing the factors on this global level shows that many of them can "hurt" as well as "kill" the system. This depends on the extent to which this factor is misused, as well as how long it takes to correct it.

4.2.3.1 More detailed explanation of the most frequent mistakes

a1) Support

This point mainly concerns:

1. Lack of top management support and involvement.
2. Lack of continuity of top management support and involvement.

Both will inevitably kill the project. Unwillingness to accept MRP, paying too little attention to the project problems and project advance, and the lack of intent to fully utilize MRP after its implementation, will subvert the position of all people who are trying to make it work. Who will believe in MRP if the "top" doesn't?

a2) Decision making

One very frequently occurring mistake at the very beginning of the project is to decide to implement MRP without:

- o knowing the reasons for this;
- o which direction to go;
- o what is needed to succeed, etc.

Another one is

- o "leaving the decision making to people at lower levels".

Managers on lower levels do not have the information to incorporate the long term company development into the decision making. They don't know:

- o whether the company will expand or, if it does, how fast it is likely to do so;
- o which products it will produce, etc.

Therefore they are unable to decide upon a management information system with which the company should operate for the next 5-10 or more years.

a3) Not doing enough homework

This point concerns mainly educational and analytical tasks which should be performed before deciding to implement MRP, but which are frequently ignored. They are explained in more detail in (b) and (d).

b1) Timing of education and training

The timing of education kills the project if performed too late or not extensively enough owing to the impact of education and training, especially on:

- o the CCC, and
- o the awareness level of management towards implementation problems.

The timing of training hurts if performed:

- o too early - "fresh-up" courses are then necessary when the system is being handed over to the users;
- o too late - owing to the inefficient usage at the system's start.

b2) Content of education and training

The difficulty of the content of the education and training program must be set under recognition of the capability of the trainees. If the contents are too easy, and are repeated too often, the lessons become boring and students will not pay the necessary attention.

If the education and training program is too difficult, the "students" as well as the teacher become frustrated.

Difficulty of the content is only one point that has to be recognised. Another one is "language". This addresses:

- o the level of expression used;
- o the accent of the presenter;
- o the different meaning of the same words in U.S.A. and S.A., and
- o the language in which the education and training is conducted.

b3) Presentation

This point mainly concerns:

- o which person presents MRP;
- o his/her credibility with the group he educates and trains;
- o the different aids used
- o the way they are being used.

Lack of credibility of the trainer with the group being instructed is often the reason for MRP failure. If the trainer is not able to answer all questions raised, the attitude "MRP does not work in our department" arises, and a loss in credibility and support is inevitable.

Pre-tailored training aids are sometimes used incorrectly. Videotapes were watched like movies. They were not stopped for discussion on things said and shown, and therefore the trainees were unable to relate the contents to their own situation.

When these aids are used as a substitute for thinking, they can do more harm than good.

b4) Location where education takes place

For top people and project team members, it is very advisable to attend outside classes. Unfortunately, this is not done to the extent necessary. Company members miss an opportunity to exchange information and build new contacts with other people from companies who are probably facing the same problems. Companies therefore often fall back to the "we are different" attitude - a very bad sign, and a sure indicator that success will be rather unlikely.

c11-c7) Data accuracy

Generally it can be said that data accuracy is one of the most important factors (see also Chapter 3).

O. Wight demands:

Inventory accuracy of	95% within counting error
BOM accuracy	98%
Routings accuracy	95%

The questionnaire and survey show that many S.A. companies are far away from those levels.

Work centre data are less essential at the beginning. Cost data are normally fairly accurate. Lead times are very important, but not

too crucial at the start of the system's running, owing to the fact that they can be reduced sometimes down to 10% of their original time span. George Plossl (3) expressed this at the Sapics conference in the following way: "It (the lead time) will be what you say it is". It is therefore possible to start off with already used or estimated lead times.

d) Project management and project organization

d1) Setting up and organisation of the project

One of the most common pitfalls is to use the "Do it in your spare time" approach. This indicates that the project is not recognized as a high priority business project and the project leader therefore will be more concerned with everyday problems than with this "new strange thing".

Others are:

- o Not using project and steering team.
- o Not developing a realistic implementation plan.
- o No regular weekly review meetings.

---

(2) Wight, O.: MRP II, p.377, O. Wight Publications, 1982.

(3) Plossl, G.: "Putting it all together" paper given at the Sapics conference, Sun City, August 1983.

- o No setting of objectives.
- o The attempt to "sneak the system in" as a surprise to some department heads or to lower level management.
- o Accountability not specified.
- o DP-department dominating throughout the implementation process.
- o Too little interaction between project and steering team.

d2) Assignment of team members

Omissions in this direction which diminish the chances of success are:

- o Not assigning the best people available.
- o Hiring outsiders or consultants to do the job.
- o Assigning people who are likely to destroy the team atmosphere.
- o To under- or overstaff (when understaffed, the project takes too long; when overstaffed, the team becomes a "discussion group" with low efficiency).
- o Staffing of employees who are not really committed.

ad d3) User involvement

The questionnaire survey showed that human resistance, especially at foreman level, was one of the biggest problems. On the other hand, these employees were hardly asked about their

requirements. They also thought that better education and training would have made their job easier at the start of the system's running.

There are clear indications that, despite their influence and the system's success, these users are still not considered important enough to be involved in the system implementation, especially in the system design phase.

ad d4) Studies of the current situation

Many companies do not recognize the importance of analysing the current situation. Therefore, they often face:

- o an unfavourable climate of change;
- o big problems in creating and cleaning out of data;
- o etc.,

which results in

- o inability to keep to timetable
- o implementation of a system which does not meet the requirements;
- o lack of resources.

ad d5) Resources

The most important resources are:

- o people and their knowledge;
- o time to perform all tasks properly;
- o money to finance the project.

ad e1) Software, and software vendor selection

The survey showed the strong impact of the software package in MRP success.

Pitfalls in this area are:

- o buying of an unproven package which is not absolutely bug-free;
- o buying of an incomplete package;
- o buying of a package which does not meet the company's requirements;
  (e.g. not having MPS when it is absolutely essential to the company);
- o buying from a vendor who is known for his bad support or .....
- o buying from a vendor, whose office is far away from the company.

ad e2)

Hardware could only become a critical factor if:

- o the vendor is far away, or
- o gives up the market.

Today, hardware is no longer a major problem.

ad e3)

The quality of software package documentation ranges from good to moderate.

Problems with improper documentation occur more often in companies which program their own system or tailor it to their needs, and try to save money in this field.

This results in:

- o loss of time (employees have to consult the "experts" owing to the lack of references);
- o the lack of optimal usage of the system;
- o the danger of loss of control of parts of the system once the "experts" have left;
- o the revitalization of the informal system
- o the loss of one potential education and training aid.

ad e4)

Software adaptations here do not concern the change of screen layouts and other options offered by the vendor.

It deals with changing the procedures or rewriting the software into another programming language (incredible as it may seem, it has happened!).

Companies which have tried this were never happy with the result, owing to:

- o loss of support from the software-supplier
- o inability to use new releases
- o unexpected bugs in the tailored package;
- o long implementation time; the programming and testing of the software becomes the critical issue in the project plan.

4.3 Summary

This chapter explained the reasons for not achieving the expected and/or possible benefits. These reasons were divided into three groups with the group 'Realistic expectations, but...' being divided into 5 subgroups.

All of these mistakes and omissions occurred and occur owing to poor management, or a lack of information and MRP education. Top management, especially, would have the power to lead the project with a lot of enthusiasm, supervision and, if necessary, force to succeed.

A prerequisite is that top management themselves must undergo intensive education, and must be really convinced about the ability of MRP to solve a lot of their business problems. They must work hard, not so much towards implementing MRP, but towards <u>successfully</u> implementing MRP.

CHAPTER 5

HOW THE CHARACTERISTICS OF THE S.A. COMPANY ENVIRONMENT AFFECT THE IMPLEMENTATION AND THE SUCCESS OF THE SYSTEM

5.1 Introduction

When analysing the survey response, it was apparent that many companies did not bother to conduct cost/benefit analyses, to set objectives and to measure success in the form of reductions of inventory, lead times, expediting, etc. Many of them checked different sources of information on MRP and software, but only very few could state costs for implementation, education and training, and operating the system.

We can say that many companies invested a lot of money, time and effort in a project which they were not sure would pay off. Today they don't know how well or badly they implemented MRP, and don't have any idea about costs, nor do they care about them.

(This type of managing can be called, in addition to MBO and MbE, "MbpC" or "Management by pure chance".)

These symptoms lead to one of the most exciting research fields. Nothing has been published so far about the impact of the different environments on MRP design, implementation, and the running of the system.

Some parts of the research opportunities are investigated in paragraphs 5, 7 and 8. (The writer could definitely not capture all aspects.) The unfamiliar S.A. environment would make it necessary to spend much more time in this field. Nevertheless, the writer believes that he covered the most essential influencing factors.

Much more research is needed to establish a proper framework, containing guidelines for successful implementation in different environments.

5.2 Special (unique) characteristics of the S.A. company environment

To get a better overview of the S.A. situation, the following 4 groups stated here in alphabetical order were surveyed.

5.2.1 Communication

5.2.2 Education

5.2.3 Industry itself

5.2.4 Management and other employees on the different levels of company hierarchy.

Again, as in Chapter 4, some of the characteristics mentioned could be ascribed to more than 1 group.

5.2.1 Communication

Three different communication problems occur. They take place:

5.2.1.1) between the different management levels

5.2.1.2) between management and shop floor personnel

5.2.1.3) between shop floor personnel itself.

ad 5.2.1.1)

Within the managerent levels, communication problems occurred mainly owing to the different levels of education (see 5.2.2). The gap in formal education received resulted in:

- Not consulting and involving lower level management during the early stages and throughout the implementation process.

- Not expecting anything worthy of thought from the lower levels.

- During education with tapes and videos, the differences in meaning of one word in U.S.-English and S.A.-English sometimes caused confusion on lower ranks.

- On the other hand, top, 1st and 2nd level management accused each other of "ignorance" and "cringing". (This was recognized in interviews within the companies.)

Top and 1st level management blame 2nd and lower levels for not producing ideas or, if they do, for not being able to "sell them" properly.

On the other hand, 1st and especially 2nd level managers complained about the difficulties they have had in "getting the message across".

ad 5.2.1.2)

As in (5.2.1.1), the education gap between management and shop floor personnel is largely to blame for the poor exchange in information between the two levels.

This is deepened by:

- language, and
- racial problems.

Many Black workers (and to a lesser extent, Indians and Coloureds), cannot express themselves properly in English or Afrikaans, nor can the predominantly White managerial levels express themselves in any of the native languages.

Racial problems stem largely from the different levels of education of the racial groups. Some interesting aspects which could also be mentioned here are ascribed to 5.2.2.

ad 5.2.13)

Communication problems on this level are a minor problem compared to the 2 mentioned before. Problems on this level were mentioned during interviews, but the writer is not qualified to explain this point more thoroughly. It is only mentioned to provide a fuller picture.

5.2.2 Education

The most important and very apparent factor in the difference in education between ethnic groups and, therefore, between the different positions held. Figure 5.1 tries to explain this S.A. peculiarity.

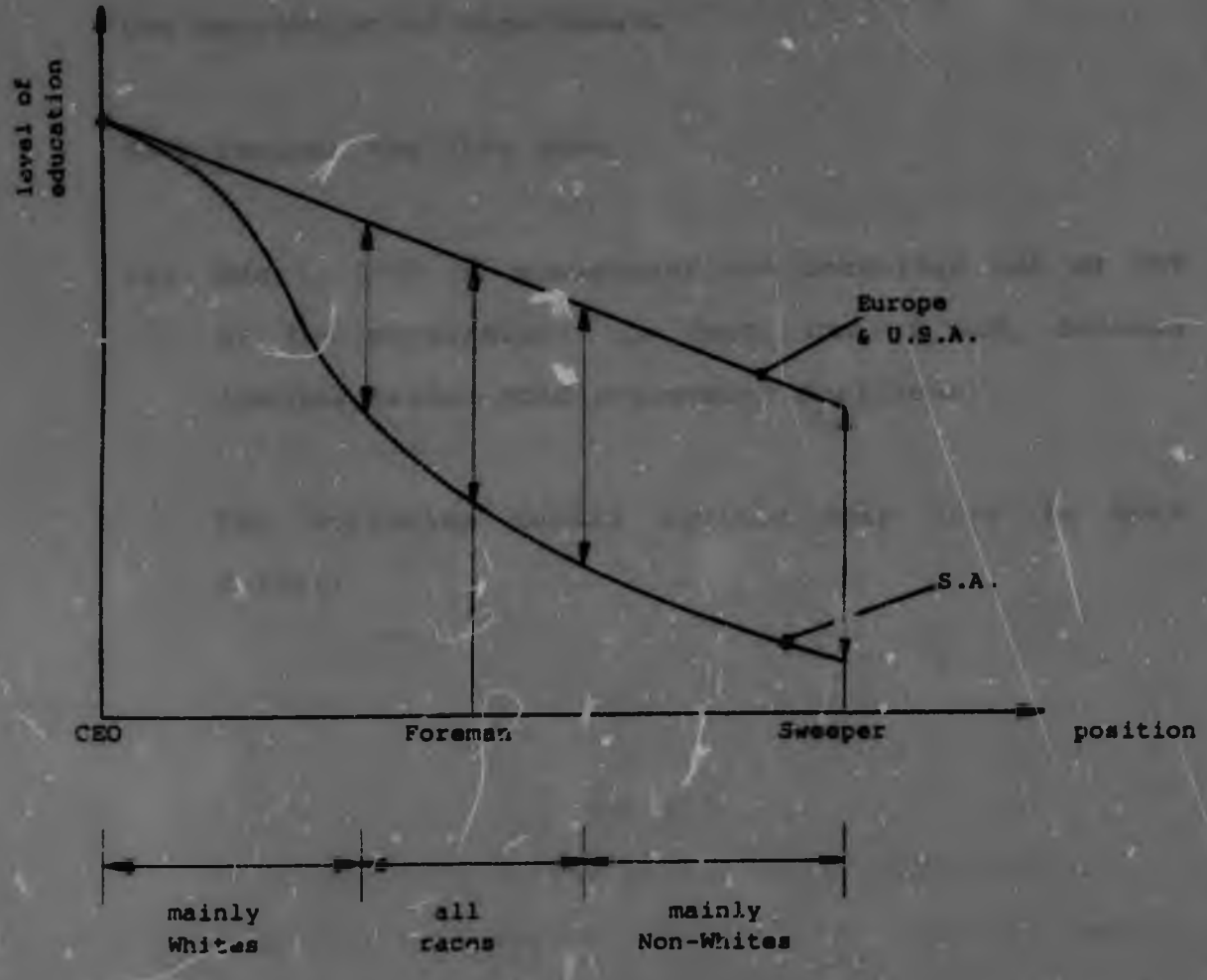


FIGURE 5.0
Correlation between position held and level of education

The picture shows the level of education on the vertical scale; the positions, which are largely dependent on race, on the horizonal scale. The graphs represent only the qualitative difference; no quantitative deductions are admissible.

The educational level of the "top people" is very similar to that overseas.

Within the following management levels, a gap between the education level of an average S.A. manager and his overseas counterpart opens and widens down to the lowest managerial level. This can be observed especially in the manufacturing department.

Some reasons for this are:

(a) Nearly 100% of management are recruited out of 20% of the population; In fact, out of 10%, because females seldom hold management positions.

The following tables explain this fact in more detail:

	Whites		Coloureds		Asians		Blacks		Total
	No.	%	No.	%	No.	%	No.	%	
Professional	17 770	89	1 220	6	1 [illegible]	5	2 [illegible]	5	42 390
Managerial	17 110	93	420	2	620	3	190	—	18 540
Clerical	66 210	59	13 410	12	12 580	11	19 970	18	112 190
Sales	20 180	72	1 [illegible]	5	1 [illegible]	7	[illegible]	16	[illegible]
Transport	1 260	7	3 [illegible]	33	2 [illegible]	3	[illegible]	76	47 [illegible]
Service	2 550	9	3 470	14	[illegible]	1	[illegible]	75	27 [illegible]
Production	42 [illegible]	7	148 910	23	32 [illegible]	5	[illegible]	65	642 150
Foremen/Supervisors	19 190	83	3 [illegible]	14	2 010	9	9 890	27	16 510
Artisans	86 420	79	14 150	14	1 820	4	[illegible]	3	101 [illegible]
Labourer	196	—	16 080	12	3 [illegible]	1	265 180	87	104 [illegible]
TOTAL	314 440	33	230 050	17	86 [illegible]	6	750 480	54	[illegible]

TABLE 5.1

Occupational distribution by population group in manufacturing 1979(1)

Occupational Category and Year	*Race Groups*			
	Africans	*Indians*	*Coloureds*	*Whites*
Managerial and Executive:				
- 1962	Nil	1%	Nil	99%
- 1972	1%	2%	Nil	97%
- 1978 Probable	1%	3%	Nil	96%
- 1978 Desirable	1%	5%	Nil	94%
Medium and Senior Clerical:				
- 1962	2%	15%	1%	82%
- 1972	2%	24%	1%	73%
- 1978 Probable	3%	25%	1%	71%
- 1978 Desirable	3%	25%	1%	71%
Lower Clerical:				
- 1962	4%	24%	Nil	72%
- 1972	4%	33%	Nil	63%
- 1978 Probable	4%	33%	1%	63%
- 1978 Desirable	4%	33%	1%	63%

TABLE 5.2

Proportions of the total labour force within categories of employment constituted by the four race groups

(b) Technical education is not very popular, regardless of race group.

The following table is based on information from the S.A. Handbook of 1983 (3), page 649-687.

Year/Degree	B.Sc.	%	Honours	%	M.Sc.	%	Ph.D.	%
76/77	732	8	32	1,9	77	6,6	17	5,1
77/78	838	7,7	69	2,2	61	5,3	22	6,1
78/79	778	6,5	100	3,3	81	5,8	24	7,1
79/80	809	7,0	130	3,5	73	5,3	17	4,1

TABLE 5.3

Percentage of White students enrolled for technical degrees on each level

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(1) "S.A. Handbook", p.493, Table 10, 1983.

(2) Schlemmer, E., Webster, E.: "Change and reform and economic growth in S.A.", p.177, part of Table 1.

(3) S.A. Handbook, 1983, p.649-687.

(5) Financial Mail Supplement, p.5, September 16, 1983.

The percentage figures reflect the proportion of White students enrolled for technical degrees to the total number of students enrolled at each level.

In Technical Colleges, Technikons and Technical Institutes, about 80 000 White students received technical education.

For Coloureds, the following table can be drawn (3):

Year/Degree	B.Sc.	Honours	M.Sc.	Ph.D.
75176	14	3	-	-
76177	16	8	-	-
77128	14	4	3	-
78179	24	-	-	-
79110	25	1	1	1

TABLE 5.4
Number of Coloured Engineering Students per year and degree

No information was available for Black and Indian students.

How low these figures are is shown by the fact that "White industrialized countries boast between 13 and 18 engineers and R & D scientists per 10 000 head of population, and Japan 35/10 000, the ratio in S.A. is only 2,4/10 000". (5)

Research conducted by Leigh Douglas showed in detail the background of S.A. managers in comparison with overseas findings.
(This is explained in point 5.2.4.)

(c) The so-called "Peter's Principle" or "raising somebody to his level of incompetence. This will be explained in (5.2.4[a]).

(d) Not only is the percentage of educated Non-Whites (especially Blacks) lower than that of Whites, but it must also be recognized "that a Black matric is not the equivalent of a White matric". (6). There is therefore, dependent on race, a discrepancy in the general knowledge of people with the "same qualification".

(e) The very low educational level of the shop floor employees is illustrated by table 5.5.

Occupational Category and Year	*Race Groups*			
	Africans	*Indians*	*Coloureds*	*Whites*
Higher Semi-Skilled and Skilled:				
- 1962	14%	43%	7%	36%
- 1972	17%	49%	9%	25%
- 1978 Probable	17%	50%	9%	24%
- 1978 Desirable	21%	48%	9%	22%
Lower Semi-Skilled:				
- 1962	45%	49%	3%	3%
- 1972	43%	53%	3%	1%
- 1978 Probable	43%	53%	3%	1%
- 1978 Desirable	43%	53%	3%	1%
Unskilled:				
- 1962	88%	11%	1%	Nil
- 1972	88%	11%	1%	Nil
- 1978 Probable	88%	11%	1%	Nil
- 1978 Desirable	88%	11%	1%	Nil

TABLE 5.5

Proportions of the total labour force within categories of employment considered by the four race groups. (4)

This Table, in conjunction with Table 5.1 (occupational distribution) on page 105 , is self-explanatory.

(f) In-house company training often faces large problems owing to a lack of basic knowledge on which to build upon (see also [9]).

(g) Attempts to raise the educational level of the shop floor work force can face difficulties according to:

g1) motivation

g2) ability.

g1) Motivation:

A couple of managers who were asked their opinion on the motivation of the mainly Black work force to increase their knowledge responded in such a way that we could presume that a kind of "80/20 rule" is also valid in this field. This would mean that only 20% of the group addressed are interested in further education and training, whereas 80% look for security and are unwilling until pushed.

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(9) Financial Mail Supplement, p.5,9,10, September 16, 1983.

(5) Schlemmer, L., Webster, E.: "Change, reform and economic growth in S.A.", p.177, part of Table 1.

---

2 project managers, when interviewed, held opposite views. One said that "they were very keen on training". The other one stopped the discussion on that field with "this is only an excuse based on prejudice".

g2) Ability:

The general view was that a large percentage of the work force is unable to comprehend even the basic education and training necessary for MRP.

Both (g1) and (g2) are not yet verified. Further, broad and specialized research, especially in developing techniques on how to motivate, teach, educate and train the different race groups, according to their cultural and educational background, must be conducted.

The results of training courses, witnessed by the writer in several companies, showed the ineffectiveness of current methods. Even the simplest filling-in transactions and usage of already nearly "foolproof" documents ended generally in disaster.

Some ways to overcome this dilemma are explained in Chapter 8.

5.2.3 Industry itself

Many of the characteristics of the S.A. industry have their origins in politics. The fear of being cut off from the long foreign supply lines in case of wars, boycotts or for other reasons, lead to the "Import Replacement Policy". This policy was followed after World War II, and was the "mother" of the S.A. industry. The "Board of Trade and Industry" was established to protect the development of the newly founded S.A. companies against foreign competition.

Thus, we can say:

(a) The S.A. industry (excluding mining) is very young (less than 50 years old).

(b) The Restriction of competition and strive to produce everything locally, has led to:

b1) a relatively small, well protected, home market; consequently to small lot sizes;

b2) relatively small companies. (When using the figures of Table 2 in the S.A. Handbook of 1983, it can be calculated that the average manufacturing company in S.A. employs 88 people.)

