MANUFACTURING MANAGEMENT OF ADVANCED TECHNOLOGIES

by

Richard D. Castle, C.Eng., M.I.Mech.E., Grad.Dip.Ed.

Thesis submitted for the Degree of Master of Engineering Science
at the University of Adelaide

Department of Mechanical Engineering

February 1995

Corrections to be pasted opposite page ii.

piii Section 9.2.3 is page 183 not page 182
p19 Paragraph 1- capital M for Manufacturing
P21 Paragraph 1- contrast not contract
p21 Paragraph 2 - capital T for Technologies
P22 & P31 CSIRO -Commonwealth Scientific Industrial Research Organisation
P22 & P31 VAM - Value Added Manufacture
P99 Section (a) - capital C for Capacity
P100 Paragraph 2 - capital T for Thesis
P140 Heading of bottom block - FINISHED GOODS
P172 Q112 - Mid -94 to 1995
P198 Mismanagement if the technology; change if to of

TABLE OF CONTENTS

Page

ABSTRACT 1

SIGNED STATEMENT 4

ACKNOWLEDGMENTS 5

NOMENCLATURE 6

LIST OF FIGURES 8

LIST OF TABLES 9

1. INTRODUCTION 10

2. AUSTRALIA'S MANUFACTURING STATUS 13

3. ADVANCED MANUFACTURING TECHNOLOGY 19
   - 3.1 AMT and WCM 19
   - 3.2 AMT Listing 22
     - 3.2.1 AMT Brief Description 23
   - 3.3 Importance of AMT 25
   - 3.4 AMT and South Australia 28
   - 3.5 European View on AMT 30
   - 3.6 AMT - Is It Too Hard? 30
   - 3.7 Integration of AMT's and Human Factors 33
   - 3.8 AMT Register 36
   - 3.9 AMT Integration 37

4. INTERNATIONAL BEST PRACTICE AND BENCHMARKING 38
   - 4.1 Introduction 38
   - 4.2 The New Workplace Culture 40
   - 4.3 Benchmarks for Manufacturers 41
   - 4.4 Thinking About Benchmarking 42

5 ACTIVITY BASED COSTING 44
   - 5.1 Why Use It? 44
   - 5.2 A Need to Change Accounting Practices 46

6 SOCIO TECHNICAL SYSTEMS 49
   - 6.1 The Need 49
   - 6.2 Changing Workplace Culture 50
   - 6.3 STS World Class 52
   - 6.4 People and Technology 53
   - 6.5 STS Case Studies 53

6.6 Teams as Part of Socio Technical Systems 56
6.7 Union Support for Teams 58
6.8 Empowering Teams 59
6.9 Warnings for Teams 60
6.10 Team Successes 61

7. MANUFACTURING RESOURCE PLANNING (MRP II)
MATERIALS REQUIREMENTS PLANNING (MRP) 63
7.1 Introduction 63
7.2 Basics of the System 63
7.3 Language of MRP 65
7.4 MRP is a Methodology not a Computer System! 65
7.5 Four Absolute Pre-Requisites for MRP 67
7.6 Is It Too Late to Start MRP? 67
7.7 Manufacturing Systems 68
7.8 MRP - Closing the Loop (MRP II) 76
7.9 MRP II Systems - People Prepared to Spend 77
7.10 MRP Why Not Universally Successful? 77
7.11 International Standards for MRP 80

8. SURVEY - COLLECTION OF DATA ON AMT MANAGEMENT 86
8.1 Introduction 86
8.2 Survey Methodology 86
8.3 Companies and People Involved in the Survey 87
8.4 Companies Main Products 89
8.5.1 MRP System - Survey Results/Comments 91
8.5.2 MRP Installation Phase - Survey Results/Comments 100
8.5.3 MRP People - Survey Results/Comments 107
8.5.4 MRP Training - Survey Results/Comments 114
8.5.5 MRP Scheduling - Survey Results/Comments 119
8.5.6 MRP Forecasting - Survey Results/ Comments 126
8.5.7 MRP Bills of Material - Survey Results/Comments 128
8.5.8 MRP Part Numbering Systems - Survey Results/Comments 133
8.5.9 MRP Inventory - Survey Results/Comments 138
8.5.10 MRP and Kanban - Survey Results and Comments 144
8.5.11 MRP Lead Time - Survey Results/Comments 147
8.5.12 MRP Routes - Survey Results/Comments 152
8.5.13 MRP Capacity Planning - Survey Results/Comments 156
8.5.14 MRP Survey Summary 161
8.6 Work Team - Survey Results/Comments 162
8.6.1 Work Team Survey Summary 170
8.7 Activity Based Costing - Survey Results/Comments 171
8.7.1 ABC Survey Summary 175

9. SURVEY SUMMARY 176
9.1 Data Review and Thesis Reflection 176
9.2 General Comments of Managing MRP 178
9.2.1 MRP - What's Needed 180
9.2.2 Failure of MRP System, its people who manage it 181
9.2.3 Japanese Management - Perspective 182

10. RECOMMENDATIONS 184
10.1 General Management of AMTs 184
10.1.1 Checklist 184
10.1.2 Benchmarks 184
10.1.3 Selection of Specialist Help 184
10.1.4 Keeping up to Date with Change 185
10.1.5 Education 186
10.2 MRP 187
10.2.1 System Basic Requirements 187
10.2.2 MRP Rating and Benchmarks 187
10.2.3 Continuous Review - Extended Checklist 189
10.2.4 Training for MRP - Video Your Own 189
10.2.5 Cross Functional Awareness 190
10.3 Socio-Technical Systems 190
10.3.1 SMWT - Task Migration 190
10.3.2 Empowerment 191
10.3.3 SMWT - Installation Speed 191
10.4 Activity Based Costing 191
10.4.1 Awareness 191

11. MANAGING AMTs - THE FUTURE 193
11.1 Vision 193
11.2 Future Trends 195
11.3 Enterprise Resource Planning 195
11.4 Survival 197
11.5 People and AMTs 197

12. CONCLUSION 198

13. REFERENCES 200

APPENDICES

MRP Logic Calculation

MRP and MRPII Basic Introduction

Questionnaire

ABSTRACT

This Thesis is published for the Mechanical Engineering Department of the University of Adelaide as a requirement for a Master of Engineering Science Degree. The focus of the research is based on Management of Advanced Manufacturing Technology.

The Thesis was compiled on a part-time basis from 1990 to 1994. During this period rapid changes to Australia's economy occurred as Australia continued to disengage itself from European connections and commenced to attached itself to the Asian and Pacific Rim nations. Also the O.E.C.D. countries experienced a massive downturn in demand and Australia experienced the "Recession we had to have", as stated by our Prime Minister, Mr Paul Keating who at the time of the statement was the Federal Treasurer of the Australian Government.

These factors plus the globalisation of competition put immense strains on Australia's manufacturers, and their competitive situation deteriorated seriously. This Thesis researches some aspects of management of Advance Manufacturing Technologies (AMT) that manufacturers should consider to help them become competitive in a global market.

To get a perspective on the importance of Manufacturing Trade to Australia, statistics from the Balance of Payments (BOP) and the Manufacturing Trade Balance are discussed.

A typical listing of AMT's is described and two additional technologies are introduced, Activity Based Costing (ABC) and Socio Technical Systems (STS). Benchmarking and Best Practice also became prevalent activities in manufacturing circles during the course of study, hence they are also discussed.

This Thesis is based on the belief that management (people) are the cause of failure of AMT's, not

the AMT itself. Manufacturing Resource Planning (MRPII) was selected as the AMT to review for this Thesis, particularly how it has been managed, how it was selected, who was involved, what functions of the business were involved in making the system work, what depth of knowledge was available to make the MRP installation successful and what basic data was available.

People make a system work, most research on MRP focuses on the technical review of the system, this Thesis reviews the people interaction in making a system useable. Functional cross relationships are reviewed together with emphasis on the basic system discipline and type of background people have who install and run systems. Training is important, this is reviewed together with techniques of how training was organised.

A questionnaire was developed to assess industry in relationship to MRP management. Also included were some questions on Socio Technical Systems and Activity Based Costing, particularly Self-Managed Workteams (SMWT). The results are published in the text in questionnaire number sequence, followed by comments by the author, plus associated comments from collated written work on the topics from resources in Australia and overseas.

The results show that there is a serious credibility gap in understanding the basic requirements of running a successful MRP system. They also show that existing forms of rating a MRP system are too complex for many Australian users and that a much simpler rating system could much more easily define progressive steps to being a successful MRP user. These are shown in the recommendations.

Socio technical systems are discussed since installing any form of AMTs without considering

people issues is a mistake. Many organisations are changing their current management structure by using SMWT, this is reviewed. Similarly the author believed ABC, was an AMT that would advance the pace of change in manufacturing, the results showed this was not the case.

Recommendations are made for MRP users to use their systems and their people more effectively to meet the challenge of global manufacturing and conclusions are drawn that AMT's must be managed with acknowledgement that people's involvement in all phases of the use of the AMT should be a paramount consideration.

SIGNED STATEMENT

I declare that this Thesis contains no material which has been accepted for the award of any Degree or Diploma in any University, and that to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference is made in the text of this Thesis.

I consent to this Thesis being made available for photocopying and loan, if applicable and if accepted, for the Degree sought.

Richard D. Castle

ACKNOWLEDGMENTS

I wish to express my gratitude to the following organisations and individuals who have helped me develop this Thesis.

University of Adelaide, Library

Regency Institute of TAFE, Library

APICS Adelaide Chapter

Many manufacturing companies throughout Australia

Australian Bureau of Statistics

South Australian Centre of Manufacturing

Dr C. Cresswell - Senior Lecturer Mechanical Engineering Department of University of Adelaide

Lynda Castle - Typing and Grammatical Corrections

Gail Trembath - Typing, Diagrams, Editing and Charts

Karen Hine - Revision and Final Draft

Lecturers in the Manufacturing Team, School of Mechanical Engineering, Regency Institute of TAFE

Also many managers of companies using MRP who have openly discussed their problems and successes of using their system.

NOMENCLATURE

ABC_1	A Coding System used in Inventory
ABC	Activity Based Costing
ABCD	Oliver Wight Standard of MRP Usage
AMT	Advanced Manufacturing Technology
AMTEC	Advanced Manufacturing Technology Centre (Victoria)
APICS	Australian, Production, Inventory Control Society
BM	Benchmark
BOM	Bills of Materials
BOP	Balance of Payments
BPCS	Business Planning and Control Systems a System Software Associates Software Product
CP	Capacity Planning
FG	Finished Goods
IBM	International Business Machines Company Limited
JIT	Just In Time
LT	Lead Time
MAPICS	Manufacturing, Accounting, Productions, Inventory Control System, an IBM Software Product
MI	Manufacturing Improvement (Scheme)
MPS	Master Production Schedule
MRP	Materials Requirement Planning
MRPII	Manufacturing Resource Planning
MRPIII	MRP, TQM, JIT

MTIA	Metal Trades Industry Association
NIES	National Industry Extension Service
OECD	Organisation of Economic Community Development
QC	Quality Control
QC Os	Quality Circles
RAW	Raw Materials
RCCP	Rough Cut Capacity Planning
SMWT	Self-Managed Work Teams
SPC	Statistical Process Control
STS	Socio Technical Systems
TQM	Total Quality Management
WCM	World Class Manufacturing
WIP	Work in Progress

LIST OF FIGURES

Figure	Title	Page
1	Balance of Payments	14
2	Balance of Payments & Balance of Merchandise Trade	15
3	Balance of Manufactured Goods	16
4	Enterprise Improvement Process	29
5	WCM Organisational Model	34
6	Productivity Assembly Plants/Operations	42
7	Advanced Cost Management	45
8	Manufacturing Costs for Large European Companies	47
9	Manufacturing System MRP Environment	68
10	Manufacturing System MRP II Environment	68
11	Manufacturing System, Mentat	70
12	BPCS CIM Package	71
13	Manufacturing System - Generic	72
14	Manufacturing System - Closing the Loops, Picman	73
15	Manufacturing System Overview - Developed for TAFE Students	75
16	Manufacturing Resource Planning	76
17	MRP Advertisement	79
18	Class A, B, C, D Companies Measurable Benefits	81
19	Class A, B, C, D Companies, Return on Investment	82
20	Checklist for Oliver Wight Class 'A' Accreditation	84
21	Sales Volume Per Year	90
22	Number Employed	90
23	The (MRP) Project Plan	105
23A	BOM Data	130
24	Counting (Inventory)	138
25	Stockturns	142
26	Master Scheduling Flow Chart	146
27	Lead Time	148
28	Routes	152
29	Adjusting Capacity	160

Table	Title	Page
I	Advanced Manufacturing Technologies Listing	22
II	Capacity Planning Comparisons	157
III	MRP Checklist Recommended	188

1. INTRODUCTION

This research Thesis was planned to review some particular aspects of Advanced Manufacturing Technologies (AMT), how companies were using them and what, if any, proposals could be suggested that would enhance the effective output of using such technologies.