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b3) the establishment of companies with a very low internal organization level. This point will be explained in (5.3);

b4) Low productivity of the whole industry:-

The average productivity increase per year for the time span 1963 to 1974 (6) was for:

S.A.	1,7%
Australia	2,6%
U.S.	2,9%
G.B.	4,2%
Japan	10,0%

More recent figures were already stated in Chapter 1. The S.A. yearbook (7) states that "...industry (sector manufacturing) has been growing on more inputs rather than on more productive inputs."

b5) Many of these inefficient and badly organized firms are still making good profits. Therefore they have:

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(6) Van der Merwe, S.: "The environment of S.A. Business."

(7) S.A. Yearbook, 1983, p.494.

---

b6) The ability to buy high technology equipment like computers, very advanced machine tools, etc., from overseas, without (see survey) justifying the investment.

Another rather unique characteristic, is the:

(c) Predominance of a few extremely powerful companies. This is illustrated in "Who owns Whom" (8) and in a "Financial Mail Special Survey" (9).

The "special survey" result was that:

c1) Anglo American controls 70 companies
c2) Rembrandt " 65 "
c3) Sanlam " 38 "
c4) Barlow Rand " 25 "

listed on the JSE (Johannesburg Stock Exchange).

c5) Fewer than 153 companies were controlled through the shareholdings of their directors.

The value of shares held by c1, c2, c3 and c4 was R67,6 billion, which represents +/- 75% of the value of shares on the market.

---

(8) Hetzegger: "Who owns Whom", 1983
(9) Financial Mail Special Survey, Section "Top companies", 6 May 1983.

---

b6) The ability to buy high technology equipment like computers, very advanced machine tools, etc., from overseas, without (see survey) justifying the investment.

Another rather unique characteristic, is the:

(c) Predominance of a few extremely powerful companies. This is illustrated in "Who owns Whom" (8) and in a "Financial Mail Special Survey" (9).

The "special survey" result was that:

c1) Anglo American controls 70 companies

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---

(8) McGregor: "Who Owns Whom", 1983

(9) Financial Mail Special Survey, Section "Top companies", 6 May 1983.

When analysing "Who Owns Whom", the results were very similar:

Anglo	78	(= 16%)
Sanlam	36	(= 7,5%)
Barlow Rand	27	(= 5,5%)
Directors	110	(=22,5%)

(d) Another interesting point is the investment-earning profile of these dominating companies. Anglo American shall be used as the representative of the "big four".

Value of Investment	Field of Investment	Earning source
44%	Gold	45%
6%	Diamonds	17%
8%	Coal	7%
3%	Platinum	3%
1%	Copper	1%
3%	Other mining	1%
7%	Finance	4%
25%	Industrial	31%
1%	Oil and gas	1%
2%	Property	2%

TABLE 5.6
Anglo American profile (10)

The impact of point (c) and (d) on MRP will be detailed in 5.3.4.4.

5.2.4 Management and other employees on different levels in the company hierarchy.

Many of the points mentioned in the following must be seen in combination with paragraph 5.2.2 (Education).

5.2.4.1 Characteristics on management level

(a) Shortage of real managers with appropriate skills on all levels.

This can be illustrated, e.g. when comparing the number of employees per supervisor in S.A. to the figure in the U.S.

In S.A. 1 supervisor controls 15 employees

In U.S. 1 supervisor controls 6 employees.

John Vissier (11) said that "not only does S.A. have fewer managers per 1000 than other developed countries, but 'those middle management executives' we have are not always real executives because we don't have a properly formulated executive training programme in S.A."

---

(10) Financial Mail Special Survey, 6.5.1983.

The best journeyman is promoted to foreman; the foreman is promoted in turn, and he ends up as production manager". The fact that this foreman can be "hopeless" as production manager is not expressed explicitly, but is one of the deductions which the reader can draw. This raising of someone who did well on a lower level up to his/her "level of incompetence" is called the "Peter Principle".

(b) Weakness of middle and lower management

The reasons for this were explained in paragraph 5.2.2.

Leigh Douglas (12) investigated the educational background of S.A. manufacturing managers. The results ars shown in the following table.

---

(11) Vissier, J.: "Productivity please". Article in Financial Mail Supplement from 16 September 1983, p.21.

(12) Douglas, L.: Production Management in S.A., p.65. Dissertation for MA., UCT, 1982.

	% Managers (N=412)
Less than matric	5%
Matric	27%
Technical diploma	40%
University degree	13%
Advanced university degree	10%

TABLE 5.7

Educational background of

Manufacturing Managers

In a paper held at the SAPICS conference in Sun City in August 1983, he compared the backgrounds of S.A. manufacturing managers with one of their counterparts in the U.S.A., Great Britain and Australia.

He came to the conclusion that "S.A. production management is dominated by relatively uneducated and immobile administrative types. However, the managers appear to be well paid." (14).

5.2.4.2 Characteristics on lower levels

Absenteeism and late attendance is of a high percentage in S.A. I.B. McLean (14) mentions that it "can be as high as 10% daily" in the clothing industry. There are definitely more characteristics at this level, e.g. racial composition, cultural differences, etc. These were partly explained in the chapter on "education".

However, they do not have a strong influence on the MRP system and its implementation, and therefore will not be dealt with.

5.2.4.3 Characteristics on all levels

I. McLean mentions the labour turnover for the Western Cape clothing industry was 65% for 1977. This turnover in staff, to a much lower extent, exists also on the managerial level.

This represented a major problem in collecting information on MRP. Hand in hand with the staff turnover, owing to too little formalization of the company activities, goes a loss of information. When a person leaves the company, his knowledge, which was a part of the company's "informal data base", is lost and cannot be recalled.

---

(13) Douglas, L.: Production Management - A survey of current practice in S.A. Paper at Sapics Conference, Sun City, August 1983.

(14) McLean, I.B.: "The Training of Coloured Supervisors in the Western Cape clothing industry, p.49. Dissertation for M.B.A., U.C.T., 1977.

5.2.4.4 Immigration and emigration

To mention immigration and emigration in connection with MRP may seem a bit strange. But for S.A., being one of those "immigration countries" with a hunger and need for well educated people, even this point is important and has to be taken into consideration.

The following table states the immigration and emigration numbers, and the net influx of persons between 1961 and 1971.

IMMIGRATION AND EMIGRATION IN SOUTH AFRICA

	61 - 64					65 - 71					
	Immi/(% N)		Emi/ (% N)		+/-(N)	Immi/		Emi/		+/-(N)	N+
prof. technical	8,1	9 400	12,1	4 730	+4 670	10,1	28 752	12,4	8 293	20 453	25 129
Management and administration	2,0	2 321	2,6	1 016	1 305	1,9	5 409	2,4	1 605	3 804	5 100
Clerical	5,2	6 035	6,6	2 580	3 455	7,0	19 927	9,2	6 153	13 774	17 229
Sales	2,3	2 670	3,3	1 290	1 380	2,3	6 547	2,5	1 672	4 875	6 255
Building	3,2	3 714	1,1	430	3 284	0,7	1 993	0,8	[illegible]	658	3 942
Mining	0,8	928	1,0	391	537	0,5	1 423	0,5	334	1 089	1 626
Trade & production workers	14 3	16 595	9,2	3 597	12 998	17,5	49 818	14,0	9 364	40 454	53 45[illegible]
Transport and communication	0,9	1 044	0,6	234	810	0,7	1 993	0,7	468	1 525	2 335
Service	1,6	1 857	1,7	664	1 193	1,6	4 555	1,6	1 07[illegible]	3 485	4 67[illegible]
N	116 054		39 096		+26 958	55,3	153 132	55,1	36 852	122 289	never employed
						284 [illegible]73		66 883			

TABLE 5.8

Immigration and Emigration

This strong migration also fostered the turnover in staff.

The study (16) showed that:

> Die mediaan tydperk van verblyf het ook geleidelik toegeneem. Die mediaan tydperk van verblyf van die immigrante wat in 1966 die land verlaat het, was 2,38 jaar, terwyl diegene wat in 1971 die land verlaat het, 'n mediaan verblyftydperk van 3,37 jaar gehad het.
>
> Die enigste duidelike tendens wat blyk uit 'n analise van die tydperk van verblyf volgens beroep, is dat wat die twee belangrikste beroepskategorieë betref, professionele en tegniese immigrante (wat Suid-Afrika weer verlaat) langer as ambagslui en produksiewerkers in Suid-Afrika bly. Hoewel die persentasie ambagslui en produksiewerkers wat Suid-Afrika binne 3 jaar na aankoms weer verlaat het, 'n duidelike afname toon en die mediaan tydperk van verblyf van die groep werkers geleidelik toegeneem het, het 1 uit elke 2 van die immigrante nogtans binne 3 jaar weer geëmigreer dat die persentasie emigrante met verblyf van minder as 1 jaar van 18,5 in 1965 tot 6,6 in 1971 gedaal het; dat die persentasie met verblyf van 1 tot 4,9 jaar toegeneem het van 51,6 in 1965 tot 59,5 in 1971, en dat die persentasie met verblyf van 5 jaar en langer van 29,9 in 1965 gestyg het tot 33,9 in 1971. Dit blyk dus dat die persentasie immigrante wat Suid-Afrika binne 1 jaar na hulle aankoms alhier weer verlaat het, geleidelik afgeneem het, terwyl die persentasie wat die land na 'n verblyf van

meer as 5 jaar weer verlaat het, 'n toename toon. Nogtans het 2 uit elke 3 immigrante wat Suid-Afrika in 1971 weer verlaat het, minder as 5 jaar hier vertoef.

5.3 How the peculiarities affect the implementation and increases or diminishes the chances for success

5.3.1 Introduction

The environment, as outlined in 5.2, sets the starting base for MRP system implementation and largely influences the amount of effort needed for success. The following outlines the ways in which the S.A. environmental peculiarities foster or diminish the chances for MRP success.

Some aspects will only be touched on in this chapter. Thorough explanations will be given in Chapters 7 and 8.

5.3.2 Communication

5.3.2.1 Communication problems between the different levels of management

The problems outlined in 5.2.1.1 result in:

(a) a bottleneck in the information flow between the different levels of management. Therefore:

(b) only limited usage of the company's idea sources when outlining with the requirements in the system specification phase;

(c) little involvement of employees whose jobs and the way they do them are strongly affected by MRP.

This can result in hidden distrust on lower management levels towards the system ("their system, not mine" attitude).

This goes hand in hand with resistance to change and striving to keep the informal system alive.

The solution to these problems are:

- to foster the flow of ideas throughout the management levels;
- to increase involvement on all levels in the system design phase;
- more education for the lower management levels;

This must be tailored to their abilities. To explain the concept of MRP, how their actions influence the whole company, etc, is absolutely necessary.

Chapters 7 and 8 explain this critical poin in more depth.

5.3.2.2 Communication problems between management and shop floor personnel

In which ways the problems mentioned in 5.2.1.1 affect the ability of companies to be successful largely depends on the stage of MRP development (MRP, closed loop MRP, MRP II) and on the design of information feedback procedure.

This point will be explained more fully in Chapters 7 and 8.

5.3.3 Education

The different levels of education will not affect MRP success, if:

1) The entire top and middle management is committed and capable of handling the implementation tasks properly; and of involving lower level management to a degree which eliminates human resistance.

2) The education and training program is tailored to the trainees abilities and needs.

3) The employees who provide the feedback can be trained to do this accurately. (This requires writing and reading skills. These abilities should be checked before employing somebody.)

4) Strict discipline is enforced by management according to executing the plan (including price lists, production schedule,.....).

Problems due to differences in educational background, which affect MRP, are mainly experienced at management levels.

This will be explained in more detail in paragraph 5.3.5.

The influence of the different levels of education can be considered partly as a disadvantage; partly as an advantage.

Disadvantages are the first 3 "ifs" mentioned above. The fourth "if" can be judged as an advantage, for it is easier to command "from now on this document has to be filled in in this way" than to convince someone more intelligent about the merits of the system.

It is also cheaper to command than to provide explanations in order to obtain the commitment and support necessary.

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5.3.4 Industry itself

5.3.4.1 Reasons for the late start of MRP in S.A.

Many points in paragraph 5.3.3 explain why MRP had its breakthrough only in 1981/82. The main factors responsible for the late start of MRP in S.A. are:

(a) The size of the companies;
(b) the lack of hard competition for the home market, and
(c) the fact that good profits were made.

They affect the success of the implementation only indirectly.

5.3.4.2 Reasons for the boom in 1981/82/83

The reasons for the boom in 1981/82/83 were the following:

(a) the economic crisis which also affected S.A.;
(b) the need for better planning and scheduling of the production process;
(c) high interest rates;
(d) the organizational level was so low that, in now harder times, the companies could not afford to manage by pure luck, but looked for an aid to better decision making;
(e) MRP successes were advertised all throughout the industrialized world.

5.3.4.3 Factors which foster MRP success in S.A.

The late break through of MRP in S.A. fosters the system's success insofar as a lot of the pioneering work was already done.

This concerns mainly:

a) software

b) hardware

c) implementation experience.

ad a)

Today software is of a high quality. Compared to what U.S. companies started with, modern software is very flexible, proven, and mainly bug-free. A wide choice of different packages are on the market.

ad b)

Hardware is very powerful, relatively cheap and very reliable. System breakdowns due to hardware failure were hardly experienced by the companies visited.

ad c)

S.A. companies have the chance to learn from pitfalls in the States and Europe. They can investigate which packages are mainly used in their type of industry; they can discuss the problems and the hidden traps which were faced

during the implementation process. Furthermore, a lot of literature on MRP and other aids for education are available. Unfortunately, not enough companies make use of these existing opportunities.

Other factors fostering MRP success are:

a) the profitability of most companies (to raise sufficient funds is the main task before deciding to implement MRP);

b) many companies realized the need of a formal system to amend bad organization (see paragraph 5.3.4.2.d).

5.3.4.4 Factors which can diminish MRP success

Factors which can diminish MRP success are:

a) The predominance of few very big companies, and

b) their strong dependence on mining (especially on gold).

ad a)

The tendency can be observed that the decision to install MRP is often made in the headquarter of the group in S.A. or overseas. A vendor is chosen and without analysing the needs of the different

companies, a contract is signed to supply the various sites.

This results in lack of commitment of the managers, and in software problems. Enthusiastic management would make even badly fitting software work.

ad b)

The strong dependence of these "giants" on gold price is reflected by the following facts:

If the gold price is high, many projects are undertaken. If it is low, planned projects are postponed or cancelled. Some managers mentioned that "in the boom, we have no time to implement, and in the depression we don't get the financial resources."

A less critical factor is:

c) the low degree of formalization, standardization and specification of data needed to run the system.

A large amount of these data often exists only in the heads of the various production people. They have to be collected, formalized and standardized, which thus raises the amount of work necessary. This is one reason for the considerably longer implementation time needed in S.A. Checks

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concerning accuracy and sufficient degree of specification of these data are necessary in any company before loading them on to the computer.

5.3.5 Management and other employees on different levels in the company hierarchy

Management, together with excellent COC and education, can be called the "most important factor" in an MRP implementation.

Bearing this in mind and what was said in paragraph 5.2.4, "management" must be exposed as being also the most critical factor, which is responsible for many failures, in the MRP implementation process.

The same mistakes and the same omissions made in the past in the U.S. and in Europe, now take place in S.A.

In this regard, the whole project is frequently doomed to failure because:

a) Top management, owing to the shortage of qualified people in this profession, is frequently overburdened with the day to day running of the business, and consequently have to neglect the main top management tasks of:

- o planning
- o directing, and
- o controlling. (16).

Consequently, these very busy people implement MRP either in their spare time or the project is carried out by less qualified people.

b) Due to their often only moderate educational level:

b1) "many owners/managers are hesitant about bringing in new well trained outsiders into the business for fear of losing control";

b2) many of them are sceptical and ignorant in their approach to MRP because it is a new way of running the business.

They would have to give up old habits and adopt new ones. The fear of not being able to compete with younger employees and of losing power within the company is widespread.

On the lower levels of the company hierarchy, more training in "how to fill in documents" and closer supervision in all aspects of the production process is necessary.

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(16), (17): McLean, I.B.: "The training of coloured supervisors in the Western Cape clothing industry", p.44. Dissertation for M.B.A., U.C.T., 1977.

The high percentage of absenteeism and staff turnover makes planning more difficult, and on-going training an even bigger necessity than overseas.

The immigration surplus, which brought more than 25 100 professionals and technical people, and 5 100 people now holding managerial and administrative jobs in S.A., can be judged as a major benefit for the country. This positive influence is partly compensated by the short time these people stay in S.A.

5.3.6 Summary

This chapter highlighted characteristics of the S.A. environment and industry which are able to influence the success of the MRP installation.

The communication problems within the companies, the relatively little education of employees on nearly all hierarchical levels and, especially, the weakness of management, decreases the chances for being successful.

The factors mentioned in paragraph 5.3.4 (= Industry itself) are more likely to foster MRP success.

Owing to the problem factors mentioned, we can deduce that:

a) MRP success is harder to achieve in S.A. than in Europe or U.S.A.

b) If MRP works properly, the benefits achieved (exposed in percentages) can be higher than the ones experienced in the U.S.A. and Europe. (The potential for improvement is because of the low organizational level, larger than overseas.

CHAPTER 6

THE CONCEPT OF CORE AND ELEMENTARY TASKS AND ELEMENTARY METHODS

6.1 The concept of elementary tasks and methods

For the fulfilment of a task or achievement of an objective, a process consisting of:

- Planning
- Realisation and
- Control

has to be conducted (sometimes more often).

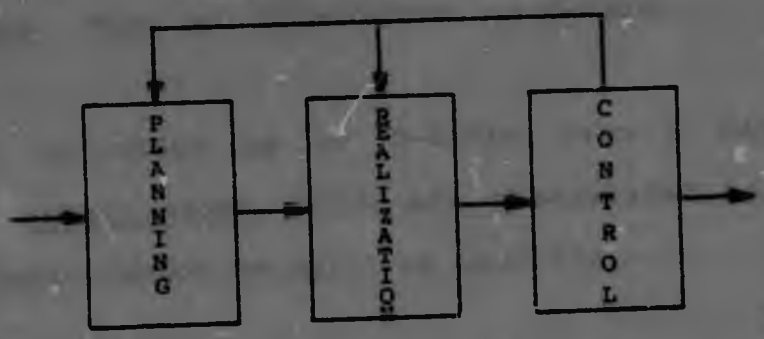


FIGURE 6.1

The planning process

Planning consists of:

- setting of clear goals
- development of alternatives
- selection of the optimal alternative and
- development of procedures for efficient realization of the selected concept.

The result of the planning process is a plan.

Realization means the realization of the plan.

Control contains the

- o development of methods and instructions for measuring the project advancement and the quality of the tasks performed and
- o reporting procedures.

The concept of core and elementary tasks and methods concerns mainly the "Planning" and "Control" phase.

It consists of:

1. The establishment of (ideally) independent core tasks. They are abbreviated as C-tasks.

2 The splitting up of C-tasks into a sequence of elementary tasks which are abbreviated as E-tasks. E-tasks cannot be split up sensibly.

Therefore the fulfilment of these elementary tasks leads from the problem to the solution of the problem.

3 The development of various methods which can be applied to solve the elementary tasks. These methods are called elementary methods or E-methods.

This is a 3 level process:
The level 3, the E-method level, is the lowest one. It can be considered to be the "micro view" of level 2.

Level 2, which is the E-task level, on the other hand, is the "macro view" for level 3, but the micro view for level 1 (C-task).

The following example and picture illustrate this concept.

Example: Autobank

1. Core task: Withdrawal or deposit of money.

2. The different "elementary tasks" which have to be performed are showed on the display.

Following through them in a certain sequence leads to the fulfilment of the C-task.

3. The elementary methods are not stated on the display. They could be for performing all tasks (actually there is only one - pressing the buttons):

   o Press the button with:
     - the fingertip of the .....
     - the big toe
     - the fist
     - etc.

To get or deposit money, all E-tasks must be performed. The method which is used is left to the customer.

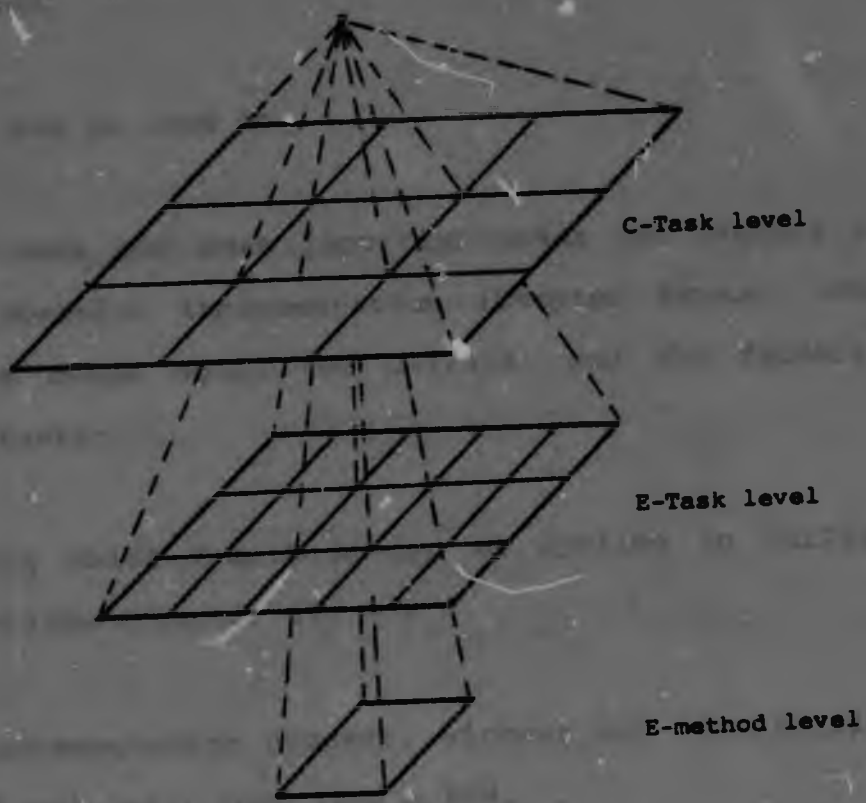


FIGURE 6.2
The concept of C-Tasks, E-Tasks and E-methods

6.2 Applicability of the concept of C- and E-tasks and E--methods to MRP implementation

Owing to the complexity of the MRP project, its dependence on the company, its kind of production, and its environment, it is impossible to give a detailed step by step concept. The tasks which have to be performed are very dependent on each other. Therefore

it is highly unlikely that a detailed sequence of independent tasks, satisfying the needs of different types of industry and environments, will ever be developed.

But it can be used to:

- present the most important areas and factors for a successful implementation (Chapter Seven), whereby the areas equal the C-tasks, and the factors the E-tasks;

- show which E-methods can be applied to fulfil the E-tasks (Chapter 8).

The implementation process, without any time phasing at this level, will look like a BOM.