During the period of research over four years, some other advances were being focused upon that were also impacting upon a cross section of existing Advanced Manufacturing Technologies. In particular two were identified, Socio Technical Systems and Activity Based Costing. Therefore some aspects of both these topics are included in this Thesis.

Also during the study period much attention has been drawn to International Best Practice and Benchmarking. It would therefore be inappropriate if these were not commented upon and how these practices impact on Advanced Manufacturing Technologies.

There is much jargon used in the manufacturing industries which confuse the outsider and limit understanding in cross-functions of most organisations. Observation could be made that few managers in a marketing function, for instance, understand the manufacturing function and visa versa. On page six and seven of this text some of the abbreviations or acronyms used throughout this Thesis are shown with full descriptions.

Some focus of the research is made on multi-functional involvement in Manufacturing Resource Planning within organisations. A Thesis is made that successful implementation and use of Manufacturing Resource Planning can only be achieved if there is a clear understanding of responsibilities across all functions. During the course of research sometimes initial contact with an organisation was usually with a Switchboard Operator. Requests to talk to someone involved with the manufacturing system or the Materials Requirement Planning was made. Frequently this failed to get any positive response hence questions became more specific. Requests to talk to someone involved in scheduling customer orders or someone in production control, or in production planning or in the supply area was made. It was demonstrated that companies first contact with the outside world, the switchboard people, knew very little about the manufacturing system used by their organisation. A visit to one company which was using an IBM product for its manufacturing software revealed most of the production supervisors were unaware of what MAPICS means, or what Material Requirements Planning was.

It became apparent, therefore, that information about "basics of systems" throughout some organisations was missing.

In the initial stages of this Thesis Advanced Manufacturing Technologies has been identified and details of Manufacturing Resource Planning systems are explained which shows how various data used in the manufacturing process is gathered, collated and dispersed.

As most companies have or are attempting to flatten their organisational structure the importance of people involvement by multi-skilling, task migration, increased training and

then most importantly using that knowledge is focused in Chapter 6 - Socio Technical Systems. This is part of the change affecting our traditional methods of working by involving people in all facets of work organisation and continuous improvement.

Similarly the need to change from traditionally based manufacturing costing practices, to Activity Based Costing is explored in Chapter 5.

A questionnaire was developed (Appendix III) that asked sufficient details of all facets of MRPII so that the recipients of that questionnaire were reviewed in regards to their knowledge of the whole of the manufacturing system. The replies to this questionnaire are shown in full detail in Chapter 8.

In summary, this Thesis reviews how an AMT is used, it demonstrates that full utilisation of the AMT is not possible because people lack the skills and knowledge to make it effective. People are the problem, not the AMT.

Amendment to Introduction
The central research question of this Thesis is that inadequate management is the cause of failure of AMT's not the AMT itself. This Thesis investigates the strengths and weaknesses of management of one particular AMT, that is MRP.
The research methodology selected is based on a personal questionnaire and interview process which was successful in this project in obtaining in depth responses to the major issues in the management of AMT.
The MRP users selected were chosen from a listing of software users involved in MRP and who stated their willingness to participate in the survey.
The feedback received on completeting the questionnaire highlighted to the participants an increased awareness of the problems associated with using MRP.

NOTE:	Much information has been quoted from a variety of sources, these are identified in the text by a numeric system (eg. 23) and then listed in the Reference section where full details of sources is disclosed.

2. AUSTRALIA'S MANUFACTURING STATUS

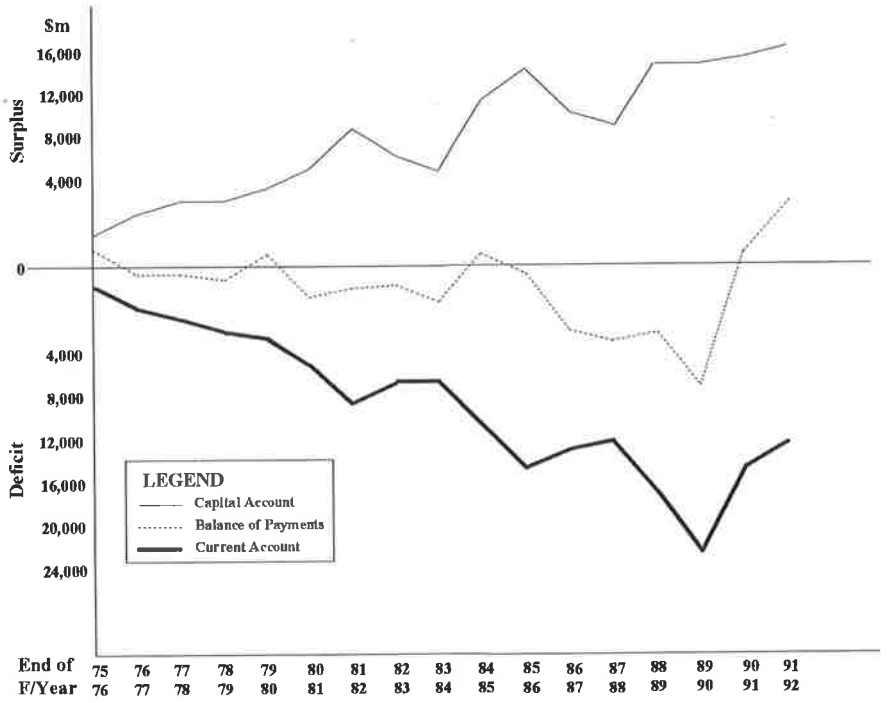
This Chapter deals with the importance of manufacturing to Australia. Manufacturing must be competitive to survive in global markets.

Australia's balance of payments (BOP) is compiled from three major accounting areas. These are the trade accounts, the invisibles (services) accounts and the capital account balance. History shows that Australia's invisibles are generally negative; that is, money spent overseas on insurance, shipping, interest costs and travel, amongst many items in this account, are always in excess of monies received into this country for similar activities. This explains how tourism can help revive our flagging BOP. The Capital Account, on the contrary, has historically always been positive; that is money invested in Australia from overseas always exceeds money invested by Australians overseas.

It would be too simplistic to say that the Invisible and Capital Accounts balance each other, but it could be said that Australia's only method of being successful in our National Accounts balance is for our Trade account to always be positive. Certainly post World War II, Australia's Trade balance was mostly in the positive mode. However, in the 1970's and 1980's our trade balance began to change. This is shown in the following charts.

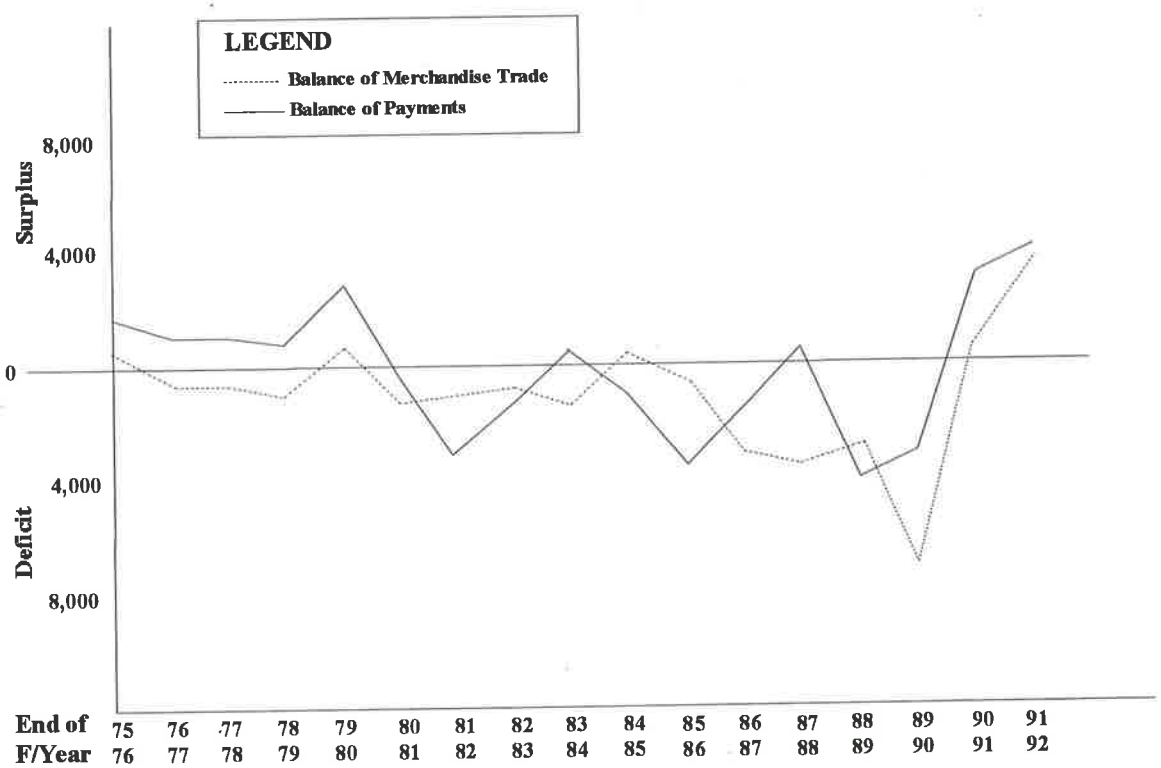
Figure 1, shows Australia's BOP, Capital Account and Current Account. Figure 2, shows the Balance of Trade and BOP, and it can be seen how the BOP seems to be closely linked to the Trade balance. If we now look at the Manufacturing part of the Trade balance, Figure 3, an even worse situation occurs. The exports of manufactured goods has only increased slowly while the imports of similar goods grew rapidly in this period. Note the growing gap.