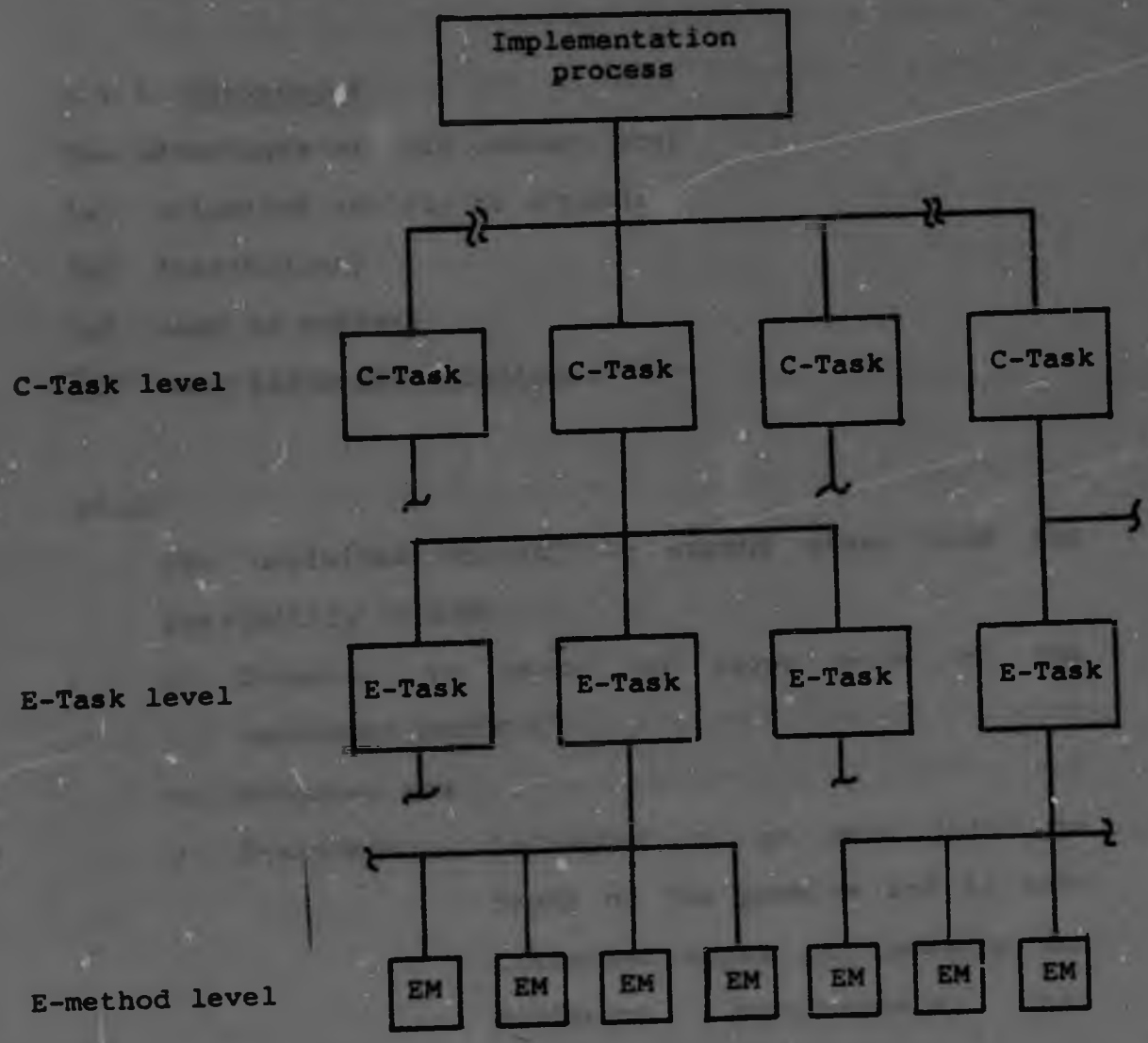


FIGURE 5.1
Implementation process without time phasing

These C- and E-tasks and E-methods are guidelines for the MRP implementation.

If it is necessary to fulfil them at a certain stage of the implementation, it will be stated explicitly.

6.3 The advantages and disadvantages of the concept

6.3.1 Advantages

The advantages of this concept are:

(a) unlimited ability to expand;

(b) flexibility;

(c) easy to survey;

(d) many different solutions.

Ad.a)

The unlimited ability to expend stems from the possibility to add:

- o C-tasks, in order to cover more of the important factors
- o E-tasks, and
- o E-methods

in order to go more into the depth of the problem and to take different types of industry and different environments into consideration.

Ad.b and Ad.c)

The ability to choose different E-tasks to fulfil a C-task and various E-methods to satisfy the needs of the E-tasks make the concept very flexible. It's easy to survey stems from its straight forward, logical structure.

Ad.d)

The ability to combine different E-tasks and E-methods allows for a large number of different solutions.

6.3.2 Disadvantages

The main disadvantages of the concept are:

- the limited ability to incorporate the time factor in a graphical disgram, without diminishing the clearness of the picture;

- the dependency of the tasks and methods on some dependency-factors (= d-factors) which are explained in paragraph [8.2]).

CHAPTER 7

FACTORS FOR SUCCESS

7.1 Introduction

The success factors explained in detail in the following paragraphs are derived from:

(a) Literature study

(b) the MRP survey

(c) interviews with system support experts of hard/software suppliers, consultants, and project managers whose companies were rated in group #3 in the MRP survey.

In Chapter (4) causes which diminish the chances of MRP success were examined and divided into 3 groups. These were:

1. the difficulty of the implementation process itself;
2. unrealistic expectations, if any at all; and
3. realistic expectations, but...

Point (3) could also be named "management omissions". This owing to the fact that all causes for failure in this category could have been avoided by strong and committed management. These 3 groups can be used as a basis for lining out how to be successful.

In this chapter the necessary expression of these factors (= tasks) will be explained.

7.2 Success factors

Nine of the ten C-tasks stated below are absolute preconditions for success; only (7.2.2) is not an essential factor to all companies. They are presented in alphabetical sequence.

The C-tasks are:

7.2.1 Climate of change
7.2.2 Consultant advice
7.2.3 Cost/benefit analysis
7.2.4 Data accuracy and integrity
7.2.5 Education and training
7.2.6 Hard/software vendor selection
7.2.7 Keep it simple
7.2.8 Planning
7.2.9 Set up of the project
7.2.10 Management

All C-tasks are explained in the following section. The E-tasks and E-methods are outlined in Chapter Eight.

7.2.1 Climate of change

"Climate of change", abbreviated as "COC", addresses the attitude of the company towards employees and the ability of the organization to handle a MRP implementation.

MRP demands a change in the habits of nearly all people in a company. The climate of change is excellent when

everybody who will be directly affected by the MRP syetem is convinced that this syetem is a help for him/her, and that the advantages are larger than the disadvantages. Only then are they willing to support MRP actively and adapt to the changes necessary.

To start a MRP implementation without an excellent COC will diminish success.

A questionnaire to assess the climate of change was developed by J. Blesingame and J. Weeks (see Appendix A.). The questionnaire addresses the most important areas:

1. The measures for and attitudes towards change on the different levels of the company hierarchy.
2. The ability to adopt change and conduct such a large project.
3. The reward system.
4. The organizational level of the company.

It is easy to use and straightforward in its interpretation of the scores achieved. The only omission is the lack of a question which concerns the resources necessary to implement the change.

Therefore the questionnaire should be supplemented by 3 more questions concerning the existence of:

- people with skills , and with

- o time available to handle this project
- o financial resources.

The company should start the MRP implementation only if:

- o it scores high on the questionnaire;
- o it has (or can employ) the number of skilled people needed to handle MRP implementation;
- o these people can spend the time necessary for MRP, and
- o it can raise the financial resources necessary.

7.2.2 Consultant advice

Consultant advice is necessary for companies which do not have experience in MkP, or in handling such a big project as MRP.

It is advisable to all other companies, even if they already have MRP-experienced people.

Before hiring a consultant, it is necessary to check:

- o where he implemented MRP systems and which successes he achieved;

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(1) Blasingame, J., Weeks, J., MRP Assessment Questionnaire, p.86-94, Production and Inventory Management, 1st quarter 1981.

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o if his consulting company sells its own package.

A company should never sign a contract with an inexperienced consultant or with a consulting company which tries to sell its company's product regardless of fit.

The consultant should be a guide on the MRP travel. He should act as a catalysator between the different management levels. He should provide new ideas, skills, and experience which are short in the company. But, as Simon Aletson (2) said, he must not be used as:

(a) project leader
(b) final decision maker
(c) executor of tasks
(d) teacher of line management and lower level employees.

---

(2) S. Aletson: Using a consultant in implementing a computer based Manufacturing Control System. Sapics conference, Sun City, 1983.

The reasons for not fulfilling the roles of:

(a) and (b) are:

o unfamiliarity with the company

- o the users would not accept the system as being theirs. This decreases the effort which they put into the implementation process, and
- o provides the company with a scapegoat who does not have the power to change the situation.

(c) are:

- o monetary reasons;
  A consultant, owing to his specialist skills, is too expensive to execute tasks.
- o execution of tasks by users fosters their identification with and therefore acceptance of the system.

(d) are:

He can be, and many companies do use him as a teacher of top management and the project team members. Most successful companies send their project leader or team to "outside" classes. These people say they learned as much after (e.g. at, and after dinner) as during the lectures. These classes, with employees of different companies which belong to the various types of industry, also destroy the always present "we are different" attitude. However, the consultant must never be used for the education and training of lower level management and shop floor personnel.

For doing this, he:

- lacks the knowledge of the company's specifics, and
- credibility with the people who he has to teach.

Not being able to answer all questions can destroy not only the credibility of the teacher, but also faith in the things he teaches (in this case, MRP).

7.2.3 Cost/benefit analysis

The survey showed a strong correlation between conducting a cost/benefit analysis and success of the implementation.

This is due to:

1. Top management sees the major benefits which can be achieved. Therefore their commitment to the project is much stronger than when they have only heard that MRP is "great".

2. Managers of all departments (preferably the department heads), who prepared this justification and signed it, can be held accountable for the achievement of the objectives set, which raises their commitment.

3. To be able to prepare a valid cost/benefit analysis, an investigation of the "status quo" of the company has to be conducted. This results in a better understanding of the company and its problems.

It also forces companies to allocate sufficient financial resources. Therefore, it should be able to avoid financial problems which, unconsidered by some companies, resulted in low success at the start of the system.

The justification must only be based on tangible benefits, although the intangible benefits were considered to be more important by many companies and authors of articles and books. The estimates should be conservative.

It should contain benefits through:

1. Inventory reductions
2. Productivity improvements
3. Increased customer service level
4. Improved purchasing.

These benefit areas are shown in more detail in the following summary:

Benefits Summary

The estimated benefits available from implementing a manufacturing information and control system

Reducing inventory levels

Stockroom inventories page 13

1 *Reduce sub assemblies / components*

$ _____

2 *Reduce finished goods*

$ _____

Work in process inventory page 17

1 *Reduce wait time*

$ _____

Other benefits

1 *Impact on sales*

$ _____

Total estimated benefit achieved through inventory reduction

$ _____

Increasing plant productivity

Foremen page 24

1 *Save foremen's time*

$ _____

2 *Increase productivity*

$ _____

Plant productivity pages 24 and 25

1 *Reduce direct labor*

$ _____

2 *Reduce indirect labor*

a *Reduce expediting*

$ _____

b *Save production control time*

$ _____

c *Save material handling time*

$ _____

Other benefits page 25

1 *Impact on sales*
Competitive pricing / reduce lead times

$ _____

Total estimated benefit achieved through increased productivity

$ _____

Improving customer service

Department productivity page 29

1 *Improve productivity*

$ _____

2 *Better customer service*

$ _____

Delivery performance page 33

o 1 *Avoid lost orders*

o 2 *Better service levels*

o 3 *Reduce late shipments*

$ _____

Total estimated benefit achieved through improved customer service

$ _____

Improving decision making

More effective purchasing pages 40 and 41

1 *Improve purchasing effectiveness*

$ _____

2 *Increase plant productivity*

a *Productivity increase*

$ _____

b *Scrap reduction*

$ _____

3 *Improve profit margins*

$ _____

4 *Reduce costs*

a *Reduce product costs*

$ _____

b *Reduce time spent maintaining redundant records*

(1) *Manufacturing and design engineering*

$ _____

(2) *Cost accounting*

$ _____

(3) *Production control*

$ _____

Total estimated benefit achieved through improved decision making

$ _____

Total estimated benefit achievable by implementing a manufacturing information and control system

$ _____

On the cost side, it should include expenses for:

- Project manager and staff
- Education
- Improvement of data accuracy and integrity
  (This also includes the costs for closing the stockroom)
- Installation costs
  e.g. consultant, temporary labour
- Hardware
- Software
- Travelling
- Other costs
  e.g. new offices, new furniture, etc.

7.2.4 Data accuracy and integrity

Data accuracy and integrity is a widely recognized and accepted prerequisite for MRP success.

Oliver Wight (3) demands accuracy of:

Inventory	> 95%
BOM	> 98%
Routings	> 95%

Quingley (4) demands even higher accuracy for inventory:

99% inventory accuracy for A items

98% inventory accuracy for B items

97% inventory accuracy for D items

These high percentages do not just happen; human beings have to work hard to achieve these objectives. To highlight the necessity of data accuracy, the following examples can be used:

1. In a company (100% made to order), the Inventory and BOM accuracy is 80%.
   The probability to find the right materials and the amount needed (when, according to MRP, they should be available), is:

   64% (= 0,8 x 0,8)

2. If, in a made to stock/made to order environment, the MPS is 90% accurate, Routings 80%, then the probability that no production problems will occur drops down to 46%.

This fact is called:

"RI-RO-RU" (Rubbish in-Rubbish out-Rule)

---

(3) Wight, O.: MRP II, p.377. O. Wight Publications, 1982.

(4) Quingley, P.E.: MRP - A preplanning test, part one. Ind. Eng. v.12,n.2, 1980, p.36-37.

When data accuracy is too low, then the failure of MRP is inevitable. Owing to the fact that the formal system

does not produce reliable information, faith in the system will decrease and the informal system will again take over.

It is therefore essential to have fairly accurate data, before the start of the pilot program.

Within the first couple of months of the implementation period, the level of accuracy, as called for by O. Wight, should be reached.

7.2.5 Education and training

In a speech at a Gapics meeting, Darryl Landvater pointed out that class A MRP users in the U.S.A., if they could start again, would do everything the same, except that they would put more emphasis on education and training.

The distinction between MRP education and MRP training was made in literature a couple of years ago, owing to the different:

- o objectives of the programs
- o depth and broadness of the curriculum
- o hierarchical groups involved.

The objective of the education programme is to create an awareness towards and knowledge in the principles of MRP. It is a mixture of selling the merits of the concept and explaining them. All levels of management should be involved in the education program.

The objective of the training program is to familiarise users with the system. Its main emphasis is on how to perform a specific job task (e.g. transaction, enquiry, completing of documents, etc.). Therefore it must be:

1. tailored to the users needs;
2. specific and detailed in its instructions;
3. software specific.

All members of the project team and people who will work on and with the terminals should be involved in the training program.

The different depth and broadness of the education and training received on different hierarchy levels is illustrated in Figure 7.1.

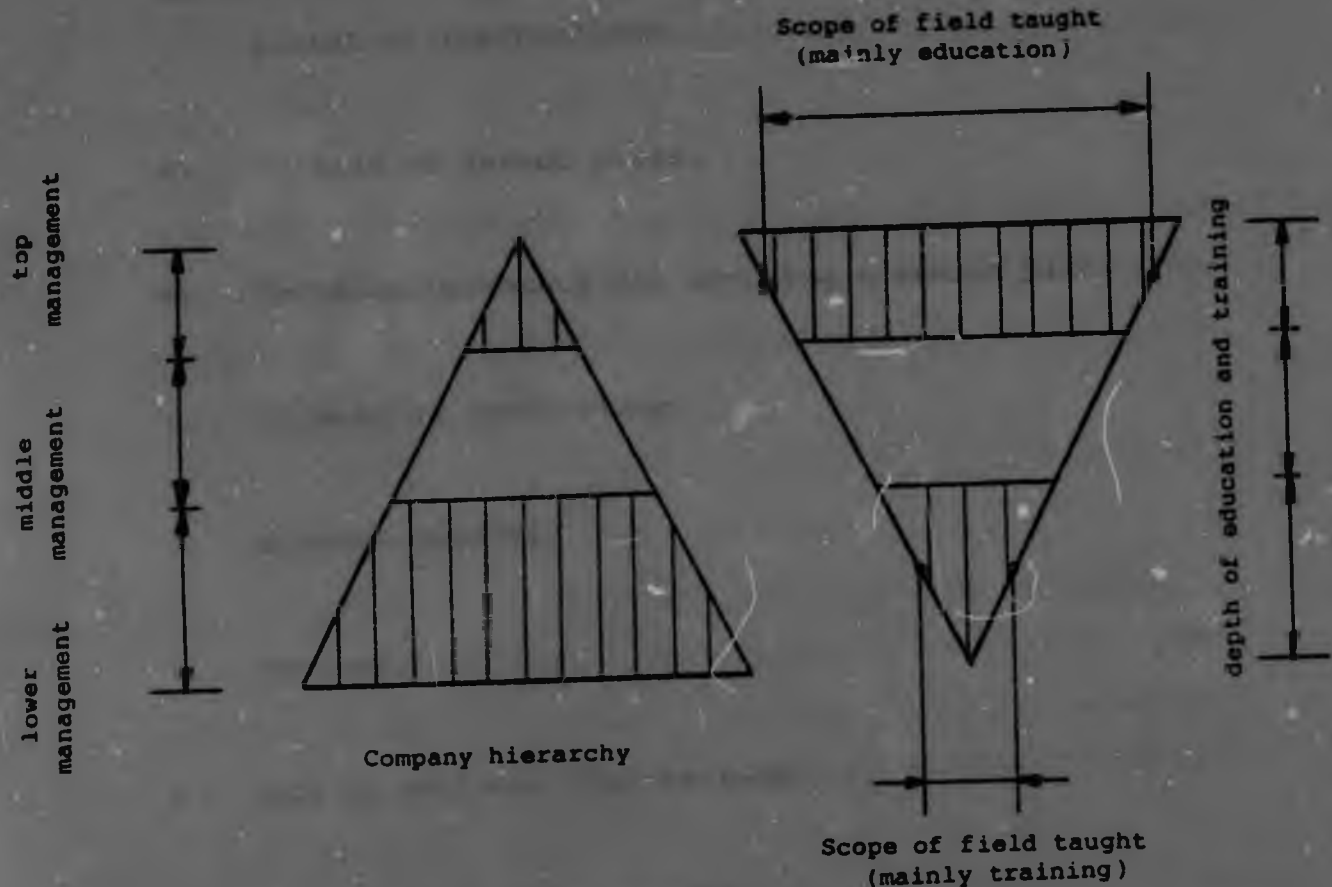


FIGURE 7.1
Relationship between positions in the company and scope of MRP education and training

Barry Roberts (5) gives the following guidelines which should be recognized when tailoring the training program:

1. Determine the training needs required by a functional area of the organization, as they relate to each system module.

2. Emphasis throughout the entire training approach should be orientated towards "how to" details. (He states that it should provide practical guidelines to identify and investigate problems and to make effective decisions.)

3. Lesson plans should be orientated towards developing job skills rather than merely providing a list of instructions.

4. Content of lesson plans.

5. Research neccesary for creating a lesson plan.

6. Climate of instruction.

7. Success control.

8. Trainer.

9. How to motivate the trainees.

10. How to write user manuals.

(These guidelines can be found in detail, together with examples, in Appendix B.)

It must always be kept in mind that MRP is a people-system. Only when properly educated and trained will they and their company:

1. be able to implement smoothly;
2. run the system successfully;
3. achieve the benefits of MRP.

Ongoing education and training (in the post-implementation stage) is necessary to:

- o educate and train new staff (of which there is a high turnover in S.A.);
- o erase "bad" habits which were established;
- o teach personnel if changes to the software were made.

All successful companies visited put heavy emphasis on education and training in the pre-implementation, implementation and post-implementation phase.

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(5) Roberts, B.: Education and Training programs to support MRP Implementation. Production and Inventory Management, Journal of the American Production and Inventory Control Society, p.45-65, 2nd quarter, 1982.

7.2.6 Hard/software selection

Today hardware is not considered to be an important factor for MRP success. The quality of software is also relatively high.

Nevertheless, the survey showed that many companies are still experiencing problems in:

- adaptation, and
- testing of software (see page 73).

Another remarkable result of the survey was the presence of all suppliers, with at least 1 company, in group 1, whereas in group 3 only 2 packages out of 10, are represented.

This shows that the selection of the package still has strong influence on success.

MRP implementation is very difficult. Selection of the wrong software for the company makes it even more difficult and therefore decreases the chances of success.

In Chapter Seven practical ways to select MRP software packages are explained.

7.2.7 Keep it simple

All the successful companies visited started with the standard package. They did not change the software

(besides report format and content), and say they are glad they didn't.

The project leader should discuss the information needs with the different information receivers. Although all information needs discussed are not absolutely necessary, these should be recorded and stored for future reference. After storing this, they should be cancelled from the list which shows the information requirements. The main objective must be to utilize the information already provided by the system to its largest possible extent. This is hardly done in most companies.) After consolidation of the system (approximately 1-2 years after the changeover to MRP) the stored material should be referred to and the different requirements discussed. If the need for one of these points still exists, then it should be implemented.

In 90% of cases it will not be necessary. As said in paragraph 7.2.6: "MRP implementation is difficult - don't make it even more difficult".

7.2.8 Planning

A complex, difficult long term project can only succeed if proper planning takes place. The "We don't have time

to plan - let's do it" approach was characterized by a very low success rate. The MRP survey shows that the most successful S.A. companies planned their implementation as an average over 24 months (some of them did not "close the loop" during that time).

All companies, with the exception of one, were able to keep to their timetable.

On the other hand, group #1 companies:

- had an implementation plan with an average length of 18,85 months.
- Only one company could keep to the timetable, while six could not. They needed on average 80% longer than planned (= 34 months for, mainly, basic MRP or even less).

Darryl Landvater (6) who helped many companies in the U.S.A. to reach class A or B status, mentioned an average implementation time for a closed loop system of 18 to 28 months for "his" companies.

Another point of the survey proves the negative correlation between success achieved and the amount of unplanned overtime needed.

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(6) Landvater, D.: The evolution of Manufacturing Resource Planning. Paper at Sapics meeting, Johannesburg October 1983.

All but one of the companies visited looked at Darryl Landvater's implementation plan, which is published in several O. Wight books (e.g. [7]). However, they did not use it in this form, nor did they tailor it to their needs.

They mainly used it as a source of information. Then they developed their own implementation plan which, in fact, had very little to do with Darryl's.

Only the level of formalization was equally high. Bar charts were used to indicate the duration of the different task fields (e.g. "Education", "Data", etc.). These task fields were split up into specific tasks, they contained planned and actual start and end dates and named of the person responsible. The signature of the project manager, who had to control the fulfilment of the task, was necessary to change the status of the task from "open" to "performed". Occuring problems were discussed in regular weekly or bi-weekly review meetings and decisions were made to bring the project back on schedule.