Figure 1 - **BALANCE OF PAYMENTS**



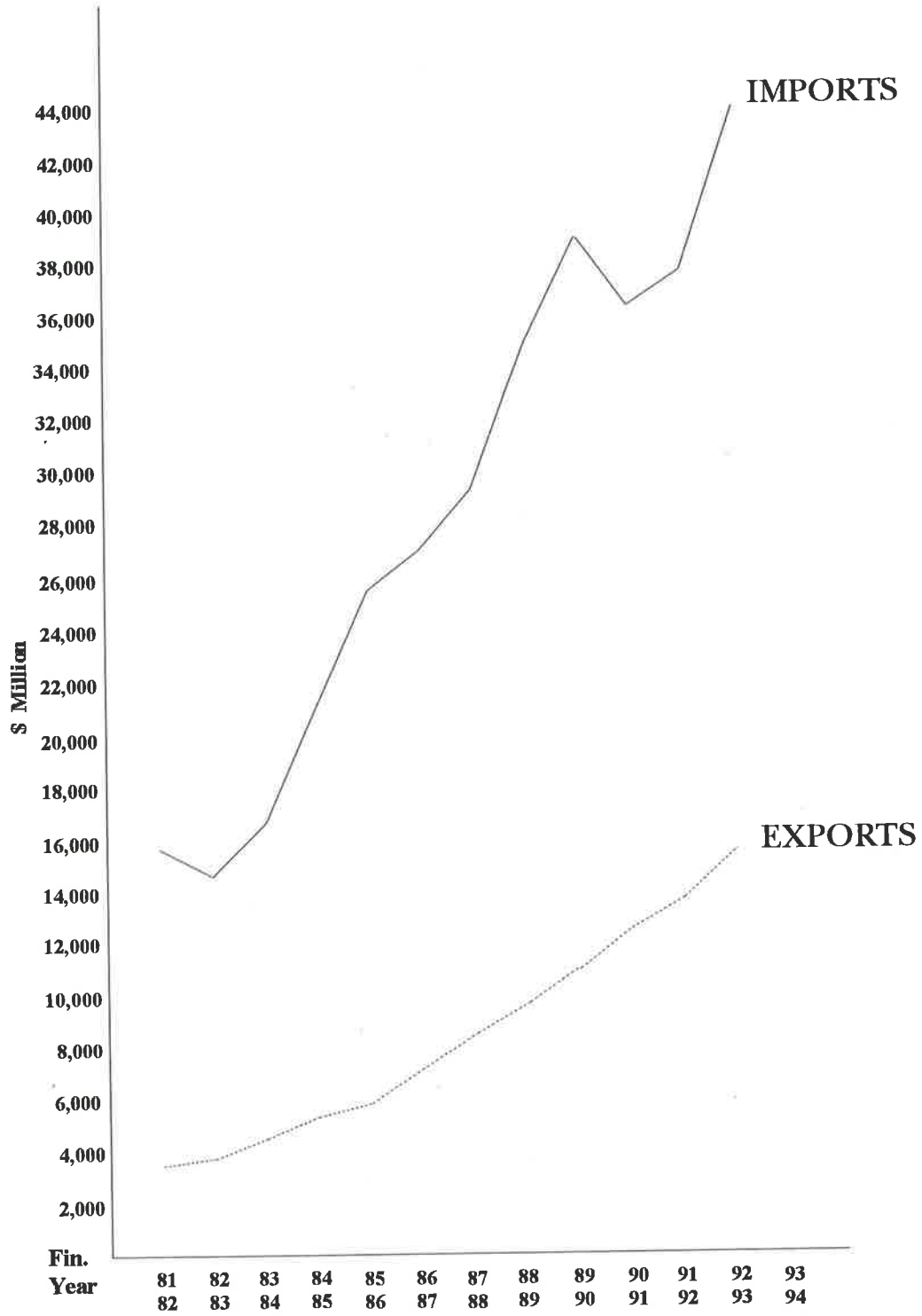
(Source - Australian Bureau of Statistics)

Figure 2 - **BALANCE OF PAYMENTS AND BALANCE OF MERCHANDISE TRADE**



(Source - Australian Bureau of Statistics)

Figure 3 - BALANCE OF MANUFACTURED GOODS - IMPORT/EXPORT



(Source - Historical Imports Exports Commodities
Foreign Trade
Australian Bureau of Statistics
1993, September Quarter only SITC Codes 6, 7 and8 on trade figures used)

It is pleasing to note, however, that in recent periods there is a small sign that this trend is changing and that Australia's ability to export manufactured goods has marginally improved. Certainly there is much focus on the Australian economy in general that need to be improved.

The Australian Manufacturing Council underlined the importance of manufacturing in the economy in its Executive Summary [1] of a 1988 report on Manufacturing Industry: Making it Together, they state: "Manufacturing is a vital part of the economy. Australia can ill afford to step away from its problems. It accounts for around 16% of GDP and 45% of current exports. It comprises the kernel of the nation's technical skills, which are vital in primary resource industries as well. No other country of significant size has been able to sustain a high standard of living over a long period without a strong manufacturing base."

Small manufactures are now contributing to Australia's export success, in an article in ANZ Bank's Business Update[2] they quoted from a study by McKinsey and Company, and the Australian Manufacturing Council on small or manufacturing companies with export sales of between $2m and $50m a year that in 1990-91 the sector contributed $9.4 billion to Australia's total exports of $52 billion.

A 1988 Report[3] emphasised that manufacturing as a percentage of GDP is falling with all the consequences to living standards that implies. The level of Australia's trade deficit has been the subject of much attention, however, what is often not mentioned is that the deficit is really a manufacturing deficit. The trade deficit in manufactured goods amounted to $19.9 billion in 1988/89. A further problem is the composition of Australia's manufactured

exports. Only $4.5 billion has a high 'value added' (elaborately transformed manufactured goods such as car engines, scientific equipment, etc.) component. Remaining 'manufactured' exports of about $16 billion comprise raw materials which have received limited processing. It is significant that 72% of Australia's imports comprise manufactured goods.

In a paper presented to the Society of Manufacturing Engineers, [4] the author used data from the Australian Bureau of Statistics to show the changes in Australia's Gross Domestic Product, Balance of Payments and Manufacturing Balance of Trade.

The paper tried to show how important Australia's manufacturing was to the survival of the pleasant lifestyle enjoyed by most Australians. Since the paper (1991) Australians have been made aware by the Federal Government the need to increase the export of manufactured goods. Much improvement in the last three years has been made as more companies join the export train. But as those export markets are located and fed, so will competitors try and snatch them from Australians. Many companies visited by the author of this Thesis in the last four years, do not demonstrate business goals of being world class, but do demonstrate a keenness to export. Unless they move to world class status with their technologies and human factors, they will find short term exports and long term failure.

3. ADVANCED MANUFACTURING TECHNOLOGY

3.1 AMT and WCM

It is important for organisations to effectively use AMT's to become competitive in a global market. How they use the AMT is dependant upon how well people understand the technology. The following briefly explains some background to AMT's and the link with World Class manufacturing concept.

Advanced Manufacturing Technology, or AMT as it is frequently referred to, was a phrase coined in the early 1980's. It was a phrase that described some technologies, processes or systems that all manufacturers should be aware of and if they were not they should be looking at introducing them or some of them into their business.

The downturn of western world economies in 1982 forced companies to look at the cost of running their businesses and shed as much of the excess costs as they could. Inventory holding was a major cost. Using outdated technologies was a cost burden and as technology became available (eg robotics) to replace labour, labour itself came under close scrutiny for reductions. It was during this period that another term was accepted as a target for companies in manufacturing and that was World Class Manufacturing (WCM).

The author's definition of WCM is "compete profitably in world markets through policies and total quality management, maximisation of new technology and people's efforts."

WCM was also defined by the then Federal Minister of Industry, Technology and Commerce, Senator John Button in 1989, as

WORLD CLASS MANUFACTURING IS

"Producing the right quality products at the right price,
at the right time and place, to satisfy customer demand."

"The products must be better in some way(s)
than competitive offerings."

Another definition of WCM in an editorial in the Engineering News (UK) April 1990 states:

WORLD CLASS MANUFACTURING

Compete profitably in world markets through policies of total
quality management and maximisation of new technology.

Henry Ford [5] in 1926 said, "the purpose of manufacturing is to perform the greatest possible service, which in a business way means doing all that is in one's power to manufacture or distribute the largest possible amount of goods at the highest quality and the lowest possible costs".

Ford's statement is about being World Class, nothing significantly different from the statement made by John Button. World Class companies have a new set of rules, claims the Technology Transfer Council, [6] in their information about World Class, they chart progress by measures that are not traditional:

- lowest possible cost productions.
- perfect quality.
- deliver exactly to customer requirements.
- exactly the right products at the right price for current customer wants and needs.
- shortest possible lead time from receipt of order to receipt of final payment.

The author's definition in contract to Senator Button included the emphasis on the **involvement of people** in the practice of WCM. This was done because we were continuously told that people were our most valuable resource. This was highlighted in Ken Wantuck's exposé to JIT when he visited Australia in 1983 and a quote from his handbook on JIT [7] shows the importance of people: "Let us make the decision as a group because we are going to be jointly affected by that decision.....In a manufacturing plant you want the workers to make their own operating decisions and to do for themselves as many things as possible."

The Victorian Government had funded some research into Advanced Manufacturing technologies which they published in 1987. This publication titled Advanced Manufacturing Technologies[8] satisfactorily identified the various technologies that Australian manufacturers considered advanced, and the author selected to fully investigate the use and level of achievement of companies using one of those particular advanced technologies, that is Manufacturing Resource Planning.

3.2 AMT Listing

A list of AMT published in 1987 by the Advanced Manufacturing Technology Centre, Victoria, is shown in Table 1.

Table 1 - ADVANCED MANUFACTURING TECHNOLOGIES LISTING

MANUFACTURING FUNCTION	ADVANCED MANUFACTURING TECHNOLOGY
PRODUCT AND PROCESS DESIGN	COMPUTER AIDED DRAFTING DESIGN AND ENGINEERING GROUP TECHNOLOGY, AND COMPUTER AIDED PROCESS PLANNING
MANAGEMENT AND CONTROL	MANUFACTURING RESOURCES PLANNING JUST IN TIME TOTAL QUALITY CONTROL
PRODUCTION PROCESS	NUMERICAL CONTROL MANUFACTURING FLEXIBLE MANUFACTURING CELLS AND SYSTEMS INDUSTRIAL ROBOTS WELDING, CUTTING AND LASERS
INSPECTION	COMPUTER AIDED INSPECTION AND TEST
INTEGRATION	COMPUTER INTEGRATED MANUFACTURING COMPUTER AIDED DESIGN AND MANUFACTURE MANUFACTURING AUTOMATION TECHNICAL OFFICE PROTOCOLS

It is interesting to note that the Advanced Manufacturing Technology Centre, AMTEC, is a joint venture between the Victorian Government, CSIRO, MTIA, Australian Chamber

of Manufacturers and Prime Computers. A brief description of each technology follows.

3.2.1 Brief Description of AMT's

The advanced manufacturing technologies described in Table 1 have been classified by function into the following groups:

- Product and Process Design
- Management and Control
- Production Processes
- Inspection
- Integration

Each AMT is defined under these functions.

Production and Process Design

Computer Aided Drafting, Design (CADD) *and Computer Aided Engineering* (CAE) use computer graphics and information processing as a tool for product design and analysis, and the preparation of engineering drawings and documentation.

Group Technology (GT) *and Computer Aided Process Planing* (CAPP) are approached to product and process design that seek to generate efficiencies and savings by recognising similarities between different problems and situations.

Management and Control

Manufacturing Resources Planning (MRP II) is a comprehensive computer-based information system for the planning and control of the manufacturing resources of a company, including labour, materials, plant and finance.

Just In Time (JIT) is a manufacturing management strategy and related techniques which seek to maintain a smooth material flow while minimising inventory.

Total Quality Control (TQC) is an operational philosophy and related techniques

which seek to establish total manufacturing systems that are focused on meeting the quality requirements of the customer.

Production Processes

Numerical Control Manufacturing (NC) is a technology which allows the operations of individual production equipment to be preprogrammed into a "Controller", and then to be performed by the equipment with little or no human intervention. The Controller can be reprogrammed readily to change the operations performed.

Flexible Manufacturing Cells (FMC)*and Flexible Manufacturing Systems* (FMS) are created by linking a group of numerically controlled machines in a way which makes it possible to produce a mixed batch of similar components with little or no direct human intervention.

Robotics is a production technology which enables the accurate and repeatable movement of materials, parts, tools or other special devices through paths that have been programmed into the robot machines. The robots can be reprogrammed readily to change the movement paths.

Welding, Cutting and Laser technology are direct cutting/joining production technologies which have undergone considerable recent development.

Inspection

Computer Aided Inspection and Test, (CAIT) *Co-ordinate Measuring Machines* (CM) *and Vision Systems* (VS) use recent advances in control and sensing technologies for measurement, inspection and testing.

Integration

Computer Aided Design and Manufacture (CAD/CAM) involves the direct transfer in manufacturing instructions between Computer Aided Design systems and Numerical Control Manufacturing equipment.

Computer Integrated Manufacturing (CIM) is the company-wide direct computer-based linkage of design, production, control and inspection systems to form an integrated manufacturing network.

Manufacturing Automation Protocol (MAP) *and Technical Office Protocol* (TOP) are standards that enable the communication links between computer controlled manufacturing equipment to be established relatively easily.

In addition two other technologies developed in the latter part of the 1980's and early 1990's which were of great interest to the author because they encapsulated the involvement of people in the AMT's described above and also proposed changes to manufacturing costing practices. These two technologies are identified as Socio Technical Systems and Activity Based Costing Systems.

Socio Technical Systems (STS) is recognising that the organisation and people will change as AMT's are introduced. It is about job re-design, organisational development, training, information sharing, team building and other human factors that need to be integrated into the new technologies.

Activity Based Costing (ABC) is a manufacturing costing system that accurately distributes costs to the products that consumes the resources used in the administration and processes to produce the product.

3.3 Importance of AMT

In an article from a NIES magazine [9] it claims Advanced Manufacturing Technology (AMT) is increasingly vital for many Australian manufacturers. It is helping to make them

busier, better, smarter. The article also uses a case study to emphasise AMT effect: "Sheet metal parts whip through Motoman's (robot) grasp with fascinating precision for hole punching, notching, folding and palletising. The 200 plus staff (at Brivis Australia Pty Ltd, Melbourne) and contract workers perform work that humans handle best; robots do their own thing. Brivis is a company that has developed major competitive strategic advantage based on AMT during the last eight years."

Many manufacturers now recognise the importance that AMT play in getting new products to market faster. Donald Reinertsen in an article on this topic [10] warns of some myths associated with shortening the product development cycle. The sequential approach to planning in the traditional sense precludes concurrent planning and design. Quick moving companies work with a mere skeleton of a specification, they don't wait for a full specification that has subsequently lots of changes anyway. These companies emphasise extensive contact between customers and designers and position high powered marketing talent on design teams.

Successful companies focus on customers, speed of product introduction, they relate to shorter life cycles of products and utilise many assets of AMT to gain their competitive edge.

Professor Danny Samson[11] believes that TQM is the single biggest opportunity for Australian organisations to become more competitive in the 1990's, whether they be service providers, manufacturers, public sector departments or agencies.

Throughout the world many reports have been commissioned to investigate why manufacturing companies remain inefficient and unable to compete in the global markets. One such report, Advanced Manufacturing Technology[12] was presented by the Advisory Council on Science and Technology (UK) for the British Government in 1991. The critical report sees that the salvation for uncompetitive manufacturing industry was increased take up of advanced manufacturing technology and that the swiftest and richest rewards are offered by 'computerised centred' operations, and by information technology. Instanced in the report are: continuous flow manufacturing for management of the entire cycle from order to deliver; computer integrated manufacturing for flexible control of design, development and production in response to market demand; concurrent engineering for the integrated planning of design and manufacture; automation and robotics for unit processes and their interactions; and electronic data interchange between customer parts supplier and manufacturer.

The report insists that none of the above can succeed unless practiced in accordance with appropriate overall strategy, and that strategy must have three essential elements:

- assessment of competitors' performance
- financial justification
- attention to human factors

The report is a confirmation of the findings of this research Thesis that unless human factors are considered AMTs will not succeed.

3.4 AMT and South Australia

The South Australian Centre for Manufacturing produced a booklet in early 1991 about World Competitive Enterprise.[13] Reproduced in Figure 4 is their chart of the Enterprise Improvement Process. Under the heading Advanced Management Methods and Techniques, they have listed:

TQM

Quality Systems

Manufacturing Systems (MRP, JIT)

Lean Production

Benchmarking/Best Practice

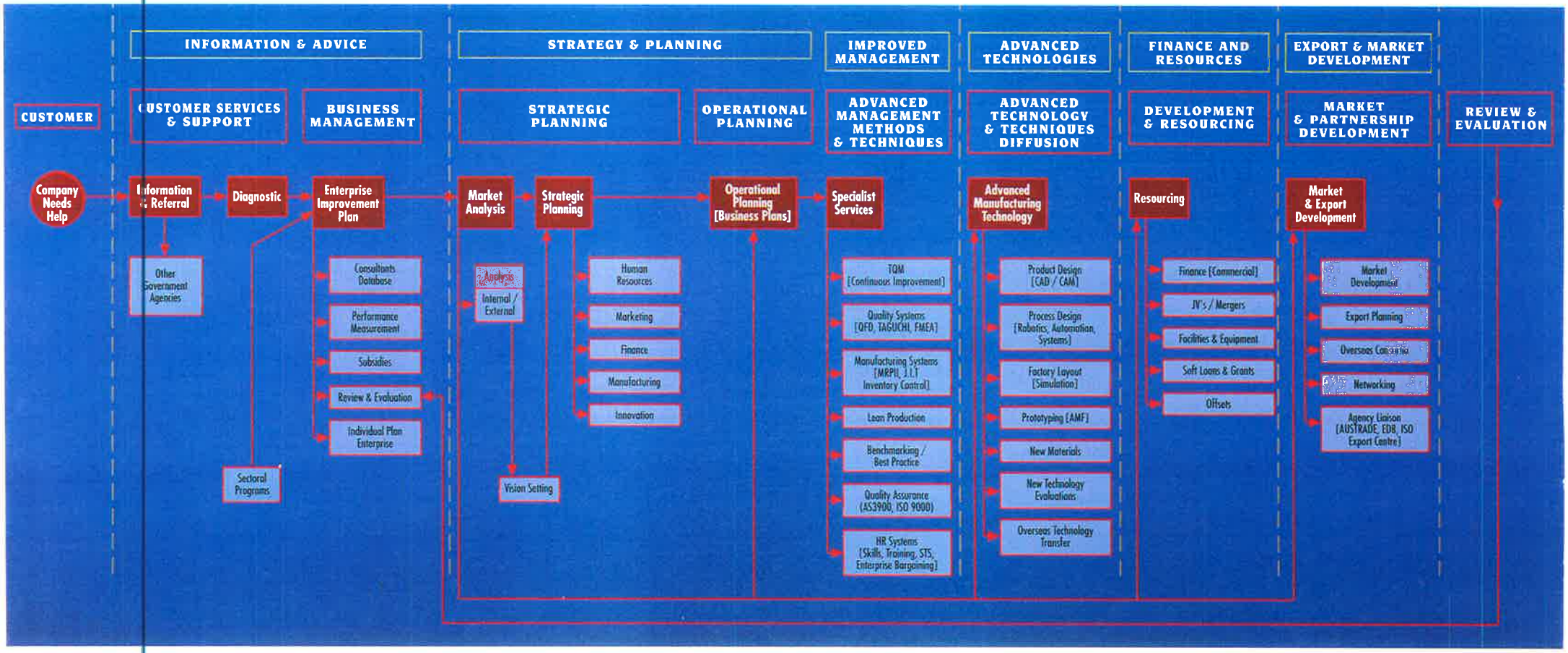
Quality Assurance

Human Resources Systems

The Arthur D. Little report on South Australia's economy in 1992 [14] was reported on by Alex Kennedy in Business Review Weekly. He quotes from Little's report the Government (SA's) has neither planned for, nor responded adequately to, tariff reductions, technological changes or globalisation. The State has a lack of preparedness to respond to the new requirements for global competitiveness.

Figure 4

THE ENTERPRISE IMPROVEMENT PROCESS



The Little report indicated more government policies to update existing industry's and attract new advanced technology manufacturers as the State's wealth generation in 1992 would not support the public sector expenditures.

The National Industry Extension Service (NIES) [15] an Australian organisation set up to promote excellence in manufacturing and offering government subsidies to help company's move to becoming world class, set up a program AMT Investment Evaluation Guidelines in 1992. The program was to help manufacturers plan their AMTs strategy.

3.5 European View on AMT

A European Study Mission to Japan in 1982 [16] to view their Flexible Manufacturing Systems saw many companies, their systems and their people. One conclusion from a report on the Mission, states, "What should we do? This is the acid question, and the most straightforward answer is for us all to change our attitude to work; union, management and individuals at all levels." The report details how well organised plants were, how little downtime there appeared to be, how production people carried out minor maintenance procedures on equipment. [Note: There is still argument in Australia about this topic in 1994, remembering the above report was written in 1982.]

3.6 AMT - Is It Too Hard?

There is another view that instead of using high technology AMT's, manufacturers should pay much more attention to the basics of manufacturing. Many visitors to Japanese manufacturers are confronted with simple systems of 'doing things right', not sophisticated

computer systems. Some other company's around the world are emulating 'doing things right' in their business. Professor Dell K. Allen from Brigham Young University [17] writes "On a recent trip to McDonnell Douglas plant ..... production staffers had something else to show, a shadowboard, a panel with hooks and pegs for finished parts. Black painted shadows highlighting missing parts. When the board was filled, the parts were kitted and delivered to assembly some 20' away. Have we been carried away by high-tech hype, I wondered? Integrated manufacturing is a must, but computer-integrated manufacturing remains a question mark. Government agencies and giant firms have spent billions of dollars on CIM without producing a single truly integrated manufacturing enterprise. We know that installing, debugging and maintaining high-tech systems isn't practical in most of the world. Why don't we look for solutions that depend on human intelligence, co-operation and teamwork? Let's use our heads."

Many people must have taken regards to Professor Allen's words (and other authors) because since the article was written in 1991 there has been a great emergence in western companies of the 'team' approach to working. It is on a roller coaster ride!

It is often stated that management do not have the skills to use AMTs, and that many managers are not aware of the techniques that are available to help them become more productive. Victor Bivoltsis [18] writing in Factory Equipment News, put the situation in a different perspective when commenting on a Federal Government study by the Senate Standing Committee on Industry, Science and Technology, titled People and Technology - New Management Techniques in Manufacturing Industry, he writes "the new management techniques it (the study) refers to are VAM, VAM-M, TQC, TQM, QC, JIT, MRP, MRP II, CPP and AMT, including FMC, FMS, CAD, CAM, CAE, CIM and IM. So the first

questions is: Hands up all those executives who can say what each acronym stands for? Hands up all those who can say what each one is about? Written in the early 1990's, the report says an examination of the extent to which new management techniques have been implemented in Australia showed not only a low level of implementation but also a low awareness of the techniques and the productivity benefits that ensue.

There continues to be a debate between the ACTU and Employers organisations about the credibility of Australian management. In a discussion paper, 'Improving Australia's Competitiveness',[19] there was argument from both sides, that the issue of management skills has become a significant one in Australian political and economic debate recently. Mr Bill Kelty, Secretary of the ACTU, has been highly critical of management abilities, as reported in the Australian Financial Review. While urging unions to learn to adapt and become more closely involved in decision making processes, Mr Kelty fired off several salvos against private employers, suggesting that he 'confronts day to day some of the most troglodyte people who are running this country. We have a major problem in this country, a management class that is by and large incompetent. Therefore the Government and Unions have a greater responsibility to lead.' Business people countered with 'there is some truth in the suggestion that Australian management needs to be more aggressive and positive. Where there are inadequacies they result from the past relative comforts of protected markets and strong world demand for commodities.'