Only in case of unsolvable problems, which did not arise in the companies visited, should the plan be revised.

Some implementation plans are shown in Appendix C.

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(7) Wight, O.: The Executive's Guide to successful MRP II, p.80-104, O. Wight Publications, Vermont (U.S.A.), 1982.

7.2.9 Set up of the project

The set up of the project must be formal. In a management meeting the CEO should state the objectives of the project and the high priority of the project.

A steering and project team with a full-time leader should be appointed. The commitment of the top management should be emphasised and at least monthly review meetings should be scheduled.

This decision should also be published in the company newspaper or in a special parphlet carrying the signatures of the highest company employees.

7.2.9.1 Project team

Important points for the establishment of a project team and appointing of its members are:

- The project team must consist of users.
- DP should play a very small role only.
- The best people should be assigned to the team.
- The team leader should be relieved from all his day to day duties. He should be a high level person in manufacturing and the best person suited for this job.

His main characteristics should include:

- credibility
- experience
- enthusiasm
- intelligence/ability to learn and understand MRP
- leadership qualities

The advantages of a project team, according to IBM, are:

- broader acceptance
- better communication
- pride of authorship
- smoother and faster implementation
- increased awareness of benefits
- increased effectiveness of the system

To increase the effectiveness of the project team, J. Nicholas (8) recommends:

- The usage of an outside process consultant. He/she should be a person trained in group processes. He/she is responsible to "help the team to solve its own problems by drawing attention to the way the group's behaviour affects the quality of its work".

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(8) Nicholas, J.: Developing effective teams for systems design and implementation. Production and Inventory management. Journal of APICS, p.37-48, 3rd quarter, 1980.

- Outside workshops with a duration of 1 to 3 days.

  Agenda points should be:

  - what is going to take place
  - review how the group worked
  - problem solving.

7.2.9.2 Steering team

It should consist of top management, including the GM or CEO, the project leader and some other members of the project team.

Their duty is to:

- make the decisions on objectives, plans and alternatives which the project team developed;
- direct the implementation efforts;
- trace the advancement of the project;
- give fullest support and leadership to the project team;
- provide the means to realize the project.

7.2.10 Management

Top management support was rated as being the most important factor for successful implementation by group #1, #3, and the whole sample. The importance of its continuity varied between third and fourth. It was considered the third most important factor by group #1

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7.2.10 Management

Top management support was rated as being the most important factor for successful implementation by group #1, #3, and the whole sample. The importance of its continuity varied between third and fourth. It was considered the third most important factor by group #1

and #3; while group #2 and the "whole sample" rated it fourth.

Lack of top management support was, after "inadequate education", the most important factor for not achieving expectations.

The lack of its continuity was considered to be fourth in importance by group #1 companies, and sixth in importance by the whole respondent sample.

Lack of top management support and the lack of its continuity were also important and frequently stated factors which lead to the need of unexpected additional implementation time.

The importance of committed management is also proved by the fact that 75% of group #3 companies stated top management as the initiator of the project (compared to 57% in group #1). Again, to the question "Who carried the responsibility for the implementation?", 75% of group #3 respondents stated "top management" (compared to 28,5% in group #1).

Not the implementation but the success of the implementation should be the goal that is aimed for. A high level of expectation must be established. To Management commitment is of absolute importance. This was verified when visiting the most successful companies of the respondent sample.

In the three most successful companies in S.A., the project leader was either the G.M. himself, or he was ranked equal to the G.M. during the implementation. In one case, the G.M. tied his success to the system's success.

It is not necessary to say that the project manager:

1. got the support needed from the "top" and the "lower levels";
2. got the necessary resources.

In fact, he said, the real project manager was the G.M. who demanded success, controlled closely, and pushed, pushed, pushed and pushed.

The main reasons for the necessity of top management support and involvement are during the preparatory and implementation phases are:

1. The backing necessary of the project from the "top".
2. The availability of the resources necessary.
3. The complexity, difficulty, expensiveness of the project, and the system's long term impact on the company.
4. The giving of a good example.
5. The ability to set unpopular steps if the objectives cannot be achieved otherwise.
6. To create the necessary quality of the COC.
7. The long term view necessary when deciding on a MRP system.

8. The big help they and all other managers can receive from MRP if they accept the new way of running the business.
9. MRP cannot reach its possible potential when it is only used by middle and lower management.

CHAPTER 8

E-TASKS AND E-METHODs FOR SOLVING THE DIFFERENT C-TASKS

8.1 Introduction

The methods which can be used to solve the different C-tasks stem from:

- o literature study
- o the MRP survey

and, to a large extent, from:

- o discussions with successful project leaders. Some of their approaches were developed further, others were abandoned.

8.2 Dependency between the various methods of the different tasks

As mentioned in paragraph 6.2, it is impossible to set the task-boundaries in a way that the C-tasks and therefore the E-tasks and E-methods, which can be applied to solve them, become completely independent.

The most important factors which establish these dependencies, from now on referred to as dependency, or abbreviated "D-factors", are:

(a) the initiator of the project;

(b) the kind of implementation approach followed;

(c) the organization of the information feedback.

According to the expression of the dependency factors, we can distinguish

D-factor (a) in:

a1) Top management

a2) 1st level managment

a3) other levels of management

a4) outsiders

D-factor (b) in:

b1) the "hard"

b2) the "soft"

b3) the "quick" and the

b4) "slow" approach

D-factor (c) in:

c1) centralized and

c2) decentralized data collection.

(I am fully conscious of the fact that more D-factors and more expressions exist [e.g. size of the company, etc.] But it was necessary throughout the paper to set boundaries, which have limited the scope of this dissertation.)

These 3 factors and their 10 expressions have direct influence on the C-tasks:

- COC
- Data accuracy and integrity

- o Education and training
- o Hard/software selection
- o Planning
- o Set up of the project

and allow 32 different implementation approaches. This is illustrated by Figure 8.1:

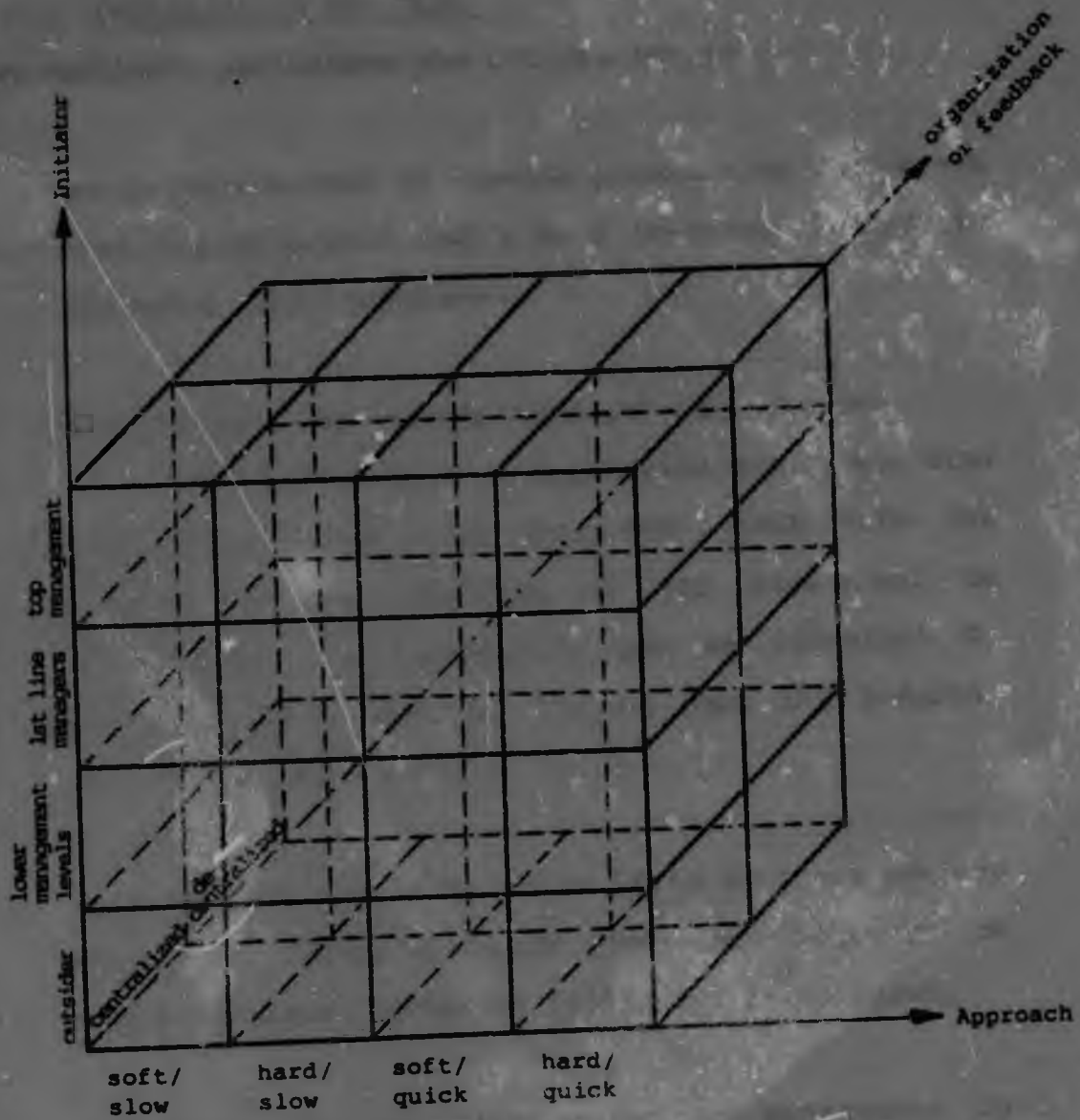


Figure 8.1

Implementation approaches

8.3 Characteristics and influence of the D-factors on the C-tasks, E-tasks and E-methods

The following is a rough overview on the impact of the D-factors on the C-tasks and consequently on the E-tasks and E-methods.

8.3.1 Influence on the "COC"

The initiator influences the COC insofar as:

- He is able/unable to provide pressure to foster the creation of a good COC - hard (D-factor [b1])/soft (D-factor [b2]) approach.

- Time to "get the message through" is concerned:
  If D-factor [a] has the expression (a1), the time span between the idea that MRP could help the company to the decision of top management to investigate its feasibility can be (ideally) 0. This time span will be longest when the D-factor has its expression (a3).

  Therefore it also determines if in this pre-project stage the "quick approach (D-factor [b3]) or the "slow" approach (d-factor [b4]) must be followed.

- The chance to really involve top management is concerned. This chance is best if the D-factor has its expression (a1). It seems to be second best if the D-factor appears as (a2) and (a4).

8.3.2 Influence on "Data accuracy and integrity"

There should not be any influence of the D-factor in its expression (a). This is owing to the fact that before the project reaches the stage where the data base has to be created, top management must know about the importance of accurate and integrated data.

D-factor (b) definitely has a strong influence:
Data were mostly correct, either where government regulation demanded it (pharmaceutica industry), or where top management insisted on the absolute correctness (= 100% accuracy) of the data base (= "hard" approach (D-factor [b1]).

D-factor (c) also has a strong impact on the data accuracy and integrity through the correctness of the feedback.

8.3.3 Influence on "Education and Training"

D-factor (a) only has influence on the pre-project stage in its expression (a1). This influence is derived from the ability to "push" 1st line management into a "first cut" education program.

The influence of D-factor (b) is strong. This is explained later. D-factor (c) only has indirect influence, due to the favoured application of either (c1) with (b1) or (c2) with (b2).

8.3.4 Influence on "Hard/Software selection"

D-factor (a) has no influence on this point.

D-factor (b) in all its expression influences the selection process, and the success of the system.

D-factor (c) in its expression (c2) sets the constraint of the existence of compatible data collection terminals.

8.3.5 Influence on "Planning"

When the project reaches its planning stage, the D-factor (a) should not have any influence.

D-factor (b) has influence in its expressions:

(b1) & (b2) especially through the planning of the education and training program, and the methods used throughout the implementation process to fulfil the different E-tasks.

(b3) & (b4) through the length of the project plan.

Therefore D-factor (b) influences every phase and aspect of the MRP implementation.

8.3.6 Influence on the "Set up of the project"

D-factor (a) should not have influence on this point owing to the preparation of a good COC and the amount of education already conducted.

D-factor (b) has the following influences:

- o (b1) & (b2) have no direct influence
- o (b3) demands which will be called the "formal method" in paragraph (8.9.3)
- o B4 allows both the "formal" and the "less formal" method.

D-factor (c) has no influence on the set up of the project.

8.4 Climate of change

8.4.1 Approaches to implement change stated in literature and criticism of them

The following 8 methods can be used, according to Hellreigel et al. (1), to implement change. These 8 methods can be devided into the following three groups:

a1) People focused methods:

- a.1.1) survey feedback
- a.1.2) team building
- a.1.3) process consultation

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(1) Hellriegel, D., Slocum Jr. J.W., Woodman, R.W.: Organizational behaviour, p. 554-574. West Publishing Company, 1983.

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a2) Task and Technology focused methods:

a.2.1) job design

a.2.2) socio-technical systems

a.2.3) M.b.O.

a3) Structure focused methods:

a.3.1) matrix organization

a.3.2) collateral organization

G. van Eedon (2) describes them briefly with exception of the structured focused approaches in his dissertation for the MBL.

He writes the following:

a1) The Survey Feedback Approach in Implementing Change

The objective of this approach is to improve the relationships amongst groups as opposed to introducing a specific change. It takes the form of a standard questionnaire which is answered by the participants. The results are then fed back to the individuals. Its strength lies in the fact that it may surface problems and clarify issues that indicate major changes in structure, task design, or technology.

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(2) van Eeden, G.: "The behavioural implications of introducing a MRP system within a medium sized manufacturing company". Dissertation for the degree MBL at Unisa, 1983, p.16-19.

As far as this study is concerned it may be a key prior activity particularly in a conservative company as described by Blasingame and Weekes in section 2.2.5.

a2) The Team Building Approach in Implementing Change

Hellreigel, et alia (5) describes this process as members of an organisational group diagnosing how they work together and plan changes that will improve their effectiveness. A cycle of steps are involved once the members recognise a problem. They are:

I Problem identification
II Data gathering
III Diagnosis
IV Planning
V Implementation
VI Evaluation

and the cycle repeats itself as the evaluation uncovers further problems.
Prerequisite is a basic interdependence amongst the group members. The focus is on goal setting and problem-solving activities. This would seem to be a more appropriate technique in terms of the scope of this study as it is concerned with problem-solving activities.

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(5) Hellriegel, D. et al.: ibid, p.557-561.

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a3) Process Consultation

This approach is based on the activities of a consultant to help members in handling the process events in their work environment, i.e. to help them in their work performance in behavioural terms. The process by which they are working towards a task accomplishment is examined.

Process consultation is designed to change attitudes, values, interpersonal skills, group norms and cohesiveness according to Hellriegel et alia (26, p.563). This would appear to be a very good approach to use in combination with the team building approach especially if there are high levels of resistance or a need to develop individuals in key positions in the team.

b1) Job Design

This involves restructuring the work that is performed and may involve creation, re-design, enlargement or enrichment of jobs in order to increase organisational efficiency according to Hellriegel, et alia (6). This approach which is task- and technology- focused may have to occur concurrently or as a result of the team building and process consultation activity.

b2) Socio-Technical Approaches

These approaches usually involve a major re-design of the way work is done, i.e. the task variable according to Hellriegel, et alia (7). Autonomous groups are established which set their

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(5) Hellriegel, D. et al.: ibid, p.564.

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own pace and quality. This approach may be very similar to the quality circles of Japan or may be applicable to a research and development situation. The writers believe that this will be a key approach in the 1980's.

b3) Management by Objectives (MBO)

This is a goal setting process and involves joint setting of goals by manager and subordinate. This is regarded as one of the most effective ways of influencing subordinate behaviour according to Hellriegel, et alia (26, p.567). The writers identify individual-oriented and team-oriented MBO models. The latter includes entire work groups or teams as well as individuals. Interdependence between jobs is recognised also. The team-oriented approach is marked by:

I Top executives develop on a consensus basis overall objectives which have time limits in a team.

II Individuals in the team develop their own objectives on the basis of the broader objectives.

III Matters of concern to the team are discussed in regular scheduled meetings while performance reviews take place.

The writers believe this approach has the greatest potential for success provided:

I There is a real need for integration.

II The top management group co-operate and offer mutual assistance.

III The participants have some skill in group processes and interpersonal relations.

G. van Eeden favours this approach as an overlay over all the other approaches.

None of these approaches was used in practice in the stage of preparing the COC. Many of the companies visited had an excellent COC right from the start. The ones which were not so lucky followed, in Hellriegel's terminology, people focused methods.

8.4.2 The E-tasks for the creation of an excellent COC at second and lower management levels

The task "creation of an excellent COC on lower management levels" consists of the 5 following E-tasks and is applicable from second level management downwards.

a) subvertion of the informal system
b) user involvement
c) evaluation of the COC
d) Announce decision to implement MRP
e) Involvement and education
f) Restart, if chances exist to be successful.

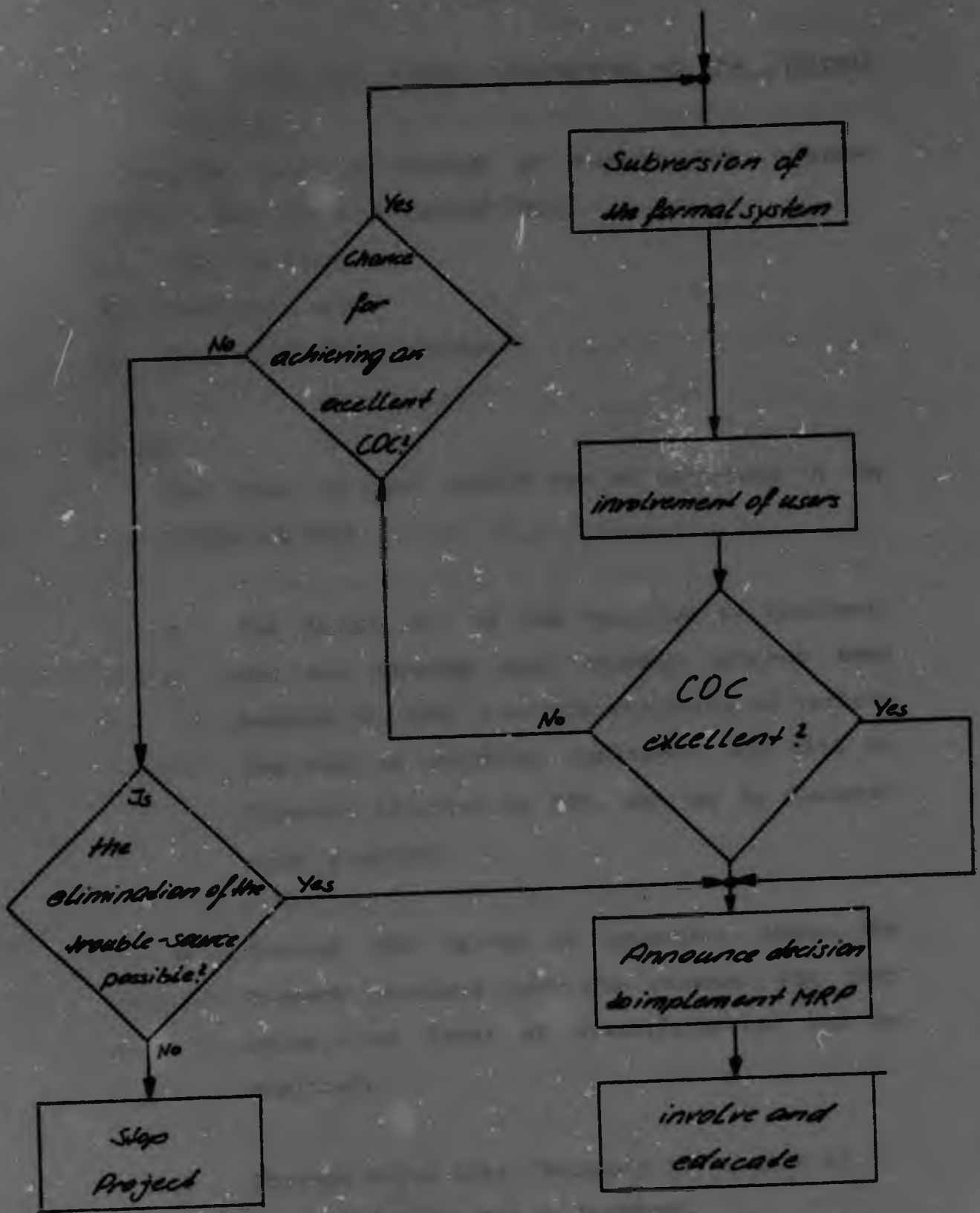


Figure 8.2 : E-tasks for the creation of an excellent COC

8.4.3 E-methods for E-task "Subversion of the informal system"

3 methods will be stated to subvert the informal system. They shall be called thus:

a1) "face to face"

a1) "meeting", and

a3) "survey feedback" method.

ad a1)

The "face to face" method can be described in the following way:

- The future or, if the decision to implement MRP was already made, present project team members to look over the shoulders of various (as many as possible) employees, who will be directly affected by MRP, and try to discover their problems.

- Through the asking of questions about the biggest problems and the reasons why they occur, the level of dissatisfaction can be explored.

- Through hints like "Wouldn't it be nice if..." dissatisfaction can be fostered.

ad a2)

In the meeting method, employees who are doing the same jobs are assembled and encouraged to discuss the problems they have with the current system.

ad a3)

This method was already described in paragraph 8.4.1.

8.4.4 E-methods for E-task "Involvement of users"

The same methods can be used as in paragraph 8.4.3. The "involvement" of users in this project stage (preferably pre-project stage) is limited to suggestions of what they think they need to solve their problems. These suggestions should be formalized.

8.4.5 E-method for E-task "Check COC"

The level of dissatisfaction can be assessed with the help of the questionnaire and the necessary supplements shown in paragraph (7.2.1).

8.4.6 E-method for E-task "Announce decision to implement MRP"

This E-task links the C-tasks "COC" and "set up of project".

Everything stated about the announcement of the decision in paragraph 8.9 is valid here. Based on the information collected, the CEO or MD could, for example, say in a meeting, or write in a pamphlet:

"Owing to the dissatisfaction of employees on all hierarchical levels caused by various problems, the company has decided to investigate aids which can eliminate the sources of troubles. After assessing the different alternatives, we decided that MRP can help us to solve the problems mentioned by our employees...,etc."

It should be made clear that the users will receive the biggest help from the system and that the system was installed owing to dissatisfaction of the "basis" (even if it had to be created).

8.4.7 E-methods for E-task "Involve and educate"

Education and training is so important that an entire paragraph, 8.6, was dedicated to this task.

Four methods for further user involvement are explained in paragraph 8.7.2 which concerns the determination of information requirements for the selection of MRP software.