These comments sum up the attitudes of the mid 1980's, 'She'll be right mate!' Australians had graduated from living off the sheeps back, to living off the resources boom; in the early stages of the 1990's we are now in a very competitive global market. Those insurances, the sheep and minerals have gone. We have to learn to manage the

manufacturing businesses while they still last. Some have time left, for others time is fast running out.

3.7 Integration of AMT's and Human Factors

An Australian National conference organised by the Graduate School of Management, University of Melbourne in 1991,[20] demonstrated that the topics chosen were there to provide the link between AMTs and the Human Factors. A flyer from the course showed the conference addressed key issues of manufacturing competitiveness, including Benchmarking, total quality management, just in time, technology strategy and human resource management in the workplace.

This again confirms a view that AMTs can only work when linked to human factors.

A vision of a company's organisation structure in operating a world class manufacturing organisation was developed in a paper by David F. Ross.[21] He claims that to be successful companies need to be structured around a culture that promotes competitive advantage, secondly, they must possess well defined and closely integrated information flows that permit continuous improvement in planning and decision making. Finally, they must be committed to training, education and motivating people.

Figure 5 shows Ross's model for world class organisation. The base is the business vision!

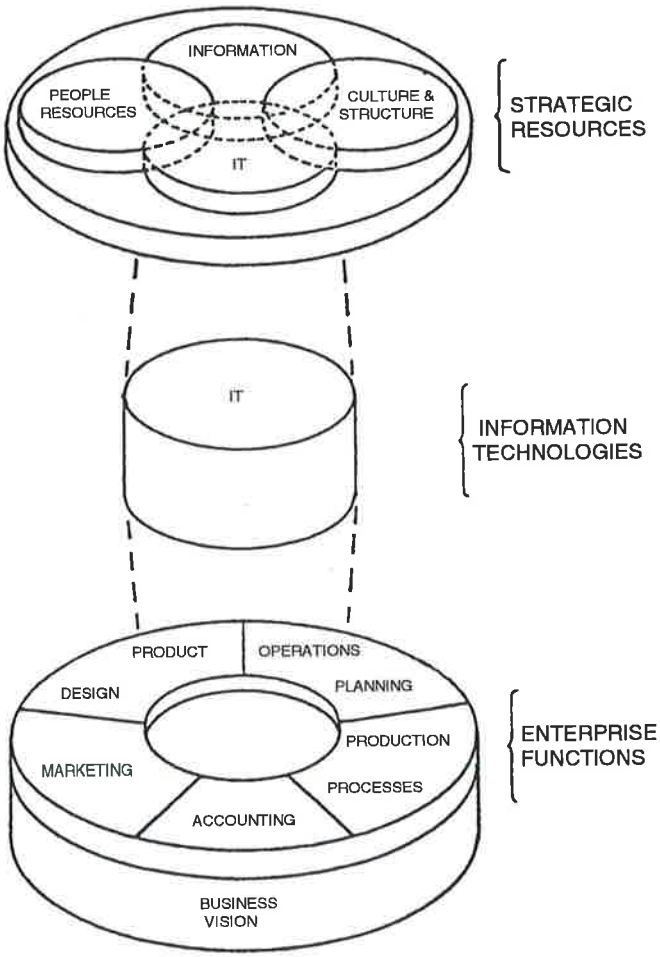


Figure 5 **WORLD CLASS MANUFACTURING ORGANISATIONAL MODEL**

The need for change in both skills and attitudes in the manufacturing sector were identified in a Commonwealth Senate report to parliament on 'People and Technology'. (22)

The report in the section dealing with 'Action for Change', makes comments that it is imperative that companies embrace the notion that co-operative management, together with the implementation of appropriate manufacturing techniques, will improve productivity and efficiency, improve management/workforce relationships and make the

company more 'successful' so that it can take its place as a world competitive company.

From the sources quoted in this research Thesis, it could be stated that the message is clear, embrace technology, organise your people into new ways of working (teams) and the company will be successful. The message is clear, but it is not until clear goals are established at all levels, in all businesses, that are freely accessible to the customer (who buy the product or service) will the message be acted upon by the majority.

When Cincinnati Milacron [23] installed a flexible manufacturing system they produced a paper on some managerial lessons gained from the project, Human Issues. It said that 'Technology is the key to the future, but people are the key to technology.' Human issues were deemed to be the biggest problem in implementing the FMS. The report stated the importance of training and involvement of the people. They claim the human issues as being 90% of the project.

From the data gathered during this research it was obvious that the human factors are hardly considered in an MRP or any other AMT project. Surely a lesson to learn!

Associate Professor Fred Zockel of the University of Adelaide, spent some time in Germany in 1992. In an article Zockel [24] is quoted as saying, "(I) he found it interesting that the concerns of senior management in Germany were similar to those expressed in Australia - high wages, short working hours and how to implement the techniques which seem to be working in Japan."

The techniques working in Japan are innovative design that customers want, short design lead time, statistical process control, quality circles and a homogenous workforce with a strong work ethic. Ask the Japanese honeymooners in Sydney how long is their holiday? Ten days would be the answer and that would be the longest holiday in their life!

Another significant statement on integration of AMTs and human factors was made in a report for the Australian Manufacturing Council.[25] The report made several recommendations for improvements in manufacturing and in Part III recommended accelerated dissemination of the 'New Workplace Culture'. This represents international 'best practice' in manufacturing, but can currently be seen in Australia in only a handful of the best managed firms. It involves a combination of:

- Advanced Technology
- Techniques such as JIT and TQM
- High Rewards for Skill and Commitment to Skill Developed
- Flexibility of Workplace Organisation
- Employee Empowerment through use of Work Teams.

Again emphasis was placed on advanced technology and work teams (the human factor). It could be concluded that what AMTs, and in particular MRP II lacks is involvement of skilled people to work the system.

3.8 AMT Register

The Australian Federal Government commissioned Practime Australia Pty Ltd [26] to develop a capability register of local firms and other organisations that provide products,

systems and services related to AMTs. The aim of the register published in 1992, was to provide information on products and services for potential AMTs users and also to provide investment evaluation guidelines to help firms evaluate AMTs. The Government seems to have the initial idea correct, correlate the available information. Unfortunately, most users of AMT's seem unable to tap into such a valuable resource.

3.9 AMT Integration

Advanced Manufacturing Technologies seem to have an excellent resource base, promoted by governments but with that essential element missing, the human factor. The people who may need to use AMT's or are in fact using them but not to their full advantage, seem to be a class of wandering Bedouin tribes people going around from waterhole to water hole, hoping that the next hole has more water. AMT's need investment in people not just the technology.

4. INTERNATIONAL BEST PRACTICE AND BENCHMARKING

4.1 Introduction

An integral part of WCM is a focus on strategic planning. As part of a WCM package distributed by the South Australian Centre of Manufacturing, manufacturing companies were encouraged to start planning long term; that is, plan their business objectives over at least a three to five year period. Companies were asked to state their strengths and weaknesses and focus their opportunities on their strengths. In developing such plans, objectives were set, often with some means of measuring them. It is often stated in management that "you cannot manage if you can't measure it." To this end, a term frequently used was: "What aims do you have? What goals do you want to reach?" Because strategic planning was, to many of these companies, the first time that they had looked beyond one financial year's plan, many hadn't experienced setting long-term goals. While having no experience in setting goals it was also necessary to conceptualise what was achievable. A world-wide move developed in 1991 that helped focus on those goals, this was International Best Practice and Benchmarking.

The idea behind these goals was to enable organisations to measure their own performance against goals achieved by other organisations recognised as achieving a world class level of performance, hence they became a benchmark.

Benchmarking is about measuring up to world standards. In an article in the Advertiser Newspaper columnist Malcolm Newell [27] revealed that the fashionable chatter about quality standards and world best practice suggests many Australian companies are taking a long hard look at how good they are compared with firms worldwide. He quotes some

benchmarks from a Cullen Egan Dell survey that come up with some interesting averages.

The survey shows that :

Sick Leave, average firm employees take 3.9 days per year. Public sector employees take 6.0 days, most efficient firms employees take 2.5 days.

Staff Turnover, excluding retrenchments and sackings, is a debilitating 11.2% a year, the top quartile organisations are holding turnover down to 5.1%.

Recruitment Costs, an average firm takes 24 working days to fill a clerical vacancy, the most efficient companies 12.5 days.

Rolf Smith writing in the Age Newspaper [28] says industry-wide studies have found sweeping differences between performances in different countries. A Bureau of Industry Economics study highlighted the dismal performance of the Australian cement industry compared to world leaders. While Australian workers produced an average 2 000 tonnes per year, their counterparts in the US produced 5 000 tonnes and in Japan 10 000 tonnes.

This demonstrates the importance of Benchmarking to give everyone involved in the manufacturing process, managers, staff, unions, government suppliers and customers that there is no guarantee of staying in business unless companies can get their performance close to world class.

Typically a South Australian brewery has quoted that a benchmark for its industry is 9¢ per litre for manufacturing costs, but accepts that due to large geographical distances in Australia an acceptable benchmark would be 13¢ per litre.

4.2 The New Workplace Culture

The New Workplace Culture is fundamentally a state of mind that drives constantly for best practice.

It is currently being applied in leading manufacturing firms around the world, especially in Japan, and there are some good examples of it in Australia. Key elements of the New Workplace Culture that can be seen to varying degrees in the most dynamic manufacturing companies include:

- Support for skills upgrading and retraining across the firm's workforce.
- Attention to technologies based on people, like statistical process control and Just-In-Time production, as well as hardware technologies like robotics and computer assisted design
- Continuous pursuit of improvements in productivity and quality through concerted efforts to incorporate the ideas of workers at all levels of the organisation
- Flexible production processes relying on multi-skilled workers and their ability to effect rapid changeovers with consistent quality.

If the above prognosis is accepted as a New Culture of the workplace it is possible to develop some simple checklists to review how companies perceive themselves against this new culture. Much time is spent in analysing company profit/loss statements yet little time is spent reviewing companies workplace culture. If the successful companies of the 21st Century are going to be "knowledge based" then some assessments of a companies culture will become most important.

4.3 Benchmarks for Manufacturers

Based on previous research work the author of this Thesis presented a paper to the South Australian Chapter of the Society of Manufacturing Engineers in April 1990, and suggested the following Goal Posts to international competitiveness. [29]

WCM Goal Posts

1. Customer Service >95%
2. Total Stock Turns >40
3. WIP Stock Turns >100
4. All set ups under 10 minutes and constantly being improved
5. Lead times under 2 days (manuf.)
6. Quality, meeting internationally recognised standards eg. Fords Q1
7. People "actually" involved
8. Training a continuous activity
9. Kanban installed
10. Aim to black light production with your technology

All above equals success and profits

The charts shown in Figure 6 demonstrates Australia's relativity to productivity of auto assembly plants and productivity by functional area. The source data is from 1989. They show Australia takes nearly three times as many hours on assembling a vehicle as the worlds best. Similar ratios are applicable in the function chart. [30]

Since 1989 there has been a massive movement for companies to be globally competitive. To meet that requirement new terms evolved helping to make that goal possible. 'Benchmarking' is helping companies to recognise their standing.

Figure 6 PRODUCTIVITY OF AUTO ASSEMBLY PLANTS

PRODUCTIVITY OF INTERNATIONAL ASSEMBLY PLANTS
(hours per vehicle)

Parent/plant location	Best	Worst	Weighted Average
Japan in Japan	13.2	25.8	16.8
Japan in N. America	20.1	25.1	21.8
US in N. America	18.6	30.7	25.1
All in Europe	22.7	55.6	36.7
Australia	35.9	44.3	38.8

PRODUCTIVITY BY FUNCTIONAL AREA OF ASSEMBLY OPERATIONS
(time per vehicle: Japan equals 100)

Parent/plant location	Welding	Paint	Assembly
Japan in Japan	100	100	100
Japan in N. America	127	110	116
US in N. America	127	124	161
All in Europe	180	200	261
Australia	237	262	223

4.3 Thinking About Benchmarking

Thinking about Benchmarking? Most leading firms in Australia believe that organisations will have to benchmark to survive. The Benchmarking Self-Help Manual [31] will help tailor the Benchmarking process to suit an organisation's unique needs.

Whatever area of industry or commerce an organisation is involved in, it will become essential to demonstrate what levels of competitiveness is being achieved by the organisation. This can be done by "Benchmarking". Use of AMT's can be similarly benchmarked. Research goals can be set for any AMT's. MRP and MRPII have some benchmarks standards, it is become an "A" class user, unfortunately this Thesis shows that 50% of users of this AMT in Australia was not aware of the "Benchmark".

5. ACTIVITY BASED COSTING

5.1 Why Use It?

Traditional manufacturing costing systems allocate overheads on the basis of the direct labour (sometimes called prime labour) attributed to the production process. This was a fairly simple rule to apply when direct labour costs were something like 50 to 75 % of the total costs of production. But as materials have become more sophisticated and production processes have been radically improved, direct labour input has been significantly reduced in most industries to around the 15 to 25 % level. Therefore, allocation of overhead costs based on direct labour allocation is now inappropriate. Activity based costing allocates costs to the product based on the resources consumed.

Many companies are looking at and using several of the AMTs described in this Thesis. They are looking at eliminating waste in all its forms throughout their organisations. But unless they change or include as an AMT, Activity Based Costing (ABC) they may well be making many incorrect decisions, keeping non profitable products and discarding profitable ones, making poor timing judgements, introducing high cost technology when simpler changes may be appropriate.

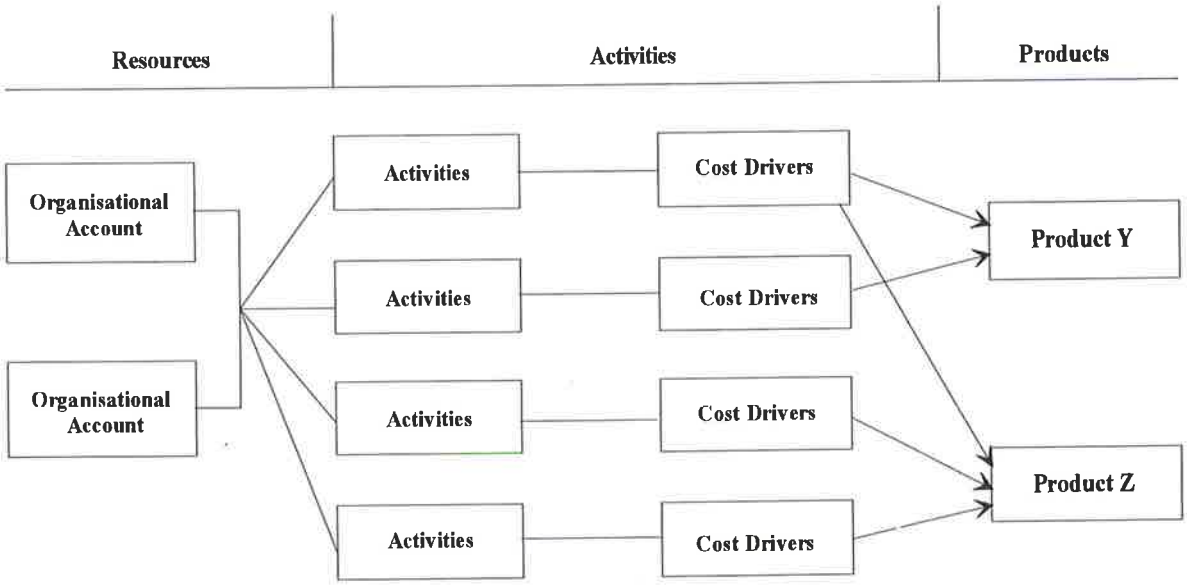
Dr Thomas Johnson, from Pacific Lutheran University warned in his paper 'New Directions in Manufacturing Financial Planning and Accounting' [32] that companies needed to re-think their product costing systems. He suggested that World Class competitors will not necessarily see profits rise unless they also design activity-based chargeout and product cost systems. Activity-based costs eliminate distortions and cross-subsidies caused by traditional cost allocations. Activity-based cost information provides a clear view of how the mix of a company's diverse products, services and activities contribute in the long run to the

bottom line. Activity based management accounting information is the key to continuous improvement in profitability, a journey without an end.

As stated previously there has been many warnings that tradition costing systems are not adequate in manufacturing in the global market. Robin [33] reminds us traditional costing systems and techniques fail to give managers the accurate information they need to manage costs. Paul Hunter [34] also reminds us that ABC is a must, he observed that the major objective of Advanced Cost Management is to develop a system which overcomes deficiencies of traditional systems and reflects the true cost structure of the business. Hunter uses a chart Advanced Cost Management, see Figure 7 to help explain his views. The chart demonstrates how activities and cost drivers can be split between two products.

Figure 7 **ADVANCED COST MANAGEMENT**

Improved Cost Management is Achieved Through Focus on Activities



5.2 A Need to Change Accounting Practices

In an article in COZ a bi-monthly publication by NIES [35] comments were made from a report by Professor Bill Birkett on 'Cost Management in Small Manufacturing Enterprises', that traditional cost accounting systems are no longer giving management the information they need to run their factories in the most efficient manner. Professor Birkett was quoted as believing that many organisations face three key issues of management accounting:

- Strategic Issues
- Financial Issues
- Cost Management Issues

"Obviously, all three issues are related", said Professor Birkett, "What we are really talking about is Advanced Cost Management Accounting of which Activity Based Costing (ABC) is one tool."

Instead of using traditional costing systems, there is a need to look beyond the manufacturing section into procurement, design research and development, marketing, distribution ..... the list goes on. It is only by looking at the full set of costs right across the business or value chain that we can really know the profitability of the products.

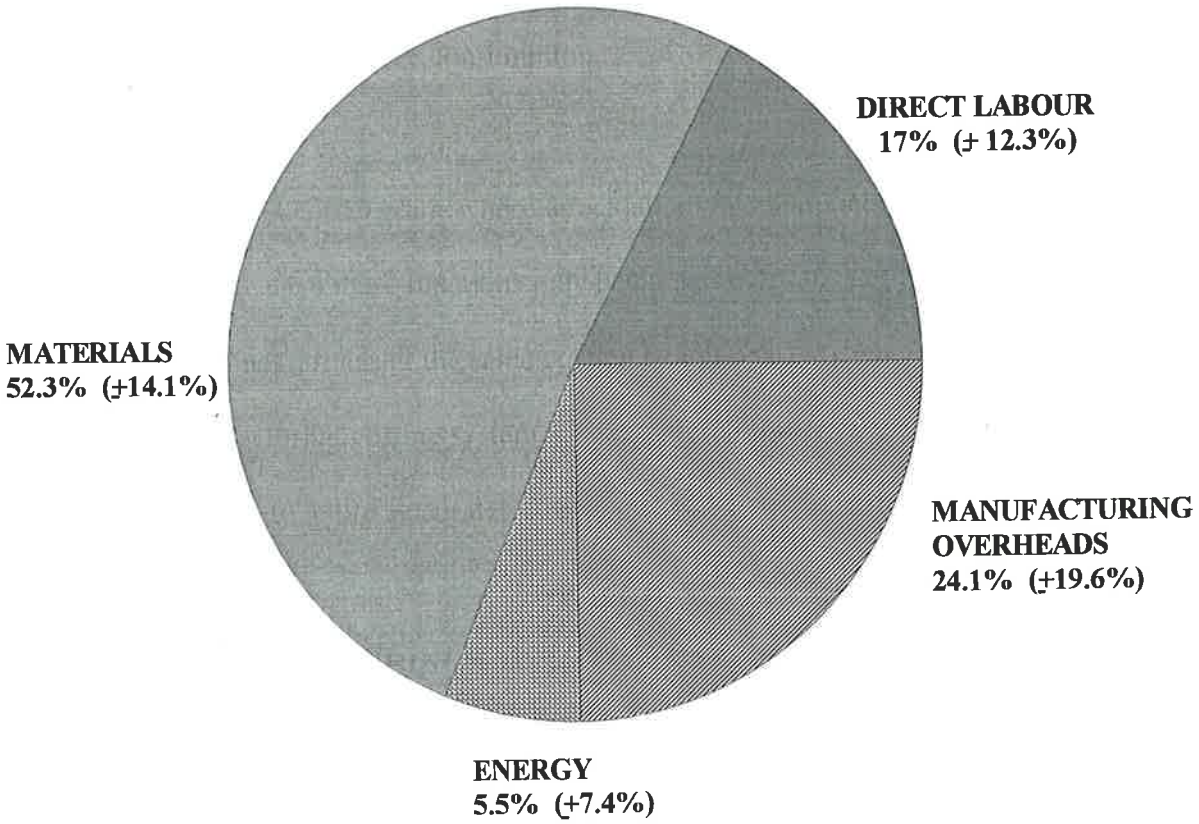
In the last 20 years the cost of technology and research and development can be quite high, and the argument today is that about 70% of a firm's costs are in overheads and not in materials and labour.

Most traditional costing systems capture very well the cost of direct labour and materials but they have captured quite arbitrarily this other 70%.

The argument now runs that resources are consumed by activities (and only when people do an activity are they consuming resources). Hence we now have to look at what is the activity that drives resource consumption.

So over the last 40 or 50 years, where direct labour and materials used to be about 75% of costs, we now have these functions only being about 15-30% of costs (see Figure 8) and 'most companies' are using the same costing (traditional) system. So the development of a new manufacturing costing system is being offered, Activity Based Costing (ABC) that enables firms to more accurately distribute costs to the products that consume the resources.

Figure 8 MANUFACTURING COSTS FOR LARGE EUROPEAN COMPANIES



(Source: Manufacturing Strategies Compared
European Management Journal, 1988)

ABC can be readily used in a Socio Technical sense once people in SMWT have been trained in its application. Teams take on a different approach to waste when they have knowledge of what activity consumes the resources. They are also able to highlight waste in a meaningful manner that attracts management attention. From one company included in this research it was found that a particular area of production output was being disrupted by excessive schedule changes after orders had been placed. A SMWT of shop floor employees trained in techniques of ABC were able to totally identify the costs of all the activities associated with unplanned schedule changes. After the shock of seeing the real costs of changes, management and the SMWT took action to correct the situation. Hence, it could be argued using an AMT with well trained people can gain good results that have up to now been hidden. Technology and people working together !.

6. SOCIO TECHNICAL SYSTEMS

6.1 The Need

Why do manufacturers need to integrate their technology advances, their information systems with their human resources? Because they have to; a paper on Socio Technical Change [36] reported that manufacturing firms are facing a business environment that is increasingly global, with intense international and domestic competition. Some concerns that must be addressed include changes in markets and customer preference, changes in products and process technology, an expanding set of knowledge requirements for managers and workers, and a host of new workforce and community pressures. Many established markets will fragment and product life cycles will shorten as products become increasingly customised. Customers will put pressure on manufacturing firms to lower cost and reduce lead time without sacrificing quality and performance. Time to market will become an important factor in establishing competitive advantage, as will effective integration of manufacturing, marketing and research and development in achieving customer satisfaction.