8.5 The influence of the D-factors

8.5.1 The influence of the D-factor (a)

The applicability of the E-tasks and E-method is limited to the second and lower hierarchical levels. A prerequisite therefore is the existing support for MRP on the two highest levels. If this is not the case, other tasks and methods have to be performed before using the one stated before. These are dependent on the expression of the D-factor (a).

8.5.1.1 The E-tasks and -methods for the creation of an excellent COC on top and first line management level

a) D-factor (a.1)

Top management, being convinced about MRP, should easily be able to create enthusiasm about these systems on first line management level. This is simply because of the fact that MRP makes sense!

Therefore first line managers, especially with pressure from the top, should become strong supporters of the project after attending:

- courses
- seminars, and
- reading of MRP-literature.

b) D-factor (a3)

It is absolutely essential to get active top management support before the project starts. There is nothing like pressure from lower level management to convince top management.

Therefore:

o careful subversion and,

after interest is created,

o education

is the only way to achieve top management involvement.

The way of subversion is largely dependent on the personality of the company leaders. This demands individual strategies.

For education of top management, "outside" courses seem to be the best way. This view is also held by Darryl Landvater with whom I discussed this topic at a dinner party.

c) D-factor (a3)

Should lower level management come up with the idea to implement MRP, then it is necessary to use the "line". The initiator should convince the supervisor and first level management. Then the first line management should follow the way outlined in (b).

d) D-factor (a4)

This outsider will either be head office personnel or a consultant. In either case, this person would have the influence to convince top management to attend "top management education courses".

Head Office personnel can apply real pressure, if necessary, (but it is not advisable to do so). The consultant, being an expert, should be able to talk top management into attending courses. Top management, once being convinced, can follow the way outlined in 8.2.1.

8.5.2 Influence of the D-factor (b)

8.5.2.1 D-factors (b1) and (b2)

The influence of (b1) and (b2) mainly concerns the number of restarts of the circle, before the "exit", which either leads to the firing or to ignoring the person who is resisting the change, or to the cancellation of the project. This number of restarts is higher when the "soft" approach is used.

8.5.2.2 D-factors (b3) and (b4)

(b3) can be used in connection with (a1) and (a2);
(b4) in connection with (a3) and (a4).
The "hard" approach (b1) fosters the usage of (b3);
The "soft" approach (b2) the usage of (b4).

It shall be emphasized that it is better to spend a month longer on the creation of an excellent COC than to fight against human resistance for the rest of the project (24 months).

8.5.3 Influence of the D-factor (c)

D-factor (c) only influences the number of people who have to be addressed in the subversion, education, training, and involvement phases. This number is much higher if (c) has its expression (c2), than if it has expression (c1).

8.6 Data accuracy and integrity

The C-task "Data accuracy and integrity" can be split into:

the C1 task : Data accuracy and integrity, before the cut over to the MRP system, and

the C2 task : Data accuracy and integrity after the cut over.

8.6.1 C1 task : Data accuracy and integrity before the cut over to the MRP system

Regardless of the kind of data, the following E-tasks should be performed:

a) Investigate the data about its present usage

b) Eliminate redundant data

c) Create or check and correct remaining data

d) Final check

e) Keypunching

f) Check for keypunching mistakes.

ad d)

The E-methods for the final check are dependant on the kind of data.

d1) BOM accuracy

The final check of BOMs can be done either by:

d.1.1) Interrogation of workers who produce this product

d.1.2) Following the various products (or assemblies) through the production process, or

d.1.3) Taking one unit of each product or assembly, disassembling it and comparing it to the BOM.

Method d.1.3 is the most time consuming, but definitely the best.

The average BOM accuracy of the companies visited was:

Median $\tilde{x}$ = 98%

Standard deviation s = 1,6%

d2) Inventory accuracy

In most companies visited, I noticed that the accuracy of inventory records was very low when fed into the computer. It ranged from 45% to 65%. Intensive cycle counting, which started with the implementation of the Inventory control model of the MRP system, raised it within 4 to 6 months to the level needed. The results of the cycle counts were and still are documented in graphical form.

The average inventory accuracy of the most successful companies of the sample is : $\bar{x} = 92\%$.
The standard deviation is : $s = 4,3\%$.

To be able to reach and keep this high level, stockrooms were secured with fences and guards. Very strict discipline was enforced. Nobody can enter the stockroom without being noticed.

d3) Routing accuracy

Routing accuracy and inventory accuracy showed a similar kind of behaviour. With the exception of 2 companies which, owing to strict government regulations in their type of industry, had already 100% accuracy right from the start, routings were not correct enough to use them for the MRP system. They were corrected before loading them into the computer.

The current routing accuracy of the successful companies is:

Average accuracy $\bar{x} = 96\%$

The standard deviation $s = 7,4\%$

d4) Lead times

Lead times are, as explained earlier, not as crucial as (d1) to (d3).

d5) Cost data

Cost data accuracy is normally fairly high. They are not considered to be a larger problem.

d6) Other data

The importance of other data, e.g. safety stock levels, etc., must not be ignored, but at the start they are not as important as BOM, Inventory, and Routing accuracy.

8.6.2 C2-task : Data accuracy and integrity after the cutover to the MRP system

High accuracy of the different data at the cutover of the system is a prerequisite for a successful start. For the successful operating of the system, these high levels must be kept or even raised further.

These tasks are to be performed after the cutover to the MRP system. Therefore they lie outside the scope of this work and only a brief overview is given.

To ensure the accuracy of BOMs and Routings, all actions which affect their accuracy must be controlled (e.g. engineering changes, work centre changes, etc.).

To ensure the accuracy of inventory records, all actions which affect their accuracy must be controlled (e.g. inflow and outflow of material, etc.). A cycle counting program is necessary to monitor the current record quality.

Accuracy of shop floor feedback can be ensured through:

- centralized data collection;
- training or employing of persons who will do the keypunching;
- training ("hard" approach) or education and training ("soft" approach).

8.7 Education and training

This C-task was, owing to its complexity, divided into importance and broadness:

C1-task : education and training before the formal establishment of the project;

C2-task : education and training during the project;

C3-task : education and training after the implementation process.

This was necessary not to loose overview on E-task and E-method levels and to timely link education and training to other C-tasks.

8.7.1 E-task of task C1

This C-task consists only of one E-task: Education.

The people who must be educated are:

- Top managers, and
- First line managers and future project team members.

The objectives are to:

- learn about MRP;
- become familiar with MRP-principles;
- recognize that it can work also in their own company;
- eliminats the remaining resistance against MRP on these hierarchical levels;

8.7.2 E-methods for the E-task "Education before the establishment of the project"

For the education and training of top and first line management, preferably:

C1a) consultants, or

C1b) the designated project loader and project team members should be used.

ad C1a)

Many consultants offer courses for top management. They range from one to five days and are either held inside or outside the company.

Many project leaders of the companies visited attended O. Wight's 5 day courses; often the entire top and first line management were educated this way.

They said that they learned nearly as much in discussions after the courses (= at lunch, dinner, etc) as during the course itself. This also eliminated the "we are different" attitude through interaction with people from the different types of industries.

In any case, these courses should only be held by experienced consultants. This is probably the biggest advantage of the O. Wight courses; they are led only by top consultants.

ad C1b

The designated project leader and the team members must be thoroughly educated in outside courses. They hold in-house classes and teach top management and first level managers.

Education aids can be:

- o videos
- o slides
- o books and brochures
- o etc.

This approach is less favourable than (a) owing to the:

- o higher probability that the "we are different" attitude arises;
- o loss of information from discussions with other future MRP users;
- o possible conflicts between teachers and students (especially hierarchical problems);
- o etc.

8.7.3 E-tasks for the tasks C2 and C3

In this stage of the project, a distinction can be made between the E-tasks:

a) Education, and

b) Training.

The line responsibility should be used for the execution of both E-tasks.

8.7.4 E-methods for the E-task "Education during and after the project"

The difference between the methods stems mainly from the:

- o aids, and
- o language

used to conduct the education program.

The following aids can be used:

a1) videos

a2) slides for overhead projector

a3) slides for slide projector

The following languages can be used:

a4) English

a5) Afrikaans

a6) Native language.

Different methods can be created by building sensible combinations of the factors (a1) to (a3) and (a4) to (a6). One constraint diminishes the number of possible combinations: Videos exist only in English, and the strong American accents further limit their usage to management levels.

8.7.5 E-methods for the E-task "Training during and after the project"

Similar to paragraph 8.6.4, the methods can be formed by sensibly combining training aids and languages.

Training aids can be:

b1) Documents which are to be completed by the trainee;

b2) Slides for slide projector;

b3) Models of the system either in the company or at the vendor's office.

The same languages as in paragraph 8.6.4 can be used.

8.7.6 Three different ways used for educating and training the employees on shop floor level

C.2.1)

The project manager was able to speak Zulu, the language of the largest part of his Black work force. Therefore, he was able to teach the very basics of the MRP concept and trained them in their mother tongue. (This company, although now using centralized key punching, used this approach together with the "soft" approach.)

C.2.2)

Another company used a Black education assistant who held a B.A. degree. He received the same education as any other project team member.

Together with the project manager, he developed the education and training programs for the shop floor personnel. Then he taught in his mother tongue. ("Hard" approach used.)

C.2.3)

The third way was conducting the education and training program in English or Afrikaans, and recording the most important points on tapes in the work force's mother tongue.

In scheduled courses, these tapes were used to back up the lectures. ("Hard" approach used.)

8.8 Influence of the D-factors

8.8.1 Influence of D-factor (a)

D-factor (a) has no influence.

8.8.2 Influence of D-factor (b)

b1) The "hard" approach is characterized through the writing of tests on the different lectures. The content of the lectures holds very little education, but a lot of training. The pressure is increased by transmitting the test scores to the personnel department. There they are used as one component which determined the future advance of the employees.

This way ensured a high standard of knowledge and proficiency.

b2) In the "soft" approach, the trainees do not write tests. But MRP specific duties become part of the job description (as in b1). The content of the lectures is as much education as training.

Therefore the employees also have to know their job specific tasks; ("If you cannot do your job, you are fired" [statement made by project manager]).

b3 and b4)

These have no influence.

8.8.3 Influence of D-factor (c)

The way the feed-back is organized has a strong influence on the E-methods.

If its expression (c1), centralized data collection, is used, it will be necessary to:

- employ and/or train and educate persons who will do the key punching accurately. (The companies visited employed Blacks and Coloureds with Matric, and Indians with Standard 8. These levels were considered to be necessary to reach the accuracy needed.);

- to train only few employees.

This was the favoured approach of the companies visited.

If (C2), decentralized data collection, is used, it is necessary to:

- educate and/or train more employees;
- structure and tailor the education and training lessons for the various levels of education;
- (for the Black work force) maximise discussions, but minimize the usage of visual aids (8).

Paragraph 8.8.7 states 3 approaches used in 3 different companies which use or will use decentralized data collection.

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(8) Boothe, W.: How Black South Africans learn. IPB Manpower Journal, July 1983, p.35.

8.8.4 Flow chart for the fulfilment of the C-task

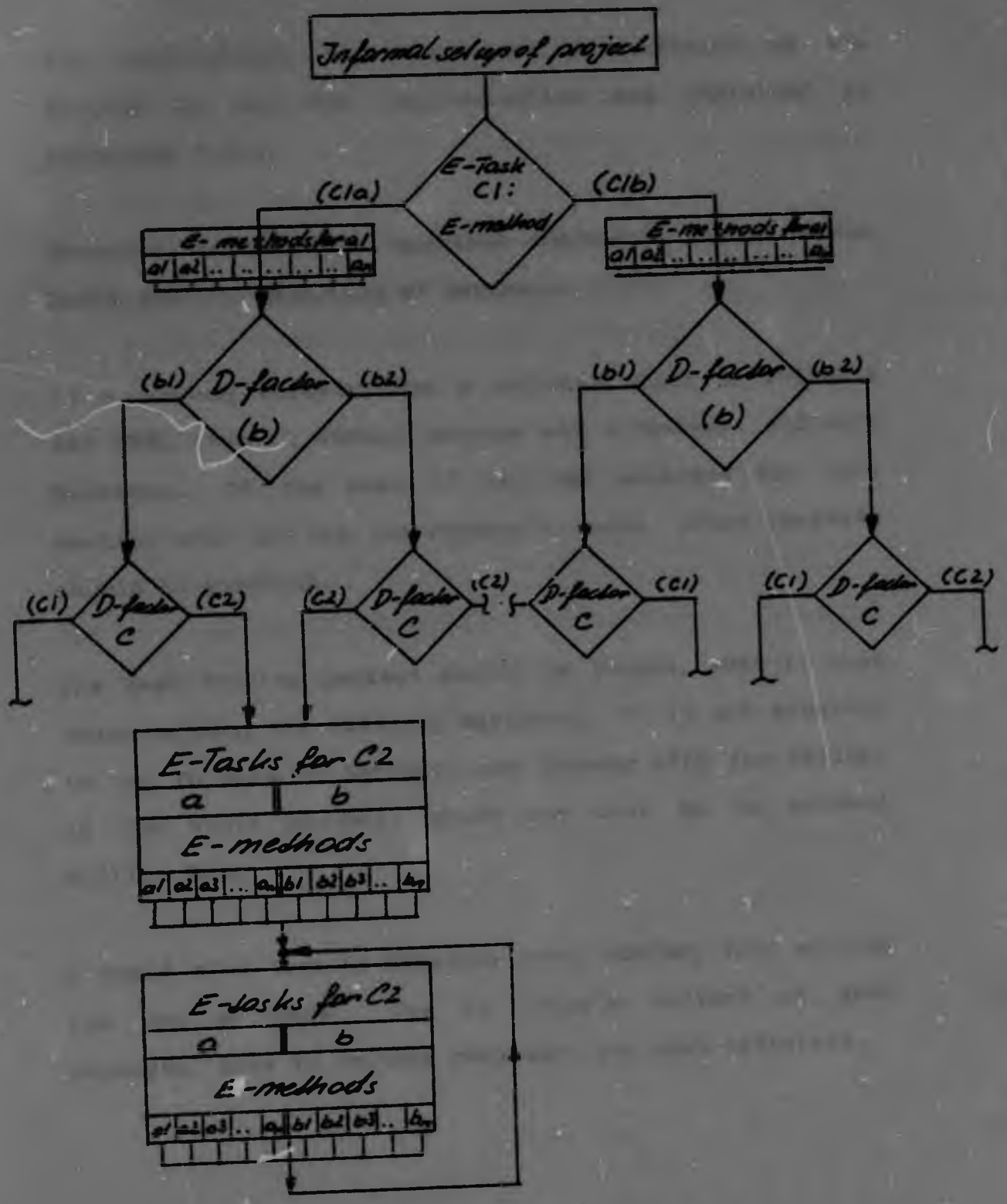


Figure 8.3 : Flow chart for the C-task "Education and Training"

8.9 Hard/software selection

The surprisingly high influence of software on the success of the MRP implementation was explained in paragraph 7.2.6.

Software, as the more important component, should be the basis for the selection of hardware.

If a company already owns a corputer which is suitable for MRP, then it should examine all compatible software packages. If the best of all MRP packages for this machine does not fit the company's needs, other packages should be examined.

The best fitting package should be bought, even if that means selling the existing hardware. It is not sensible to try to save on hardware and thereby risk the failure of the whole project, which can cost up to several million Rand.

I would also like to dissuade every company from writing its own software. Due to today's variety of good packages, this is neither necessary nor cost efficient.

8.9.1 The E-tasks of "Software selection"

The E-tasks of the software selection process are:

a) determine information and business requirements (= criteria against which the packages are measured against);

b) determine "other criteria";

c) determine priorities for all criteria;

d) analyse software against the criteria;

e) evaluate software;

f) analyse and

g) evaluate the areas concerned by "other criteria";

h) select software.

The software selection process is graphically shown in Figure 8.4.

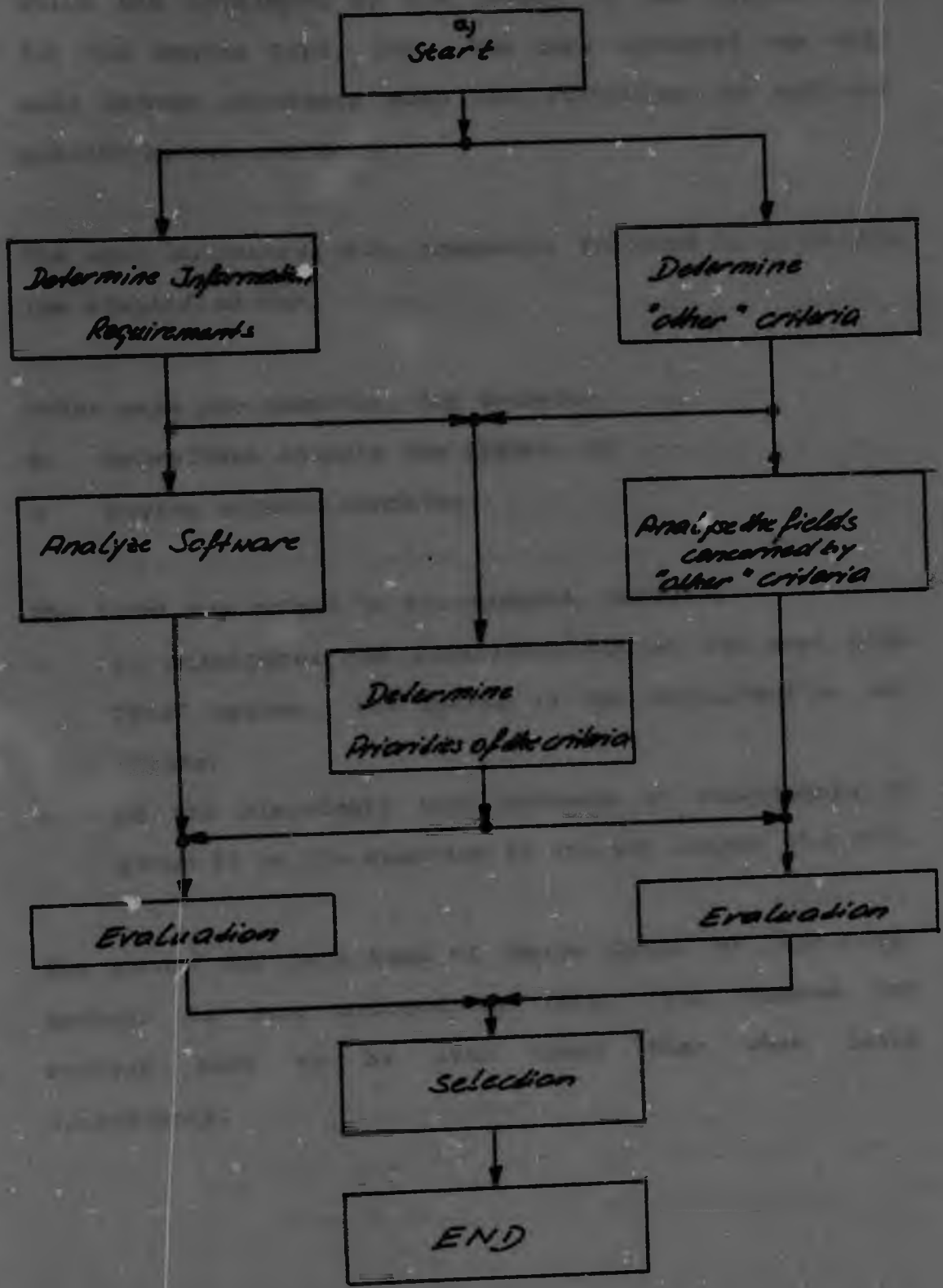


Figure 8.4 : E-tasks for the "Selection of MRP Software"

This way is a simplified form of the selection process which was developed by the author in his dissertation for the degree Dipl. Ing. The more advanced way will only become necessary when the variations in software quality become smaller.

The most successful S.A. companies followed in principle the simplified way.

Other ways are possible, for example:

- o consultant selects the system, or
- o buying without checking.

The first way cannot be recommended, because:

- it eliminates the identification of the user with "his" system. The system is the consultant's, not theirs;
- of the alarmingly high presence of consultants in group #1 in the question #5 and #10 (pages 43 & 44).

The second way is a kind of "Monte Carlo" or "Sun City" method. As many succeed as fail. The chances for success seem to be even lower than when using consultants.

8.9.2 E-methods for E-task "Determine information requirements"

The successfully used methods to fulfil E-task (a) can be divided into two groups:

a1) autocratic, and

a2) participative methods.

ad a1)

The autocratic methods are characterised through the "we know best" attitude. The information needs are determined by the department heads, without consulting the affected employees on lower levels.

The information can be collected by the project manager, either:

a.1.1) In an informal meeting with every department head.
The results are already optimized information needs; "nice to haves" can be eliminated in these discussions.

a.1.2) By questionnaire.
The results must be discussed in a meeting to eliminate surplus requests.

ad a2)

The participative methods involve the future users by asking them about their requirements. Again the collection of information can be done by:

a.2.1) interviewing, or

a.2.2) questionnaires.

All methods have advantages and disadvantages, which are shown in Figure 8.1.

Regardless of the method, these information needs must be approved by the steering team.

	ADVANTAGES	DISADVANTAGES
a.1.1)	1. Only few core people to interview 2. Results of meetings immediately useable 3. Dealing with far-sighted people who can assess the future information needs. 4. No structuring of questionnaires necessary.	1. Very little user involvement. 2. Loss of ideas likely.
a.1.2)	1. Same as 1. and 3. of (a.1.1). 2. Quick first overview 3. Response can be used for documentation.	1. Structuring of questionnaires necessary. 2. Same as 1. and 2. of (a.1.1). 3. More "Nice-to-haves". 4. Further discussions necessary to sort out surplus wishes.
a.2.1)	1. Same as 2. and 4. in (a.1.1). 2. No loss of ideas. 3. User involvement.	1. Time consuming. 2. Same as 3. and 4. in (a.1.2).
a.2.2)	Same as 2. and 3. in (a.1.2). Same as 2. and 3. in (a.2.1).	1. Same as 1., 3. and 4. in (a.1.2). 2. Time consuming.

TABLE 8.1:

Advantages and disadvantages

of the various methods to determine the organization's

information needs

8.9.3 E-methods for E-task "Determine other criteria"

"Other criteria" are those which are important to the company, but are not covered by the "information needs". This could be:

- programming language
- size of data fields
- other hard/software specific criteria
- vendor reliability, presence, service, and
- where and with what success the software package is used. (This is an extremely important criteria; if visits to overseas countries are necessary to see systems working in similar companies, the future MRP user should not hesitate to do this.)

To develop this criteria catelogue, different well-known methods can be applied, for example:

b1) interviews

b2) discussions

and other problem solving methods, like:

b3) brainstorming

b4) brainwriting, etc.

None of these points need further explanation.

The methods (b1) or (b2) should normally be sufficient to satisfy the needs of this E-task.

8.9.4 E-methods for E-task "Determine priorities of the criteria"

The following methods can be used to judge the priority of the different criteria.

c1) Estimating

c2) "Criteria-Criteria" comparison

c3) "Criteria - Business characteristics" comparison.

ad c1)

After completion of the criteria catalogue, it is distributed to important people within the company (preferably department heads). These judges shall estimate the importance of the various criteria. A point-system can be used: e.g. "1" = not important; "5" = very important.

This method can be expanded, by:

- o handing out the catalogue to more people in every department;
- o for the judgement on criteria which concerns entirely one department, the score of this department head gets a higher weight.

Regardless of the sophistication of this method, the scores of all judges are added up and an average score can be calculated.

This represents the importance of this criteria.

ad c2)

The "criteria-criteria" comparison method is widely known and may already have another name in literature. Unfortunately, no book which mentions it could be found in the library.

This method is based on the comparison of every criterion with all others. If the judge considers the currently judged criterion to be more important than that to which it is compared, then he gives this criterion a "1" (or another score), and the comparison partner receives a "0" as its score.

If both are equally important, both get the same score. (In the case of "1" being the score ceiling, both would score "0,5".) If it is less important, the criterion receives a "0" as its score, and its comparison partner a "1".

At the end, all these "single scores" are added up to a "final score", which represents the importance of the criteria for this judge.

A short example illustrates this method:

criteria	c1	c2	c3	c4
c1	X	1 *	1/2 +	0 #
c2	0	X	1	1
c3			X	
c4				X

* c1 more important than c2

\+ c1 as important as c3

\# c1 less important than c4

In the case of c4 being the last criteria, the final score of c1 would be: 1 + 1/2 + 0 = 1 1/2

The score of c2 would be: 0 + 1 + 1 = 2

Therefore c2 is more important than c1. The importance of c2 is therefore "1", and of c1 therefore "2".

Owing to the steps "1", "1/2", "0", the difference in the "final scores" does not represent the percentage of more or less importance. It can be modified in a way that it does this. In this case, a value of 100 (or 10) has to be split up according to the estimates difference in importance; e.g.

	c1	c2	c3	c4	
c1	X	70	50	20	140
c2	30	X	90	80	200
c3	50	10	X		
c4	80	20		X	

Then we can say that c2 is 1,4 (= 200/140) times more important than c1.

Again the scores of the different judges are added up and the average is calculated. This average score represents the importance of the criteria.

ad c3)

This method was developed in the writer's last dissertation (9), which ties the importance of the different criteria to the characteristics of the company and its environment. This method demands the study of the characteristics of the company's organization, product system, production facilities, stores and market. Then the necessary procedures of the software package, which can be determined from the information needs, can be tied to these characteristics.

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(9) Kleebinder, J.: Kriterien zum Auswahl von Software-systemen feur die Fertigungssteuerung, Dissertation for the degree "Dipl. Ing.", p.33-45, Tu-Wien, 1982.

A short example:

One of the information needs of the company may be the proprities of the "planned" and "open" orders for the next x weeks.

Some of the company and environmental characteristics may be:

X1 orders per week (average)

Y1 work centres

Z1 penalties for late deliveries.

Another company may have:

X2 (X1) orders per week

Y2 (Y1) work centres.

Z2 (21) penalties for late deliveries.

The scores could be (if ceiling = 10):

Criteria "Priority planning"		
Company characteristic	Co. 1	Co. 2
# of orders per week	*10	*4
# of work centres	6	1
Penalties for late deliveries	10	2
	26	7

* owing to the high/low # of orders per week (environmental factor), the criteria gets a high/low score.

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Penalties for late deliveries	10	2
	26	7

* owing to the high/low # of orders per week (environmental factor), the criteria gets a high/low score.

This process has to be performed for each criterion. The the scores are summed up to a final score. These judgements can be best made in a meeting of all judges. The differences of the final scores represent the difference in importance.

This method is by far the most complex, most time consuming and most difficult. It will become a necessity, when the software packages are relatively equal in quality, but not so good that a selection process becomes unnecessary.

8.9.5 E-methods for E-task "Analyse software"

The results of the analysis should be the knowledge of what the system can do, and even more important - because no system analyst of the package supplier says this without being forced to - what the system cannot do.

To avoid spending time on systems which cannot satisfy the company's needs, the information needs catalogue can be sent to software suppliers with the question "Do they want to participate in the selection contest?" They definitely will be interested if their system satisfies the majority of criteria stated - if not, then even they dont see the chance for success. This will reduce the number of "worth-looking at" software packages to 3 or 4.

To find out the cans' and can'ts' of the remaining systems, several ways are possible:

d1) seminars by the package supplier

d2) consultants

d3) checklists

d4) demonstrations of the system

d5) O. Wight's software evaluations.

The methods (d1) to (d3) cannot be recommended owing to:

d1) The supplier will try to present the good sides of his system and hide the week spots.

d2) Consultants were strongly represented in group #1 in questions #5 and #7 of the questionnaire survey.

d3) Checklists, like the one which W. Dorse (10) presented, are a good orientation help, but the analyses are not thorough enough to disclose the weak spots of the system.

The methods (d4) and (d5) were used by the most successful S.A. companies. Often they used both of them.

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(10) Dorse, W.: "Which Computer System?". Paper given at SAPICS Conference, 1982. Under "Session B11/12" of the conference proceedings. Johannesburg, 1982.

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ad d4)

Demonstrations are only a good way to learn about the systems only if they are not done for a large number of companies using a "representative" company.

At the demonstration, data supplied by the future customer should (must) be used. Another way is to ask for a model of the system with which the company can "play" for some weeks.

Both ways, together with the study of the system documentation (and visits to other companies, mentioned in "other criteria"), give a clear picture of what the system is able to do and where its weak points are. A scale from 0 (= criterion not satisfied) up to 100 (= criterion satisfied) should be used for judging each criterion.

ad d5)

The software evaluations give detailed descriptions of the capabilities and limits of each system. The packages are measured against a standard system.

This addresses the areas:

- Netting and exception logic of MRP
- Order planning and explosion
- Entry into the planning sequence for processing
- The firm planned order

- o Pegging
- o Reporting
- o MPS
- o BOM
- o Inventory transaction subsystem
- o Scheduled receipt subsystem.
- o Firm planned order subsystem
- o Shop floor control
- o Capacity requirements planning
- o Input-output control
- o Purchasing
- o Distribution requirements planning.

These areas contain 45 criteria. None of the currently available systems is able to satisfy all of them (not even the "third" generation systems like "Data 3" and Forman"). They also contain detailed system descriptions, screen layouts, etc.

8.9.6 E-methods for E-task "Analyse the fields concerned by other criteria"

The only method to fulfil E-task (f) is to check how far the supplier satisfies the demands of the "other" criteria. This must be done for every criterion using a percentage system (e.g. from: 100% = fulfilled, down to 0% = not fulfilled).

Of great importance is the successful implementation in a similar company. This cannot be stated often enough.

8.9.7 E-methods for E-task "Evaluation"

The evaluations of the system uses the results of the software analysis and the priorities of the criteria.

It simply consists of the multiplication of the "single" score of each criterion with its "single" priority score.

The single score is either 0 or 1, if a Yes-No system was used, or a certain percentage if a scale, as recommended in (d4), was used.

The priority of the criterion is either 1, 2, 3,.. if a system is used which allows only the judgements 0, 1/2, 1, (like the basic method in [c2]), or a number or percentage if the method (c1), (c2 expanded) or (c3) is used.

All scores are added up; therefore every software system gets 2 different final scores - one for "software", and one for "other" criteria.

8.9.8 E-method for E-task "Selection"

The "selection" consists of adding up both scores for each software package. The system which scores highest

represents the optimal MRP software for this company. This package should be purchased.

8.10 Planning

The importance of proper planning was explained in paragraph 7.2.8. All companies visited used different aids as sources of information to establish their implementation plan.

These aids were:

- videos
- books
- seminars

8.10.1 The E-tasks of "Planning"

The planning of an MRP implementaton follows the same principles as for any other complex and long-term project. The planning process consists of the E-tasks:

- Analysis
- Development of plan(s)
- Evaluation of the different alternatives and selection of the optimal one
- realization
- review.

This logic is illustrated in the following figure:

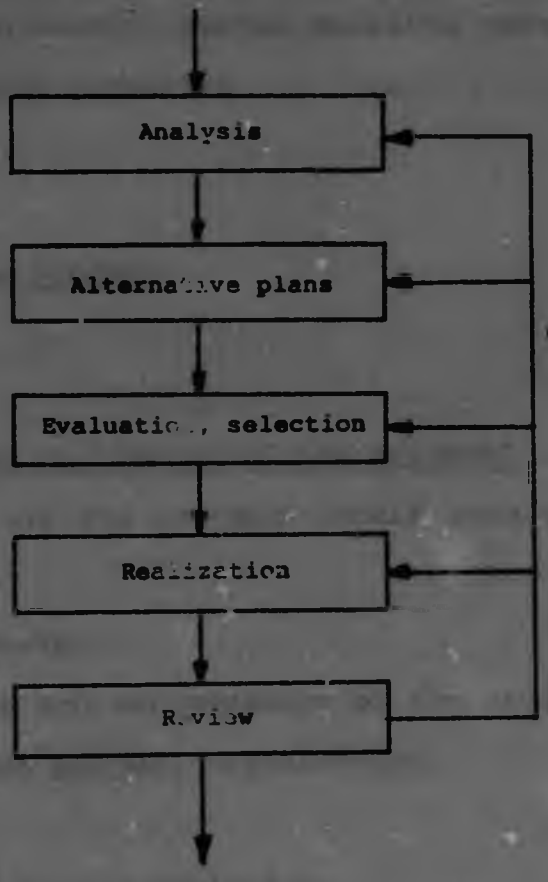


Figure 8.5

Planning Logic

The complexity of the MRP project makes it necessary to split up the project plan in subplans and follow the same planning logic.

D. Landvater's plan (see Appendix D) shows what this plan should look like.

No methods to solve the E-tasks are presented here owing to the general nature of project planning (not MRP specific) and the fact that the plans viewed varied extremely in their layout.

ad review:

Weekly to bi-weekly review meetings were held by all successful companies.

8.11 Set-up of the project

8.11.1 The E-tasks of "Set up of the project"

The E-task set-up of the project should consist of the three E-tasks:

- Informal set-up.
- Decision for and announcement of the project.
- Set-up of the project organization.

They are discussed in the following.

8.11.2 The E-methods for the E-task "Informal set-up"

The informal set up of the project should be made in a meeting of top management and the department heads. A prerequisite is that a good COC on top management level (result of the process described in paragraph 8.4.2). The time span between "Informal set-up" and "Decision for and announcement of the project" can be used to analyse the feasibility of the project and assessment of the COC on lower hierarchical levels.

One of the ways possible to perform the tasks in this phase is the Mini-Project Team method.

The mini-project team should consist of the department heads who report to the CEO. Its members should, after receiving basic education on MRP, conduct the studies necessary. This takes only little time.

8.11.3 E-methods for the E-task "Decision for and announcement of the project"

The decision on the project must be made in a top and 1st line management meeting.

The methods of announcement could be:

a) A meeting of all people concerned with the implementation of MRP.

b) An article in the company newspaper.

c) A special pamphlet.

etc.

In any case, the announcement must be made or signed by the "top people" of the company.

8.11.4 E-methods for the E-task "Set-up of the project organization"

Principally, two methods to organize the project can be used:

(a) Formal method.

(b) Less formal method.

ad a)

The formal method is characterized through:

- a full-time project manager;
- a formally approved project team, and
- a steering committee.

The advantages were already shown in paragraph 6.2.9.1

ad b)

The less formal methods have, in most cases, a:

- part-time project manager;
- informal project team;
- steering committee.

Method (a) is preferable to method (b).

8.12 Summary

This chapter presented, using the concept of C-tasks, E-tasks, E-methods and D-factors, various methods which can be used for fulfilling the different E-tasks. This allows 32 entirely different implementation approaches.

The combination of the E-methods presented leads, without taking the dependencies into consideration, to 367920 different ways of implementation.

CHAPTER 9

POST-IMPLEMENTATION PHASE

The title of this chapter is, in fact, misleading! There must never be a "post-implementation" phase!

Implementation must be an ongoing process. Once the system has settled in (1 year after the cutover), improvements can be made. These improvements can be initiated by the company employees themselves or by outsiders.

New releases of the software used can create further applications of the system. Company specific supplements to the software can be created, but it must be avoided to change the procedures of the software. Therefore these supplements should be separate programs, which only use the MRP Database.

e.g. Software X calculates economic order quantities using formula Y. The company wants to use its in-house developed formula Z.

Figure 9.1 shows how this should be accomplished.

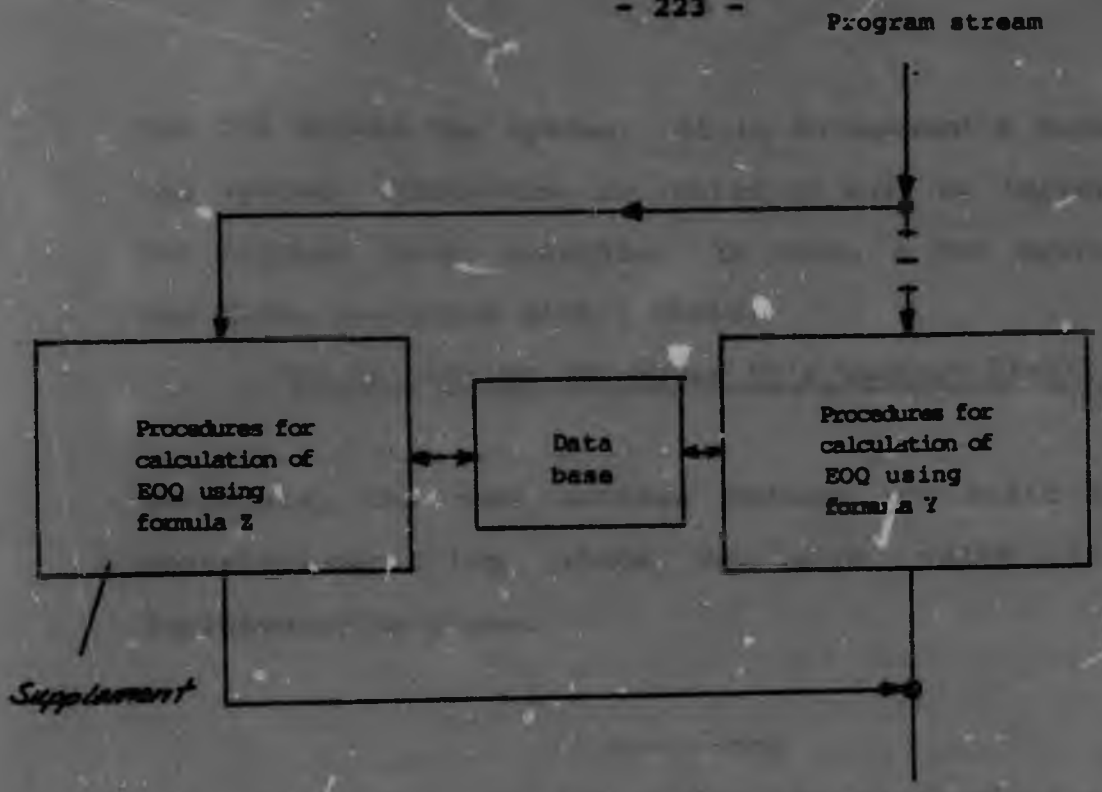


FIGURE 9.1

Software supplement

To improve the software is important, but the main objective must still be the optimal usage of the system and the information provided by it.

O. Wight's (1) ABCD checklist, which was shown in Chapter 1, or the checklist developed by S. Clark et al. (2) which is shown in Appendix E can be used for investigating the yet unexploited potentials of the existing MRP system.

Ongoing education and training is extremely important to achieve long term optimal usage of the system. Data accuracy in this phase is as essential as during the implementation.

The MPS drives the system; it is management's handle on the system; therefore its validity must be improved to its highest level possible. In fact, a MRP system has one thing in common with a chain:

"It is only as strong as it's weakest link".

Therefore, the same success factors are valid in the post-implementation stage as were valid in the implementation phase.

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(1) Wight, O.: MRP II, p. 447. O. Wight Publications, 1982.

(2) Clark, S., Cox, J., Jesse, R., Zmud, R.: How to evaluate your Material Requirements Planning System. Production and Inventory Management, 3rd Quarter, 1982, p.20-34.

CHAPTER 10

THE FUTURE OF MRP

The results of a delphi study conducted by P. Benson et al. (1), reveals the following:

> The panelists expect that the popularity of MRP systems will continue to grow at a rapid pace. They predicted that by 1989 two-thirds of all manufacturing companies will have MRP systems. These systems will tend to be net change, closed-loop, infinite loading systems that interface with strategic planning as well as financial systems.
>
> The survey reveals a continuing gap between operations research theory and manufacturing practice. According to our respondents, it is unlikely that Wagner-Whiten lot sizing, more esoteric forecasting methods, or linear programming techniques will play a significant role in manufacturing systems in the next twenty years. Deterministic simulation, which is more of a data processing technique than an operations research technique, will grow in popularity, especially in the master scheduling area.
>
> Implementation of manufacturing systems will continue to be a major obstacle to the realization of their potential benefits. Data accuracy, "people problems", implementation approach top management support, and education are implementation problems that will not disappear in the 1980s and 1990s.

While proliferation of MRP systems will continue, education will still be a key factor in successful MRP implementation. In-house training, college courses, and instructional video tapes may help in this area as well as in other areas of production and inventory control.

In the data processing area, online, real-time video terminals with graphical displays are on the horizon for manufacturing systems. The software is likely to be supplied by independent vendors and may depend on data base management systems.

Unfortunately, this study did not investigate the sectors of industry in which MRP will be used in 5-10 years time. Consultants and software support specialists hold the view that in future MRP will be used to a larger extent in the following industries:

Construction
Textiles
Rubber and plastics
Warehousing and distribution
Paper and wood
Clay, glass and stoneware.

The MRP logic can be used in all areas in which dependent demand occurs:

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(1) Benson, P., Hill, A., Hoffmann, Th.: Manufacturing systems of the future - a delphi study. Production and Inventory Management, 3rd Quarter 1982, p.87-105.

For example:

a) Hospitals:
   - Operations.
     A BOM, containing the number of doctors, nurses, and the amount of equipment, required, etc., can be created.

b) Meal distribution centres:
   - BOMS are the recipes - the MPS contains the number of different meals needed. Capacity limits could be created by the number of people, stoves, dishes, cars for distribution, etc.

It is therefore highly likely that MRP will be operating in nearly all areas of industry in 10 to 15 years.

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KLEEBINDER.

Appendix A

MRP Assessment Questionnaire

Instructions: Following are a series of items which should help you access your organization's potential response to a new MRP program. For each question below, select the response which corresponds to your judgement by circling the number (from 1 to 9) on the scale above the item.

Example:

Most key people in your organization:

9 8 7 6 5 4 3 2 1

actively seek change; devote much energy to resolving problems; are generally very optimistic of change results	often suggest changes; will adopt changes at an early stage	may resist change; generally will accept change if results are forthcoming and highly visible	often go along with change if forced to comply; rarely adopt change quickly; seek rapid payoffs	oppose most significant changes as a matter of course; very pessimistic as to change results; generally very resistant

In this example the person responding felt that the response under #3 was the most accurate and thus circled number 3.

MRP Assessment Questionnaire (*continued*)

1. Most key people in your organization:

9 8 7 6 5 4 3 2 1

actively seek change; devote much energy to resolving problems; are generally very optimistic of change results	often suggest changes; will adopt changes at an early stage	may resist change; will accept innovations if results are forthcoming and highly visible	often go along with change if forced to comply, rarely adopt change quickly; seek rapid payoffs	oppose many changes as a matter of course; very pessimistic as to change results; generally very resistant

2. First line (lower level) managers in your organization:

9 8 7 6 5 4 3 2 1

actively seek change; devote much energy to resolving problems are generally very optimistic of change results	often suggest changes; will adopt changes at an early stage	may resist change; will accept innovations if results are forthcoming and highly visible	often go along with change if forced to comply, rarely adopt change quickly; seek rapid payoffs	oppose many changes as a matter of course; very pessimistic as to change results; generally very resistant

3. Middle managers in your organization:

9 8 7 6 5 4 3 2 1

actively seek change; devote much energy to resolving problems; are generally very optimistic of change results	often suggest changes; will adopt changes at an early stage	may resist change; will accept innovations if results are forthcoming and highly visible	often go along with change if forced to comply, rarely adopt change quickly; seek rapid payoffs	oppose many changes as a matter of course; very pessimistic as to change results; generally very resistant

MRP Assessment Questionnaire (*continued*)

4. Top executive managers:

9	8	7	6	5	4	3	2	1
actively seek change; devote much energy to resolving problems; are generally very optimistic of change results	often suggest changes; generally responsive to changing conditions	monitor the external environment, but suggest changes only if necessary	often go along with change if forced to comply by outside forces; rarely react quickly to changing conditions	greatly value stability; oppose changes as a matter of course; very pessimistic as to change results; generally very resistant

5. In the past, large scale change programs in your organization have generally been characterized by:

9	8	7	6	5	4	3	2	1
little significant resistance; conflict readily resolved; satisfactory results				some resistance; most conflict handled satisfactorily, moderately successful				substantial resistance; unresolved conflict; mostly unsatisfactory results

Note: If your organization has had no significant change programs introduced in the past ten years circle #1 above.

6. In comparison to your competitors, your organization has the reputation of:

9	8	7	6	5	4	3	2	1
being an innovator or leader; good at forecasting important changes in the environment				being fairly conservative; innovative in some areas, following in others; some forecasting of changes				being a follower; generally late in adopting innovations; relying upon forecasts of others

MRP Assessment Questionnaire (*continued*)

7. In your organization, people whose job responsibilities and tasks will increase significantly with MRP are likely:

9	8	7	6	5	4	3	2	1
to be rewarded with pay increments and recognition				to be recognized informally (i.e., pat on the back) but not thru added compensation				to receive no additional compensation, reward, or recognition

8. The market and technological environments of your business or industry could be characterized as:

9	8	7	6	5	4	3	2	1
very turbulent, unpredictable; highly competitive; markets and technology rapidly changing and difficult to predict; short product life cycles of custom make to-order; very unstable product mix				changing moderately with some competition; some technological and market changes but not extremely difficult to predict				very placid, changing slowly, generally low competition; technological and market changes are incremental and generally predictable; make to stock or inventoriable make to order components; very stable product mix

9. Which of the following would best describe your organization?

9	8	7	6	5	4	3	2	1
a good deal of formal planning takes place; use is made of task forces, top level planning committees, management steering committees or other formal planning techniques				some, but not extensive, formal planning occurs; few formal mechanisms exist for planning and forecasting change				very little formal planning occurs; heavy emphasis placed on day-to-day operations; no formal planning devices

10. Communications within your organization could be described as:

9	8	7	6	5	4	3	2	1
extensive sharing of information up and down the organization; high level of communications between departments and diagonally among departmental levels				communications up and down the organization; communications between departments primarily only when required; some diagonal communications				mostly downward communications, little information sharing from top; little diagonal exchange; minimum information shared between departments

MRP Assessment Questionnaire (*continued*)

11. Describe the way significant changes have been made in your organization in the past.

9	8	7	6	5	4	3	2	1
concerned members of all levels participated in developing the change and recommending ways of implementing				some information sharing from the top and some participation in the change decision and implementation				most directives from higher levels to change; little or no participation in change decision; little upward influence

12. Which of the following would best describe past change efforts in your organization?

9	8	7	6	5	4	3	2	1
significant changes were well supported from the top; support communicated throughout the change and later	top level support apparent in most cases; generally good involvement of top level managers		strong initial top level support; later support not as well communicated		fairly strong top level support and commitment initially; less visible support during and after change			little communicated top level support at any stage; tend to "forget" change once underway

13. Which of the following describes the use of computer data processing in your organization?

9	8	7	6	5	4	3	2	1
computer is integral to a management information system; used widely for operational and strategic decision				computer data processing mostly used for record keeping functions (payroll, personnel, etc.)				have no computerized data processing in organization at this time

14. Describe the general attitude toward your present system of handling materials/production requirements.

9	8	7	6	5	4	3	2	1
there is general agreement present system is inefficient and obsolete: source of general dissatisfaction		most production and materials handling key personnel perceive a problem with present system; other members may or may not recognize a problem		some key people see a need for change, however no general dissatisfaction exists		only a few people at the top perceive the need for change; those directly involved are generally satisfied		organization considering a change with very little expressed dissatisfaction from key members

15. Below are listed operating conditions an organization may face. Opposite each condition write in the number from the scale below (2, 5, or 8) which describes your situation.