This last statement underlines the necessity for companies to manage their total business functions. Company's cannot sell into a market that has short ordering lead times unless the manufacturing function can accommodate this requirement. Company's that accommodate that situation with large amounts of finished goods inventory will not survive. Survival is shortening to absolute minimum manufacturing lead times. For survival, managers have to recognise this requirement and utilise all resources to beat the competition. They must use their people resources. Hence organisation re-structure with use of teams. (The Socio Technical aspect)

The Transfer Technology Council (TTC) [37] which has been an organisation for promotion by AMTs into Australian industries for the last fifteen years, describes Socio Technical Systems, (STS) as the key to organisational productivity. It is a powerful approach to successful change that recognises the Social, Technical and Economic systems operating within your organisation. ..... STS is a unique team based progress that inspires and cultivates change through a spirit of participation and personal growth. The ultimate result is a synchronised and harmonious organisation that is able to adapt quickly to changing external forces and in doing so secure its future success.

The messages are clear, technology with people, the way to survive!

Some companies that have had success with STS are: [37]

- ICI, PILKINGTONS, BLUE CIRCLE, BRITISH STEEL, IND COPPER, BURTON BREWERY, WESTINGHOUSE CANADA, POLAROID, MONROE, SA BREWING, AIR INTERNATIONAL.

6.2 Changing Workplace Culture

Companies need to be aware of changes to workplace culture. They need to be aware of the consequences of not changing fast enough to be globally competitive. This research has shown that literature available to any 'reasonable' Manufacturing Manager would have shown over the last ten years a need to change the workplace to accommodate technological changes and human factor changes as the workforce becomes more educated.

In his paper 'Advanced Manufacturing to Achieve World Competitiveness', Professor Hans-

Jurgen Warnecke, [38] highlighted what vision/affects would occur in companies using lean production. He writes:

- The integration of as many jobs as possible like process control, maintenance, quality assurance, logistics-functions, etc. and responsibility at that manpower, who actually adds value in production.
- Continuous education and training of the workforce, also in indirect functions.
- Teamwork in all areas.
- The implementation of an overall information system, especially for fault recognition.
- Feedback of all faults to their source or reason.

Many of Professor Warnecke words were similar in structure to those of Dr Deming, written nearly forty years earlier in his 14 points of management. [39] Words like involving all the people and continuous education seem to be re-introduced in different packages to suit the climate of the day.

It is important for manufacturers to not only say their people are their most important resource, but to demonstrate in their company's goals and actions that they are providing scope for actively pursuing improved opportunities for people to get higher rewards for higher skills and efforts.

Dr Deming of Quality Assurance and Management note, qualified some fourteen points for management in the new age. His fourteenth point was, "PUT EVERYBODY TO WORK TO ACCOMPLISH THE TRANSFORMATION". His words of wisdom were also echoed by J.M. Juran in 1951 [40] he wrote, create teams of workers so as to increase employee

involvement in discussion and solution of departmental problems. The precise method of organising these teams and of working with them varies widely - the technique is comparatively new. However, the reported results have been generally favourable and the concept may be in a growth cycle. Note this was published in 1951.

6.3 STS World Class

Harry Challis reported in an article for Engineering News (UK) [41] that a study by IBM and the London Business School, Made in Britain, that from a muster of 202 companies 42% had those vital new management practices demanded by the top league, but only 2% can expect to beat world's best. When asked (in the study) What stands in the way of progress? 24% of respondents chose 'the ability to implement change quickly enough'.
Attempting to effect radical change has clearly taken its toll of managements' sanguinity. Who should be surprised? Changing human behaviour is a far cry from steady state management.

It is not easy obtaining world class status. It is not easy using socio technical systems to integrate all resources in companies, but it is attainable, it is possible, the route is hard but has excellent rewards for everyone. Many Australian companies are taking the long route, still debating on the need for change, debating whether to go for teams, debating if teams will be effective. Those debaters will be seen later, due to inaction, outside Commonwealth Employment Services, looking for a job.

6.4 People and Technology

During the course of study for this Thesis it became increasingly obvious during discussion with management, staff and shop floor people that AMTs, without change in the organisational structure of company's to co-ordinate their people power would fall behind company's that did utilise their people by getting into teams. Professor G. Arndt, Professor of Manufacturing Engineering at the University of Wollongong, [42] also commented on this point in a paper presented at an International Manufacturing Conference, he writes, "It is concluded that most industrialised countries are today realising that the people based Kaizen approach to manufacturing improvement is just as, if not more, important than the use of technology (eg. CIM, FMS)."

In an article in the Advertiser Newspaper, Professor Vilkanas [43] from the University of South Australia was quoted as saying, "World Class business leaders possess both a hard and a soft side. Australia's future business leaders were being educated to delivery the 'hard stuff' defined as measures of quality, systems, procedure and benchmarking. But managers found the 'soft side' difficult because it was intangible, grey and has no right answers. There is no teaching of skills to develop a vision, to be inspirational and to communicate this to others."

6.5 STS Case Studies

- The importance of people in technical systems is reviewed in two case studies:

Case Study 1

In a case study used in a paper on STS by Sam Joukadjian [44] he quotes some parts of Edy's Grand Ice Cream Company, USA, philosophy statement of 1985.

- Our organisation's success in achieving its mission is based on bringing the technical and social requirements together in the best way for both.
- The social system supports the technical system.
- Members of the social system act to overcome or prevent difficulties as they arise in the technical system.
- The basic units of our organisation are the action teams. Each action team is made up of associates as members.
- Each action team has specific objectives to achieve in support of the organisation's mission.
- Each action team has skills, information and other capabilities to act autonomously in achieving its assigned objectives and to co-ordinate with other action teams in achieving the organisation's mission.
- Each group has responsibilities and appropriate authority to complete tasks required to meet the group objective. Supporting this, there is:
  - Decision making at the level where action takes place.
  - Total information sharing.
  - Self regulation mechanisms.
  - Individual growth.
  - Individual commitment is necessary for successful operations.
- Our organisation supports high commitment of its members to our mission.
- Commitment develops when working conditions are satisfactory, desirable futures exist, and individual's are considered.

Case Study 2

In a case study on a manufacturer of medical and hospital supplies for Royal Gist-Brocades NV, a company at Kingstree, South Carolina, James E Hettenhaus [45] reports on the

integrating organisational development of people and technology. Hettenhaus reports, Management focus only on results is becoming more widely recognised as a fundamental flaw in remaining competitive. Instead the process which produces the result must be bought into focus. Ways to improve the process must be continuously examined. Process improvements come from three general categories: organisational changes, core technology improvement and application of automation and information based technologies. Unifying these three with a common aim can enhance organisation capability and create a competitive advantage which can be sustained. Unification was achieved by taking the **socio-technical** approach to work design, guided by a shared vision of values and a common purpose. The automation and information technologies were packed in a computer integrated manufacturing (CIM) project. The technical components of the project include a PC network, manufacturing resource planning (MRP II) and a distributed process control system (DCS) ..... Job redesign was considered as the new technology was designed, started up and demonstrated. Organisational development, training, information sharing, team building and other human factors were integrated with the adoption of the new technologies.

Results

Start up socio-technical system approach occurred at beginning of 1985, at end of 1985, costs were 40% below the 1984 baseline. In 1986 the plan goals were exceeded by more than $6m. Production efficiencies and the quality of work life continue to improve as people continue to develop.

This report confirms that application of information technologies (MRP) with people involvement can produce significant results. Installing a MRP II system without people training, involvement, understanding will not work! Not only during installation stages do

people need to feel ownership of the system but continuously through the life of the system.

Considering the drive for organisational changes, team development and people growth it was appropriate to include in this Thesis, together with the MRP review some comments on self managing teams in a hope of relating to the socio-technical integration.

6.6 Teams as Part of Socio Technical Systems

Why are organisations moving towards Self Managing Teams? Several reasons have been mooted and Lawrence Holpp [46] in an article in Training Magazine suggests organisations must begin to fight the war against poor quality, low productivity and inadequate resource utilisation and high costs, to gain customer satisfaction, market share and survival.

The purpose of Self Managing Teams philosophy is to empower workers to decide questions of cost, quality, vendor relations and administration practices. Self Managing Teams are often more aligned with the trends of organisations today, these trends include:

- People are taking more responsibility for their own career. While not the blue suited loyalty of the past, they are pro-active workers who assume responsibilities for quality and productivity in their units as a survival tactic.
- Downsizing has struck the middle ranks of organisations in both operational and administration areas. Power vacuums in day to day supervision, quality assurance, information systems, human resources and training are being filled by members of work units - survivors, that is - rather than through staff additions.
- Much higher educated workforce calls for more involvement and flexibility.

Other reasons include:

- Shorter product life cycles.
- Global challenges.
- Environmental restraints.
- Restructuring.

The way in which we organise our workplace must change. The goal of any economy must be productivity improvements and leading edge technology is only part of the solution. We require a smaller and smarter workforce who know and understand the key issues for world class manufacturing success and who are empowered and involved enough to make the changes a reality, so advises Stephen N. Hood from Alcan Australia's Granville Sheet Division. (47)

In all industries, companies world-wide have found that self directed work teams provide truly impressive results. What makes these work teams so effective at achieving the results that management has desired so long? In short, the highly involved work team members bring not only their 'hands' to work, but the full capacity of their hearts and minds as well. So Ed Musselwhite tells in a paper on Self Directed Work Teams. (48)

The important point for Australian organisations to recognise is the measurability of performance changes. People grow by achievement, if results of achievement are not posted, are not recognised then team evolution will be slow and may even be a detrimental step.

"Traditional industrial management must make way for leadership, teamwork and workforce involvement if UK Ltd is to become world class." This was a broad message given to

young professional engineers in a two day management presentation by the Institution of Mechanical Engineers (UK) in 1992. [49]

In the book Zapp [50] the authors suggest that for teams to work they need:

- Direction (key result areas, goals, measurements).
- Knowledge (skills, training, information, goals).
- Resources (tools, materials, facilities, money).
- Support (approval, coaching, feedback, encouragement).

A new publication became available in 1994 in Australia to circulate information about teams, it's called Self Managed Work Teams Global Network News. [51] As part of an unattributed newsbrief the publication printed some key predictions for organisational changes beyond 2000. Many researchers and company managers at the 1993 International Conference on Self Managed Work Teams, in Dallas, made predictions of how the best performing organisations will be designed going into and beyond the year 2000.

Their best guesses are that modern organisations will:

- Have self managed work teams at all levels.
- Be a composition of mini enterprises and strategic business units.
- Formally partner with their customers, suppliers, government and competition.

6.7 Union Support for Teams

John Lesse of the United Trades and Labour Council of SA [52] circulated to all affiliates information from the Council about restructuring and workplace re-organisation. The

information contained relevant discussion points for affiliates to use in enterprise bargaining. Some of the issues included the range of matters which may be discussed in this consultative process at the enterprise level will include:

- Training to broaden and enhance skills available to all workers and reduction in demarcation barriers on an agreed basis.
- Changes to work organisation and job design to improve the quality of the working environment and improve workforce commitment to new production systems.
- Improving the quality of supervision skills, developing less authoritarian and more co-operative management techniques.

6.8 Empowering Teams

What does Empowering mean. In a company training document prepared by Willbury Pty Ltd, Training and Manufacturing Consultants, [53] they define empowerment as follows: Power means control, authority, dominion. The prefix em - means, to put on to or to cover with. Empowering, then, is passing on authority and responsibility. As it is referred to here, empowerment occurs when power goes from management to employees who then experience a sense of ownership and control over their jobs.

In a paper Empowering People, Dr Billie Slater [54] suggests that involving everyone in everything means just that and can be summed up by the following quote by Rosabeth Kanter, 'Powerlessness corrupts, Absolute powerlessness corrupts absolutely'.