2 — not true of my organization; 5 — somewhat true of my organization; 8 — very true of my organization

	Score
a. Declining customer service with increasing customer complaints	____
b. Inventory imbalances (too few of required parts; too many of other items - excesses and subsequent obsolescence).	____
c. Product costs increasing	____
d. Unpredictable shipping performance	____
e. Insufficient lead times allowed for purchasing and manufacturing	____
f. Imbalanced loads in manufacturing departments; low manufacturing efficiencies	____

APPENDIX B

STRUCTURING AN EDUCATION PROGRAM

An entire article could be devoted to the listing and evaluation of available education programs. For example, the Society for Mechanical Engineers (SME) sponsors a two-day seminar on bill of material structure, the American Institute of Industrial Engineering (AIIE) also sponsors seminars on methods analysis/standard creation and routings, while the National Association of Purchasing Management (NAPM) offers many seminars related to purchasing activity. Many APICS chapters and regions also sponsor seminars and workshops on materials management, manufacturing (including CAD/CAM) and data processing principles.

While these offerings and those of many private firms or individuals are very beneficial, they are usually too costly for attendance by more than a handful of a company's staff.

The goal must be to provide high quality, effective, and interesting education courses economically to large groups of people. This goal will require on-site, repetitive instruction. Therefore, home grown and/or canned audio/visual presentations are generally the most cost effective alternative. Commercially available MRP audio/visual information (video tape, audio tape, 35 mm slides) can be rented for as little as $50.00 a month. The associations previously mentioned (APICS, AIIE, SME, NAPM) also offer training material that can be purchased for as little as $20.00 to $30.00.

Exhibit I provides the course content of a generalized education program that utilized commercially available audio visual material.

TRAINING CONSIDERATIONS

Training is one area where most MRP installations break down. While education can be purchased "off the shelf," training must be meticulously nurtured and developed. All too often the documentation is lacking in substance and is terribly dry.

The following training considerations are provided to correct these ills:

1. Determine the training needs required by a functional area of the organization, as they relate to each system module.
2. Emphasis throughout the entire training approach should be oriented towards "how to" detail. Employees should be trained in how to perform specific tasks, so that they become competent enough to do their jobs in the day-to-day working environment. While this may involve "how to complete a form," or "read a report," it is far more encompassing. The training should provide practical guidance regarding the use and analysis of information (from reports or screens) to make effective decisions; and what steps to take to identify and investigate problems along with corrective actions (which might include filling out various forms.)
3. Lesson plan content should be oriented towards developing job skills rather than merely providing a list of instructions. Whenever possible, potential problems or situations should be simulated using actual data. Employees should have the benefit of seeing the cause and effect impact of their actions. They should also see how their job tasks affect people (in other areas), who must rely on and use the information.
4. Preparation of lesson plans should include:
   - —Script/lecture notes
   - —Artwork/slides/overheads/video tape
   - —Examples/handouts/test data
   - —Student test
   - —Instructor evaluation form
5. Research for lesson plans should include:
   - —Investigation and resolution of all procedural issues
   - —Identification of typical problems and solutions
   - —Familiarization of user activities and concerns
   - —Incorporation of supporting literature (journal articles, APICS training aids, video tapes, etc.)
6. Class participation and membership should foster student involvement. Student involvement will foster enthusiasm, alertness, and the creation of "memory hooks" regarding the subject matter. Class attendance should be made up of peers to foster a relaxed atmosphere. While training sessions should be structured and informative, they should not appear rigid, formal, or impersonal.
7. Measurement standards should be created to monitor class performance. These measurements should include before and after performance (pre- and post-tests.) It is important to note that attendance lists are a poor substitute. They do not provide an indication of the learner's level of understanding.
8. Identify the "experts" within the organization who should present each lesson topic. The person with the best knowledge of particular job tasks should be the one to teach those tasks. Recognition of the person's qualifications is a crucial element in establishing credibility for the training program. Program success is directly related to this credibility.
9. Employees should be provided with goals and incentives for achieving personal improvement from training programs:
   - —Certificates for successful completion of course work and achievement of passing test scores.
   - —Job descriptions which include in-house training requirements and minimum standards.
   - —Career paths that are linked to job experience, work performance, and training achievements.

- Award banquets for successful course completion and/or recognition in the company's newsletter.

10. Written materials such as user manuals and procedures should be structured so that they can be incorporated into the training sessions, *and* can also be used as a means for building upon the classroom instruction. Written procedures should provide guidelines regarding decision making and alternative courses of action. User manuals should provide programmed learning for new employees, while serving as reference documents for all employees. To this latter end, these user manuals should be tailored to the specific system implementation, and serve as a replacement for any vendor supplied manuals that may have accompanied a software package.

TRAINING PROGRAM APPROACH

A detailed training program should be developed for all aspects of the new manufacturing system. This program should be tailored to the needs of each system module and plant site and should coincide with the system's implementation timetable.

The portion of a detailed training program covering the implementation of a purchase order control system is illustrated in Exhibit II. This illustration serves as a model for the type of training program needed for a successful systems implementation.

COMBINING EDUCATION WITH TRAINING INTO AN OVERALL PROGRAM

A common practice has been the combining of generalized education with task specific training to achieve a comprehensive overall program of user instruction. When using this approach, education is used to introduce the student to concepts and established practices regarding a particular topic, which is then followed up by task specific training that builds upon the generalized concepts. The student is allowed to first assimilate generalized concepts, and to then acclimate these concepts (through training) into effective job skills.

Many companies, recognizing the importance of this approach, have established a training coordinator/manager who is responsible for administering the program. The training coordinator can assist in developing detailed education/training programs for the manufacturing system, serve as coordinator at training sessions, and provide guidance to instructors when developing lesson plans. The actual training should be performed by members of the organization, which is in keeping with the concept of using in-house "experts" to present lesson topics.

Exhibit III is provided to illustrate the integration of education and training into an effective program. The example focuses attention to a particular topic, which happened to be cycle counting.

PRESENTATION AND DOCUMENTATION TECHNIQUES.

The remainder of the article provides some tips and examples for developing education and/or training materials. Concepts regarding audio/visual presentations, procedure manual style, and user manual content are presented. The concepts presented are universal and can apply to most any environment. They do not have to be restricted only to MRP implementations.

PROGRESSIVE DISCLOSURE DURING AUDIO/VISUAL PRESENTATION

Progressive disclosure is a useful technique for presenting information that is interrelated or builds upon itself. Progressive disclosure is ideally suited for presenting bar charts or lists of statements regarding benefits, objectives, goals, and conclusions. The intention of this technique is to present the information "progressively," which is how the technique derived its name.

Progressive disclosure is a useful technique for slide presentations, overhead projectors, flip charts, and graphs. It can also be used in video or movies, by having the camera pan across a series of charts or artwork. For example, in a slide presentation the first slide would show a single statement (or a single item, or a single bar on a bar chart). A second slide would show an added statement (or an added item, or an added bar on a bar chart). This would continue until the final slide included all statements, items, or the entire bar chart.

Progressive disclosure offers many advantages:

1. It prevents the audience from reading ahead of the presentation.
2. It keeps the audience more alert to what the speaker is saying.
3. The speaker retains better control over the presentation.
4. It is easier for the audience to remember one point at a time and to build each new thought upon the others, rather than trying to absorb an entire list of information at once.
5. The speaker is able to keep the presentation moving. Audience interest drops considerably when one slide or overhead is kept on the screen for an extended length of time.

Exhibit IV presents an example depicting the benefits obtained from implementing a program of machine capacity and tooling analysis.

PLAYSCRIPT TECHNIQUE FOR EFFECTIVE PROCEDURES

Procedures are characteristically dull and tedious both for the writer and the reader. Dull procedures can serve as a catalyst for creating "informal systems." Employees will simply avoid reading or consulting the procedures, if they are dull, difficult to follow, overly detailed, or written for too high an education level. By either not reading the established procedures, or failing to understand them, employees will be

- Award banquets for successful course completion and/or recognition in the company's newsletter.

10. Written materials such as user manuals and procedures should be structured so that they can be incorporated into the training sessions, *and* can also be used as a means for building upon the classroom instruction. Written procedures should provide guidelines regarding decision making and alternative courses of action. User manuals should provide programmed learning for new employees, while serving as reference documents for all employees. To this latter end, these user manuals should be tailored to the specific system implementation, and serve as a replacement for any vendor supplied manuals that may have accompanied a software package.

TRAINING PROGRAM APPROACH

A detailed training program should be developed for all aspects of the new manufacturing system. This program should be tailored to the needs of each system module and plant site and should coincide with the system's implementation timetable.

The portion of a detailed training program covering the implementation of a purchase order control system is illustrated in Exhibit II. This illustration serves as a model for the type of training program needed for a successful systems implementation.

COMBINING EDUCATION WITH TRAINING INTO AN OVERALL PROGRAM

A common practice has been the combining of generalized education with task specific training to achieve a comprehensive overall program of user instruction. When using this approach, education is used to introduce the student to concepts and established practices regarding a particular topic, which is then followed up by task specific training that builds upon the generalized concepts. The student is allowed to first assimilate generalized concepts, and to then actimate these concepts (through training) into effective job skills.

Many companies, recognizing the importance of this approach, have established a training coordinator/manager who is responsible for administering the program. The training coordinator can assist in developing detailed education/training programs for the manufacturing system, serve as coordinator at training sessions, and provide guidance to instructors when developing lesson plans. The actual training should be performed by members of the organization, which is in keeping with the concept of using in-house "experts" to present lesson topics.

Exhibit III is provided to illustrate the integration of education and training into an effective program. The example focuses attention to a particular topic, which happened to be cycle counting.

PRESENTATION AND DOCUMENTATION TECHNIQUES.

The remainder of the article provides some tips and examples for developing education and/or training materials. Concepts regarding audio/visual presentations, procedure manual style, and user manual content are presented. The concepts presented are universal and can apply to most any environment. They do not have to be restricted only to MRP implementations.

PROGRESSIVE DISCLOSURE DURING AUDIO/VISUAL PRESENTATION

Progressive disclosure is a useful technique for presenting information that is interrelated or builds upon itself. Progressive disclosure is ideally suited for presenting bar charts or lists of statements regarding benefits, objectives, goals, and conclusions. The intention of this technique is to present the information "progressively," which is how the technique derived its name.

Progressive disclosure is a useful technique for slide presentations, overhead projectors, flip charts, and graphs. It can also be used in video or movies, by having the camera pan across a series of charts or artwork. For example, in a slide presentation the first slide would show a single statement (or a single item, or a single bar on a bar chart). A second slide would show an added statement (or an added item, or an added bar on a bar chart). This would continue until the final slide included all statements, items, or the entire bar chart.

Progressive disclosure offers many advantages:

1. It prevents the audience from reading ahead of the presentation.
2. It keeps the audience more alert to what the speaker is saying.
3. The speaker retains better control over the presentation.
4. It is easier for the audience to remember one point at a time and to build each new thought upon the others, rather than trying to absorb an entire list of information at once.
5. The speaker is able to keep the presentation moving. Audience interest drops considerably when one slide or overhead is kept on the screen for an extended length of time.

Exhibit IV presents an example depicting the benefits obtained from implementing a program of machine capacity and tooling analysis.

PLAYSCRIPT TECHNIQUE FOR EFFECTIVE PROCEDURES

Procedures are characteristically dull and tedious both for the writer and the reader. Dull procedures can serve as a catalyst for creating "informal systems." Employees will simply avoid reading or consulting the procedures, if they are dull, difficult to follow, overly detailed, or written for too high an education level. By either not reading the established procedures, or failing to understand them, employees will be

unaware of established guidelines. This will lead them to create their own guidelines. As time passes, these informal guidelines will become the informal, yet accepted practice of the organization.

The playscript technique emphasizes the responsibilities of the individual, and the actions that must be taken. Sentences are short, words are kept simple, and the instructions convey action.

Exhibit V provides an example of a playscript procedure explaining how to process an incoming inspection.

USER MANUAL CONTENT AND FORMAT

A user manual should serve two purposes: it should be a handy reference document for the seasoned employee who is generally knowledgeable of company operations, and it should serve as a training aid for guiding the new or inexperienced employee.

User manuals should provide detailed information about input documents, output reports, CRT screens, and maintenance forms. Each topic should be fully illustrated with examples of actual contents. Each field should be explained in detail. The explanations should be definitional as well as functional. A quick referenced glossary of terminology, as well as an appendix of codes and systems values should also be included.

No reference should be made to specific actions. They belong in procedures. However, reference should be made to types of activity, because they provide a link between the user manual and the procedure manual.

Exhibit VI provides two facing pages from a user manual. The document being illustrated on the left page is explained on that page and the facing right page. When additional examples (other than those contained in the illustration) are needed to further define other conditions, (eg., type of errors or other types of requisitions) then the illustration can be changed on the following left page, and the narrative on the additional left and right page would reflect the revised illustration. This concept provides considerable flexibility while also retaining clarity and ease of reading. Whatever is being read on either the left or right hand page reflects the illustration shown. As the illustrations change, so do the narratives.

The Purpose section provides a brief definition of the document being illustrated. A reader can quickly skim the purpose and determine whether or not they have the right document for answering their question. They do not have to waste time leafing though pages of explanation.

The Frequency and Distribution sections collectively identify when the report is generated, who receives it, how their copies are sorted, and the report numbers. If, for example, a buyer had a question about a particular requisition, the buyer could telephone the appropriate analyst. The two of them could easily refer to one another's reports and resolve the question quickly. Cross referencing contributes to employee productivity and work efficiency.

The Input Document and Maintenance Form sections identify the data sources from which the output report was generated and maintained. The reader can turn to those sections of the user manual and look up the appropriate document or form for a detailed explanation similar to the one provided for the output report. In this way, the manual is thoroughly cross referenced, also the cause and effect between data entry, maintenance and report generation are thoroughly understood by the user.

The Pagination section defines the way in which the report page breaks.

The Contents section provides detailed field by field explanations of every field in the document. Oftentimes cross references are made between fields, or to other reports in which the data appears, or even to other sections of the manual.

A few additional comments before closing on this subject. Codes are always listed separately in an Appendix section, since they may change frequently. Any references to personnel are also segregated in the Appendix. The objective is to isolate those elements of the manual that change the most frequently into a separate section. This makes it much easier to keep the manual up to date.

A Glossary section is also recommended. The glossary would contain an alphabetical listing of definitions and terms. These definitions would be detailed and unabridged. This concept allows for the saving of space by providing abridged explanations throughout the manual except for the Glossary. The reader can always reference the Glossary for additional information.

EXHIBIT I

MRP EDUCATION PROGRAM

FUNCTIONAL AREA	*EDUCATION TOPIC*
All Users	Overview of MRP concept Day to Day operation of system MRP as company game plan Overview of MRP Concept and priority planning
Marketing P & IC	Relationship of forecast policy, production plan, and master schedule Creating an effective MPS
Stockroom	Explanation of how it is developed and used Stockroom evaluation and cycle counting guidelines Need for accurate inventory counts Principles and concepts of cycle counting Reducing lead times and improving vendor delivery performance
Purchasing	Implementing MRP in the purchasing department Operating the purchasing department with an MRP system Preparation for creating a master production schedule to drive MRP
P & IC Shop Supv Fit Mgt	Implementing a master production scheduling system Record accuracy as the foundation of MRP success
Data Processing	Implementing MRP Software Closed loop modular concepts of MRP II Data base structure Physical and logical record linkages
Ind. Eng. Shop Spv Pit Mgt Ind. Engr., Mfg./Dev. Engr. Groups	Implementing routings, methods and standards, and their combined impact Explanation of concepts and techniques Product structure consideration Part master considerations
Shop Supv. Pit. Mgmt. Marketing, Accounting, Data Processing & Mfg./Dev. Engineering Groups	Principles and concepts of product structure Impact of MRP system on non-manufacturing departments

EXHIBIT II

TRAINING PROGRAM FOR IMPLEMENTING PURCHASE ORDER CONTROL

TYPICAL USER AREA	*TRAINING TOPIC*	*TRAINING DESCRIPTION*
Purchasing	Raw Material Requisitions	Explain how requisitions are created within the manufacturing system. Explain how they should be reviewed and combined into appropriate order quantities. Explain why system will not provide total bottom line requirements until implemented at all plant locations.
Purchasing	Closing Requisitions	Explain how to close a requisition in each of the three ways provided by the system, and why they must be closed at the time of order placement. Show examples of the relationship between the two.
Purchasing	Raw Material Order Placement	Explain how the typing of a purchase order results in order header/order detail transaction pairs. Illustrate how the purchase order line item number becomes a suffix to the P.O. number when entered into the system, and why this must be done. Explain the various order status codes.
Purchasing	Raw Material Order Maintenance	Explain the use and application of multi-part change orders and single part maintenance forms. Give examples of each application. Stress the cost savings benefits of maintenance forms.

EXHIBIT II - Continued
TRAINING PROGRAM FOR IMPLEMENTING PURCHASE ORDER CONTROL

TYPICAL USER AREA	TRAINING TOPIC	TRAINING DESCRIPTION
Purchasing	Unit of Measure Conversion	Review and explain the unit of measure conversion issue (why both are needed and the application of each). Illustrate the use of CRT screens for conversion calculation and have users make conversion calculations at the CRT.
Purchasing	Blanket and Release Orders	Explain the application and processing by the manufacturing system.
Purchasing/ Quality Assurance	Discarded and Return to Vendor Dispositions	Explain how to process the paperwork, the cause and effect of activities, the chronologic order of events resulting from either disposition, and the conditions under which to re-open or create a new purchase order to return goods to vendors.
Receiving Dock	Recording the Receipt of Material From Vendors	Explain how to process a receipt.
Purchasing/ Receiving Dock	Receiving Maintenance	Explain how to determine the need for maintenance, coordinate its use, and *control* its application.

EXHIBIT II - Continued
TRAINING PROGRAM FOR IMPLEMENTING PURCHASE ORDER CONTROL

TYPICAL USER AREA	TRAINING TOPIC	TRAINING DESCRIPTION
Quality Assurance	Incoming Inspection of Raw Materials and Purchased Parts	Explain the inspection acitivities that are changed or modified by initiation of a quality control disposition. Explain how to fill out and process the forms.
Quality Assurance	Rejected Material Disposition	Explain the entire rejection, review, final disposition process. Use flow charts, diagrams, illustrations and examples as needed. Explain how to fill out and process the Rejection Disposition form and the activities that take place for each type of reason code.
Quality Assurance	Data Maintenance	Explain under what circumstances a delete or a delete/add back are required. Give examples.
Stock Room	Moving Materials Into Stock Location	Explain under what conditions a receipt move ticket are completed and how they are processed.
Purchasing/ Stock Room/ P & IC/ Quality Assurance	Part Master Maintenance	Explain how to fill out part master maintenance transactions and all the relevant data that are expected from each function. Explain how to develop the data and why these are needed. Give examples of how the data are used within the manufacturing system, and how management benefits from the subsequent information.

EXHIBIT II - Continued
TRAINING PROGRAM FOR IMPLEMENTING PURCHASE ORDER CONTROL

TYPICAL USER AREA	TRAINING TOPIC	TRAINING DESCRIPTION
All Users	Output Reports and CRT Screens	Explain relevant reports and screens to each user area and explain the analysis tools available from these outputs.
All Users	Data Processing Overview	Explain data processing terms, data definitions, proposed report distributions, CRT sign-on and CRT access.
Data Processing	Job Streams	Explain the new job streams, how they should be loaded and run. Reference operating procedure and job steps. Explain all restart procedures.

EXHIBIT III
CYCLE COUNTING
EXAMPLE OF COMBINED EDUCATION/
TRAINING PROGRAM

Generalized Education
Cycle Counting Procedures and Practices
—Why Cycle Counting achieves improved inventory record accuracy.
—The concept and need for a locked stockroom.
—What techniques are available for determining cycle count frequency.
—Techniques available for establishing the timing (and tracking) of the actual count taken during the work day.
—Illustrations of reduced inventory shrink and program cost justification.

Task Specific Training
—How to perform bin/bay location verification for each unique stockroom layout within the company.
—How to perform physical cycle counts
a) At time of the required cycle count date and/or interval identified on the part master file.
b) At time of stock out.
c) At time of creating a new location from a verified receipt quantity.
—Recount procedures for verifying a physical count discrepancy (including dollar value ranges of the material, and percent deviation ranges of the physical count).
—Recording and reviewing cycle count results.
a) How and when to use reports and forms.
b) Data entry and maintenance procedures.
c) CRT screen access and use.
—How to determine when a physical adjustment is needed.

EXHIBIT IV

ILLUSTRATING MACHINE CAPACITY AND TOOLING ANALYSIS BENEFITS USING THE PROGRESSIVE DISCLOSURE TECHNIQUE

BENEFITS

- PREVENTION OF TOOL/PROCESS SHORTAGES

BENEFITS

- PREVENTION OF TOOL/PROCESS SHORTAGES
- HIGHLIGHT NEED FOR PRIORITY PLANNING
- MACHINE PRODUCTION DATA
- SCRAP, REJECTIONS, AND YIELD LOSS DATA

BENEFITS

- PREVENTION OF TOOL/PROCESS SHORTAGES
- HIGHLIGHT NEED FOR PRIORITY PLANNING

BENEFITS

- PREVENTION OF TOOL/PROCESS SHORTAGES
- HIGHLIGHT NEED FOR PRIORITY PLANNING
- MACHINE PRODUCTION DATA
- SCRAP, REJECTIONS, AND YIELD LOSS DATA
- IDENTITY, CATALOGING, AND ASSESSMENT OF TOOLING AND EQUIPMENT AT PLANTS AND VENDORS

BENEFITS

- PREVENTION OF TOOL/PROCESS SHORTAGES
- HIGHLIGHT NEED FOR PRIORITY PLANNING
- MACHINE PRODUCTION DATA

BENEFITS

- PREVENTION OF TOOL/PROCESS SHORTAGES
- HIGHLIGHT NEED FOR PRIORITY PLANNING
- MACHINE PRODUCTION DATA
- SCRAP, REJECTIONS, AND YIELD LOSS DATA
- IDENTITY, CATALOGING, AND ASSESSMENT OF TOOLING AND EQUIPMENT AT PLANTS AND VENDORS
- IDENTIFY ERRORS IN THE PART MASTER FILE AND BILLS OF MATERIAL

EXHIBIT V

EXPLAINING HOW TO PROCESS AN INCOMING INSPECTION USING THE PLAYSCRIPT PROCEDURE TECHNIQUE

RESPONSIBILITY	*ACTION*
Receiving Dock Clerk	1. Gives Quality Assurance copy of deculated receiving form to Incoming Inspection Department.
	2. Places Move Order copy of deculated receiving form on skid with material in the receiving dock/incoming inspection hold area.
	3. Places yellow hold tag on skid with material in receiving dock/incoming inspection hold area.
Incoming Inspection Supervisor	4. Access the stock status by part number, and order status screens (or reports) on basis of the order number and part number obtained from the Q.A. copy of the receiving report.
	5. Compare Q.A. copy of receiving report to screens (or reports) and verify order number and part number. If unable to achieve a match, then contact Receiving Dock Supervisor.
	6. Determine relative need for material and priority of inspection. Normal priority is based upon first in/first out basis (FIFO).
	7. Consult manual files of Quality Assurance inspection procedures, protocols, and sample plans. This documentation to be filed by part number. These files to be maintained in part number sequence.
Incoming Inspection Staff	8. Perform inspection(s) or test(s) and complete Quality Control Disposition Form.
	9. If raw material or purchased parts pass the incoming inspection(s) or test(s), go to *step 11*.

EXHIBIT V - Continued
EXPLAINING HOW TO PROCESS AN INCOMING INSPECTION USING THE PLAYSCRIPT PROCEDURE TECHNIQUE

RESPONSIBILITY	*ACTION*
	10. If raw material or purchased parts *fail* the incoming inspection(s) or test result(s), go to *step 19*.
	INCOMING INSPECTION PASSED
Incoming Inspection Supervisor	11. Review inspection and/or test results.
Incoming Inspection Supervisor (continued)	12. Deculate Quality Control Disposition Form.
	13. Batch keypunch copy for data processing.
	14. Stamp move order copies of Quality Control Disposition Form with green accept stamp.
	15. Place move order copy of Quality Control Disposition Form on skid with material.
	16. Remove yellow hold tag from skid.
	17. Remove move order copy of *receiving form* from skid and *discard*.
Fork Lift Driver	18. Remove skid from receiving/incoming inspection hold area, and move material or parts according to the fork lift driver instructions on the move order copy of the Quality Control Disposition Form.
	INCOMING INSPECTION FAILED
Incoming Inspection Supervisor	19. Review inspection and/or test results.
	20. Deculate Quality Control Disposition Form.
	21. Batch keypunch copy for data processing.
	22. Stamp move order copy of Quality Control Disposition Form with red "reject" stamp.

EXHIBIT V - Continued
EXPLAINING HOW TO PROCESS AN INCOMING INSPECTION USING THE PLAYSCRIPT PROCEDURE TECHNIQUE

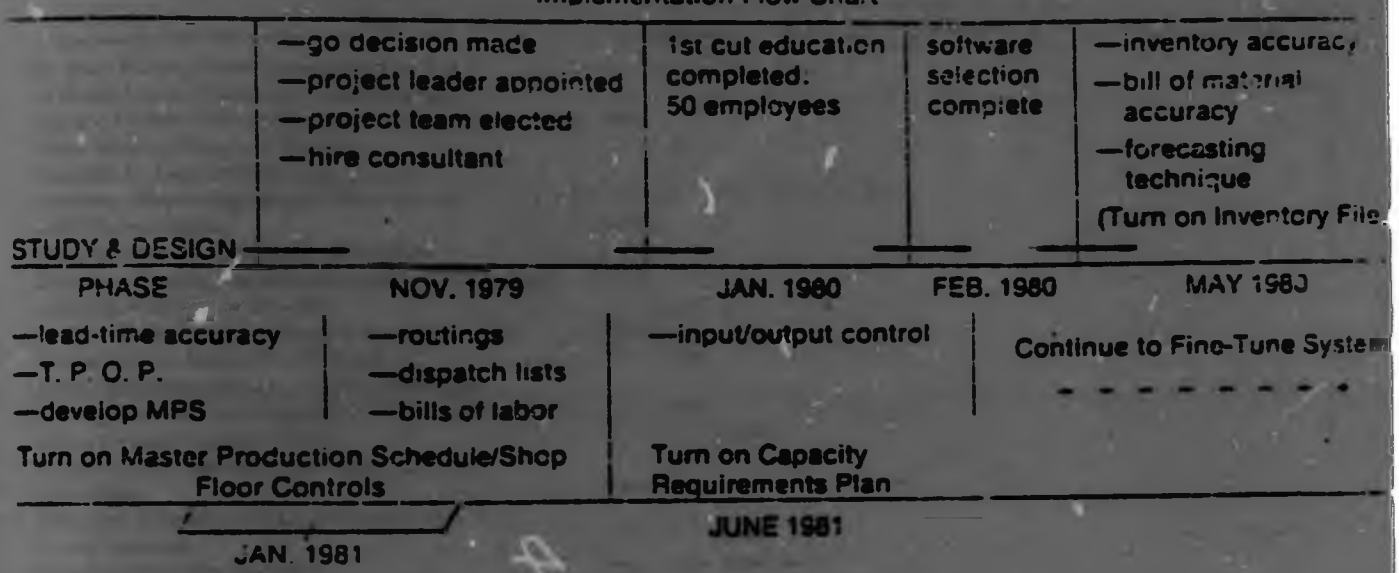
RESPONSIBILITY	*ACTION*
	23. Fill out Reject Disposition Form and include inspection/test result data on form.
	24. Save Reject Disposition Form for Quality Assurance/MRB reviews.
	25. Place move order copy of Quality Control Disposition Form on skid with material.
	26. Place red reject tag on skid.
	27. Remove yellow hold tag from skid.
	28. Remove move order copy of *receiving form* from skid and *discard*.
Fork Lift Driver	29. Remove skid from receiving/incoming inspection hold area, and move material or parts according to the fork lift driver instructions on the move order copy of the Quality Control Disposition Form.

CROSS REFERENCE TO OTHER PROCEDURES

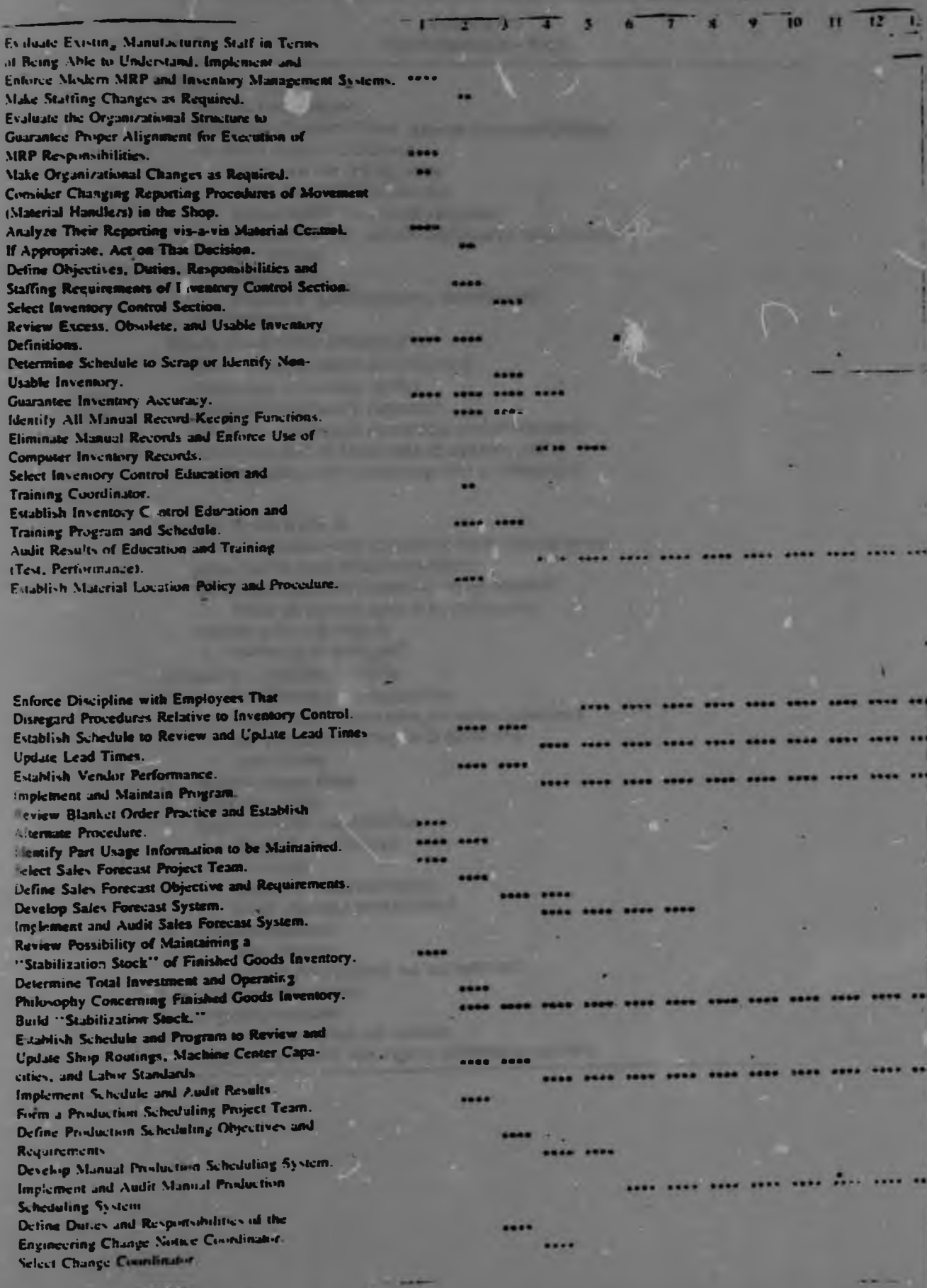
PROCEDURE TITLE	*ACTION*
Batch Control and Job Routing	Completion of Batch Control Form
How to Complete the Quality Control Disposition Form	Explanation and Use of the Quality Control Disposition
How to Complete the Rejection Disposition Form	Explanation and Use of the Rejection Disposition Form

APPENDIX C1

FIGURE 5
Implementation Flow Chart



APPENDIX C2


1 2 3 4 5 6 7 8 9 10 11 12 1
Evaluate Existing Manufacturing Staff in Terms of Being Able to Understand, Implement and Enforce Modern MRP and Inventory Management Systems.
Make Staffing Changes as Required.
Evaluate the Organizational Structure to Guarantee Proper Alignment for Execution of MRP Responsibilities.
Make Organizational Changes as Required.
Consider Changing Reporting Procedures of Movement (Material Handlers) in the Shop.
Analyze Their Reporting vis-a-vis Material Control.
If Appropriate, Act on That Decision.
Define Objectives, Duties, Responsibilities and Staffing Requirements of Inventory Control Section.
Select Inventory Control Section.
Review Excess, Obsolete, and Usable Inventory Definitions.
Determine Schedule to Scrap or Identify Non-Usable Inventory.
Guarantee Inventory Accuracy.
Identify All Manual Record-Keeping Functions.
Eliminate Manual Records and Enforce Use of Computer Inventory Records.
Select Inventory Control Education and Training Coordinator.
Establish Inventory Control Education and Training Program and Schedule.
Audit Results of Education and Training (Test, Performance).
Establish Material Location Policy and Procedure.
Enforce Discipline with Employees That Disregard Procedures Relative to Inventory Control.
Establish Schedule to Review and Update Lead Times
Update Lead Times.
Establish Vendor Performance.
Implement and Maintain Program.
Review Blanket Order Practice and Establish Alternate Procedure.
Identify Part Usage Information to be Maintained.
Select Sales Forecast Project Team.
Define Sales Forecast Objective and Requirements.
Develop Sales Forecast System.
Implement and Audit Sales Forecast System.
Review Possibility of Maintaining a "Stabilization Stock" of Finished Goods Inventory.
Determine Total Investment and Operating Philosophy Concerning Finished Goods Inventory.
Build "Stabilization Stock."
Establish Schedule and Program to Review and Update Shop Routings, Machine Center Capacities, and Labor Standards
Implement Schedule and Audit Results
Form a Production Scheduling Project Team.
Define Production Scheduling Objectives and Requirements
Develop Manual Production Scheduling System.
Implement and Audit Manual Production Scheduling System
Define Duties and Responsibilities of the Engineering Change Notice Coordinator.
Select Change Coordinator

APPENDIX C3

EXHIBIT 1
Implementation Plan

Phase 1— STUDY
- first-cut education
- establish Project Team, assign responsibilities
- review present functions
  - what are we doing now
  - what can MRP do for us
  - select MRP functions required
  - determine + detail manpower requirements
- Project review
  - education
  - financial justifications, cost/benefit
- set timetable

Phase 2—DEVELOPMENT
- detailed education and training
- inventory accuracy (95%)
- hardware/software research
- hardware/software purchase and installation
- structure Bill of Materials to system (99%)
- load system with inventory, Bill of Materials
- test system parts
- item analysis—expansion of MRP capabilities
- paperwork flow documentation
- write policies and procedures as needed
  - + tailor program spec's to company
- review with top mgmt.
  - running to budget?

Phase 3—INSTALLATION
- Master Schedule preparation
  - review with marketing—sales forecasts
  - set procedures for M-S revisions
  - lead times
- review paper flow
- pilot program
- Expand MRP capabilities
  - Shop floor control
  - routings
  - capacity requirements
  - work centers established
- monitor system
  - late orders
  - actual production vs. scheduled
- cost/benefit review
- ongoing support
  - maintenance education
- final review with top mgmt. (implementation)

TASK	RESPONSIBLE	DATE	COMMENTS
A. Measure 100 parts as a starting point.	Stockroom Mgr.	+1	This will help assess the work that needs to be done to bring the inventory records to 95%.
B. Map out limited access to the stockroom areas.	Stockroom Mgr.	+1	Lay out any stockroom changes that are necessary to insure limited access.
C. Provide the tools for limited access and transaction recording.	Top Management Stockroom Mgr. Team Leader DP Mgr.	+3	A fence, enough stockroom people, adequate space, counting scales, transaction forms, labels, skids, etc.

TASK	RESPONSIBLE	— SCHEDULED — START	DUE	— ACTUAL — START	DUE
A. Measure 100 parts as a starting point.	R. Ferris	6/20/80	6/27/80	6/20/80	6/24/80
	Results indicate that the inventory accuracy is 63%.				
B. Map out limited access to the stockroom areas.	R. Ferris K. Miller	6/1/80	7/1/80	6/5/80	
	Lay out any stockroom changes that are necessary to insure limited access. Main and spare parts stockrooms to be enclosed and third stockroom to be consolidated into the existing stockrooms.				
C. Provide the tools for limiting access and transaction recording.	D. Roser R. Ferris K. Miller H. Arner	7/15/80	9/1/80		
	A fence, enough stockroom people, adequate space, counting scales, transaction forms, labels, skids, etc.				

APPENDIX B

INSTRUCTIONS FOR THE TECHNICAL PROBLEMS QUESTIONNAIRE

The technical problems questionnaire consists of the following sections:

1. System Design,
2. Master Scheduling/Capacity Planning,
3. Information Quality,
4. Inventory Management, and
5. Rescheduling.

Each section should be completed by the individual responsible for that activity. Two types of questions are given: Yes (Y)—No (N) type questions and short-answer type questions. For the Yes—No type questions, the respondents should circle the appropriate letter. For the short-answer questions, the respondents should fill in the information requested in the space provided.

TECHNICAL PROBLEMS

System Design

1. Shop orders are developed from information provided by the MRP system? Y N
2. Purchase orders are developed from information provided by the MRP system? Y N
3. A daily dispatch list is generated which gives priorities of shop orders for each work center? Y N
4. The size for all time buckets is one week or less? Y N
5. Every work-in-process item is maintained by the MRP system? Y N
6. Exception messages are generated on a weekly or more frequent basis? Y N
7. All critical reports are generated at least once a week? Y N
8. A formal procedure exists for correcting the source of each exception on each report? Y N

The MRP system provides:

9. Information for production control? Y N
10. Information for standard costs of labor and materials? Y N

11. Information for marketing planning? Y N
12. Information for cash management? Y N
13. Information for short-range manpower planning? Y N
14. Information for short-range capacity planning? Y N
15. Information for long-range financial planning? Y N
16. Information for long-range manpower planning? Y N
17. Information for long-range capacity planning? Y N

Master Scheduling/Capacity Planning

1. Order promising is accomplished only after an examination of available shop capacity and materials? Y N
2. A production control calendar is used to define major selling seasons during the year? Y N
3. A formal master scheduling procedure is used? Y N
4. A new master schedule is made out weekly or more frequently? Y N
5. A set of formal time intervals (fences) is used to stabilize orders in the master schedule? Y N
6. Changes caused by internal problems (high scrap rates, machine break downs, etc.) are made to the master schedule only after all viable alternatives have been considered? Y N
7. Order completions are uniformly distributed during the master scheduling period? Y N
8. Work centers are loaded in the MRP system by using a formal capacity loading technique? Y N
9. Shop orders are released to the production departments daily only in amounts to fill that day's available capacity? Y N
10. Weekly capacity of the bottleneck work center is used as an estimate of weekly production capacity? Y N
11. A capacity planning technique is used to review the master schedule? Y N
12. A form of input/output analysis is used to measure and review each work center's performance? Y N
13. Less than 5% of the required capacity of a master schedule is created by past due orders from previous schedules? Y N
14. Less than 10% of orders are requested in less than normal leadtime? Y N

What is:

15. The average number of orders in the master schedule? _____
16. The planning horizon of the master schedule? _____
17. The length of the manufacturing cycle time? _____
18. The length of the manufacturing and purchasing cycle time? _____
19. The frequency of planning a new master schedule? _____
20. The average length of time in advance that the master schedule is planned? _____
21. The percentage of orders in a master schedule which are past due? _____
22. The length of the cumulative planning cycle (production plan)? _____

Information Quality

1. A formal procedure is used for reviewing and changing report content and format? Y N
2. The content of the reports exceeds the job requirements? Y N
3. Inventory records have at least 95% accuracy? Y N
4. Inventory records are verified before each generation run? Y N
5. Cycle counting is used to measure the accuracy of inventory records? Y N
6. The causes of inaccurate inventory records are identified and eliminated? Y N
7. Bill-of-material records have at least 99% accuracy? Y N
8. A formal procedure is used for updating bill-of-material records when the product's structure is modified? Y N
9. Bill-of-material records are audited to insure their accuracy? Y N
10. The causes of inaccurate bill-of-material records are identified and eliminated? Y N
11. The routing and production specification files have at least a 99% accuracy? Y N

12. A formal procedure is used for updating the production specifications records as production methods are modified? Y N
13. Production specification records are audited to insure their accuracy? Y N
14. The causes of inaccurate production specification records are identified and eliminated? Y N
15. A formal procedure is used to compare current shop orders to current needs? Y N
16. A formal procedure is used to compare current purchase orders to current needs? Y N

What is:

17. The frequency of reviewing and changing report content and format? _____
18. The frequency of inventory records verification? _____
19. The frequency of bill-of-material records verification? _____
20. The frequency of routing and production specifications records verification? _____
21. The frequency of purchase order records verification? _____

Inventory Management

1. Actual demand is compared with forecasted demand after each period to improve forecasting? Y N
2. Safety stock is utilized in finished-goods inventory to increase the customer service level? Y N
3. A review of finished-goods inventory is used to adjust the product forecast prior to master scheduling? Y N
4. Customer orders are scheduled for production based on customer need date and available capacity? Y N
5. Safety stock is used only for finished goods and spare parts (independent demand items)? Y N
6. Service parts and allowances for defects are included in the master schedule? Y N
7. The lot-sizing policy produces balanced or complete sets of product components (except for service parts and allowances)? Y N

8. All inventory items are identified by use of a shop order or inventory labeling system? Y N
9. The quantity of required work-in-process inventory on the shop floor is controlled by examining the queue at the bottleneck work center? Y N
10. Cycle counting of work-in-process inventory is performed weekly to verify inventory records? Y N
11. A pegging technique is used to identify the source of material requirements? Y N

What is:	Implementation Before	After
12. The customer service level based on the percentage of customer orders that are filled from finished-goods inventory?	_____	_____
13. The customer service level based on the quantity of items that are filled from finished-goods inventory?	_____	_____
14. The customer service level based on the dollar value of customer orders that are immediately supplied from finished-goods inventory?	_____	_____
15. The average duration of a stockout?	_____	_____
16. The average dollar amount of a stockout?	_____	_____
17. The average leadtime for a customer order that can't be filled from finished-goods inventory?	_____	_____
18. The frequency per week of customer complaints due to delayed deliveries of orders?	_____	_____

Rescheduling

1. Rescheduling of previously planned production orders requires little of the production scheduling time? Y N
2. Priorities of shop orders are maintained with little need for expediting? Y N
3. A daily routine is used to review and clear exceptions to the planned production schedule? Y N
4. A formal policy exists for rescheduling previously planned production orders? Y N
5. Rescheduling occurs only when there is no viable alternative? Y N
6. The backlog at the bottleneck work center is controlled by a daily dispatching technique that considers available work-center capacity? Y N

What is:

7. The percentage of scheduling time spent in rescheduling previously planned shop orders? _____
8. The length of time in which orders can not be changed (time fence)? _____
9. The percentage of expediting time used for expediting orders? De-expediting orders? _____

INSTRUCTIONS FOR THE MANAGEMENT PROBLEMS QUESTIONNAIRE

The management problems questionnaire is to be answered by the manager most knowledgeable about the managment responsibilities associated with the MRP system. Questions are given in a Yes (Y)—No (N) type format. The respondent should circle the appropriate letter corresponding to each question.

MANAGEMENT PROBLEMS

Forecasting

1. Is a specific individual assigned the responsibility of forecasting? Y N
2. Is this individual's performance monitored? Y N
3. Is this individual held accountable for the accuracy of forecasting? Y N
4. Is this individual held accountable for identifying the causes of errors and correcting them? Y N

Production Planning

5. Is a specific individual responsible for the overall development of the production plan? Y N

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