Dr Slater further suggests that organisations and communication research has shown that for simple tasks under static conditions, an autocratic, centralised structure, such as has

characterised most industrial organisations in the past, is quicker, neater and more efficient. But for adaptability to changing conditions, for rapid acceptance of a new idea, for flexibility in dealing with novel problems, generally morale and loyalty .... the more egalitarian or decentralised type (of organisation) seems to work better. She adds, "we must organise as much as possible around teams to achieve enhanced focus task orientation, innovativeness and individual commitment."

6.9 Warnings for Teams

Many companies are switching their organisations to incorporate a Team environment. Some company's are doing it well, some are struggling, most are experiencing slow changes but are feeling positive about the results. Some team members feel empowered to take on new challenges, some feel as though they are being exploited because rewards are not being shared. Some team members, leaders and supervisors are confused. Their roles are not clear, their goals not defined and assistance is not available to clarify their situation. There is much information on developing organisational change using teams and an article, by Dr Amanda Sinclair [55] highlights some myths. Teams are not magic. They must have tasks that are achievable within a specified time frame. The team charged with 'management' has an impossible brief and will surely fail unless effort is spent spelling out what that management task involves and what constitutes success. She goes on to warn about the emotional agenda of teams, a second illusion is that good teams focus only on the task. Teams are there to get a job done. However, their existence as a group means they have an emotional agenda as well as a task agenda.

Many people in many organisations have said that teams self managing is a problem for

them, it's new, they are seeing failures and some successes, they want to be sure, they want the route mapped out for them. It's not new of course, and this can be considered by looking at articles of earlier years. The Age (Melbourne Newspaper) [56] printed in 1977 an article Everybody is the Boss, about Dynavac Pty Ltd where the then Managing Director wanted to involve everyone in the company's management .... to become self managers.

Dynavac [57] published a report about Self Management which the article was picked up from. The report states "We did not set out to bring about worker participation or industrial democracy but to develop fully the ability in each individual for management of self."

6.10 Team Successes

There are many approaches to self managing, most of which let the teams evolve into their level of comfort or challenge depending upon their educational background. Many people when they commence the process of self managing want to be given a blue print of how to do it. Of course that is not possible as each organisation, each team and level of empowerment is going to be different. This was exemplified in a statement in the book 'Mega-Trends 2000 [58], "The leadership of constant change requires people who are comfortable with ambiguity, although most of us prefer order." Some examples of successes of firms changing to Self Managing Teams is worth recording.

Averitt Express, a Tennessee trucking firm, divided its 1400 member workforce into teams of 3-10 people; sales went up 38%, earnings by 48%. General Electric (US) who adopted SMT now makes custom industrial circuits in three days instead of three weeks. Motorola used to make electronic pagers in three weeks. Now it takes two hours. High tech

products that come to market six months late but on budget will earn 33% less profit over 5 years, while products that come out on time and 50% over budget will cut profits only 4%.

In Summary it could be argued that AMT's need people and that people need AMT's. The Socio Technical System response pays much attention to this focus but has largely been ignored by organisations.

This Thesis goes onto explore in more depth this apparent disaffection by looking further into the management of an AMT, Manufacturing Resource Planning in Chapter 7.

7. MANUFACTURING RESOURCE PLANNING (MRP II) AND MATERIALS REQUIREMENTS PLANNING (MRP)

7.1 Introduction

This AMT was selected to research in detail organisations usability of the technique, to assess its standard of operation, to find where the successes were, and where or what part of the AMT was causing failure. In particular assessment of the Socio Technical aspirations of the AMT was explored. This Thesis is based on the view that AMT's are not well used because of lack of consideration of people's requirements.

Firstly the AMT is reviewed, the "basics of the system", then data gathered in a survey of MRP users is reviewed and recommendations and conclusions made on results from the survey in Chapter 10 and 12.

7.2 Basics of the System

What can be less complicated than when a company needs to produce something, someone places an order, the company knows that it has to manufacture a product. The company knows that the product may be made from other parts and materials. They know what goes into it. They also know, for those parts or materials, what processes or machines those items need to go on to get them ready for assembly. The company also knows that if they do not make all the parts, that they have to purchase from other vendors some parts or materials. Simple, get all in sourced items and out sourced items together at final assembly and the product the customer wants is finished. This is what MRP is all about.

Companies used to use a 'reactive system', it was based on two basic inventory policy decisions **when** to reorder stock and **how much** stock to reorder. The time to reorder is called the reorder point. A predetermined inventory level, based on replenishment lead time, tells personnel when it is time to reorder stocks. This system had serious drawbacks,

especially their high inventory costs and low production delivery reliability. The newer way, the planning way, the MRP way, is more complex to manage but offers many potential advantages. MRP can reduce inventories because it should carry only those items and components that are needed. By looking ahead the MRP system can ensure that all materials are available when needed for product buildup. By setting realistic due dates, (completion dates) jobs get done on time, order promises are kept and production lead times can be shortened. The increased customer services require an information system with accurate data inputs on inventory, Bills Of Materials (BOMs) and routes. It also requires realistic master production schedules (MPS). It requires discipline to make the system work.

Materials Planning Requirements (MRP) takes the gross requirements of the item, at the highest level from the MPS. It considers the structure of the product from the BOMs, it then feeds in data from inventory records, lead times, orders previously released and calculates the new planned order release.

In Appendix I is an example of a calculation for a product using MRP logic. It is an extract from Adams and Ebert's book on Production and Operations Management. [59] It shows how planned order releases are calculated. This calculation of the planned order release is the fundamental functioning of MRP as a planning tool. Although it is simple it requires a full understanding of all the ingredients of a manufacturing system: MPS, inventory balance, BOM, routes and leadtime. Knowledge of how these ingredients work together is fundamental to running a successful MRP.

Also included in Appendix II is an extract from the book, 'Zero Inventories' by Robert W. Hall, [60] where he discusses why MRP was introduced, then how MRP II developed from it. He uses a questioning and answering technique to explain his points. The following is

a typical example. "MRP II is literally a simulation of a manufacturing business. It can be used to schedule the factory, schedule vendors, plan manpower, plan capacity requirements for new equipment more accurately farther into the future and with more capability of testing various plans. It can be used to generate the planned shipping dollars, it can be tied in with the Business Plan, and it can be used to simulate 'what ifs'!"

In short MRP II becomes a company game plan for manufacturing, marketing, engineering and finance.

7.3 Language of MRP

Global markets require global languages, particularly for manufacturing terminologies. Throughout this Thesis the Australian Production Inventory Control Society's (APICS) Dictionary has been used as a source of word/term reference. [61]

7.4 MRP is a Methodology not a Computer System!

An advertising brochure on Quantum MRP II 1994 Conference, August 1994, was described by Homer, [62] one of the Consultants advertising their services, as a conference to improve knowledge of MRP II's integrated approach to Manufacturing Management, it says MRP II is a methodology rather than a computer software. In Australia, over 50 MRPII type software packages are available with around 3 000 Australian manufacturers using these packages with the objective of improving productivity and customer service whilst reducing inventory and overheads.

In his book Introduction to Materials Management, J.R. Tony Arnold [63] tells us what MRP II should do for a company, it provides co-ordination between marketing and production. Marketing, Finance and Production agree on an overall workable plan that is expressed in the production plan. Marketing and production must work together on a weekly and daily basis to make adjustments to the plan as changes occur. Order sizes may need to be changed, orders cancelled and delivery dates adjusted. This kind of change is made through the master production schedule. Marketing Managers and Production Managers may change master production schedules to meet changes in forecast demand. Senior management may adjust the production plan to reflect overall changes in demand or resources. But they all work through the MRP II system.

The problem in many Australian companies is a lack of a MPS committee representing the correct company functions, that should be making company decisions on the production plan. More frequently the production plan is made by Production Control with insufficient information to make correct decisions.

In a series of case studies presented by the TAFE National Centre for Research and Development Ltd, [64] they suggest that Integration of systems and procedures was an important factor in the manufacturing strategy of all the companies appearing in the case studies. They suggest that the systems incorporate MRP II, JIT and TQM.
In other words companies cannot concentrate on a single area of their business but must integrate the whole continuous improvement program.

7.5 Four Absolute Pre-Requisites for MRP

David W. Buker Incorporated and Associates, [65] recommend four absolute pre-requisites for running MRP.

1. Accurate inventory records - 95%.
2. Properly structured, accurate BOM - 99%.
3. Properly managed MPS.
4. People understanding.

The above seems so simple, but the survey results in this Thesis in Chapter 9 indicate that achieving these pre-requisites is mostly unobtainable in Australian industries.

7.6 Is It Too Late to Start MRP?

An example of a company's starting on the road of using manufacturing software was announced in Factory Equipment News [66] in 1993, "Queensland based Mack Trucks Pty Ltd invested $1.9m over three years with IBM and Mode Computer Services to establish a fully integrated computer network (using BPCS software).

The technology is expected to help Mack Trucks increase its market share in the heavy vehicle assembly business by improving the productivity of its Purchasing Department through the adoption of a J.I.T. inventory control system, together with material and assembly scheduling and costing systems.

Whilst MRP has been around for over 20 years and there is a lot of non-believers in the vailidity of using MRP, Mack Trucks still think it's not too late to start it.

7.7 Manufacturing Systems

Figure 9 shows some common applications used in a MRP manufacturing environment. In Figure 10 is another chart that shows applications used in the total business environment of MRP. [67] These figures show the integration of function that can be achieved using a MRPII computer aided manufacturing/business control system. Other systems are shown in figures 11, 12, 13, 14, 15 for comparative purposes. It can be observed that all systems must exhibit the same basic modules, how they work and interact becomes, a selling point for producers and a choice for purchasers.

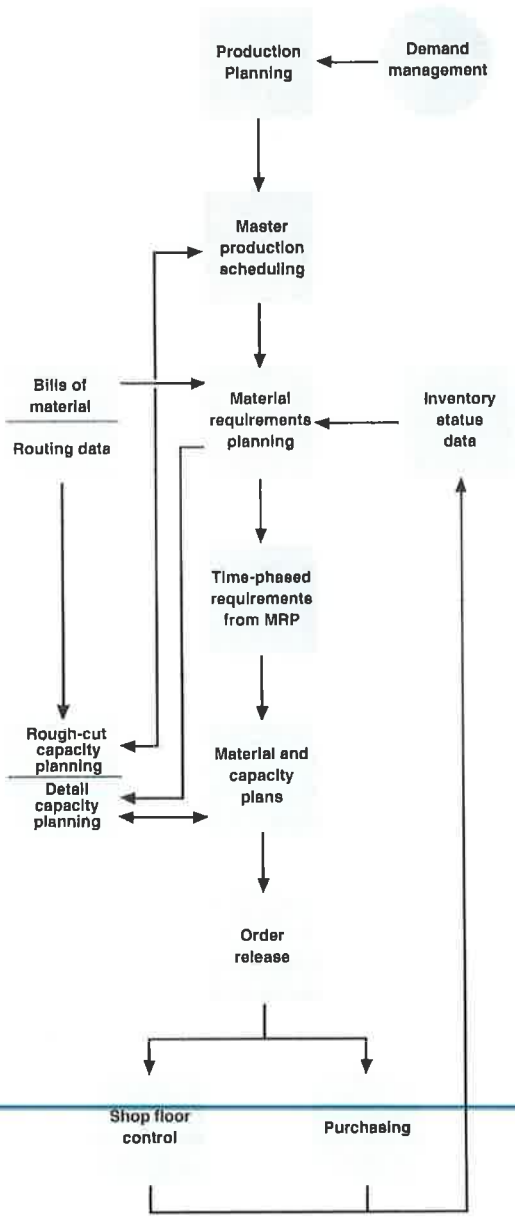
BPCS Closed-Loop Manufacturing Resource Planning (MRP II) Support

Figure 9 and Figure 10

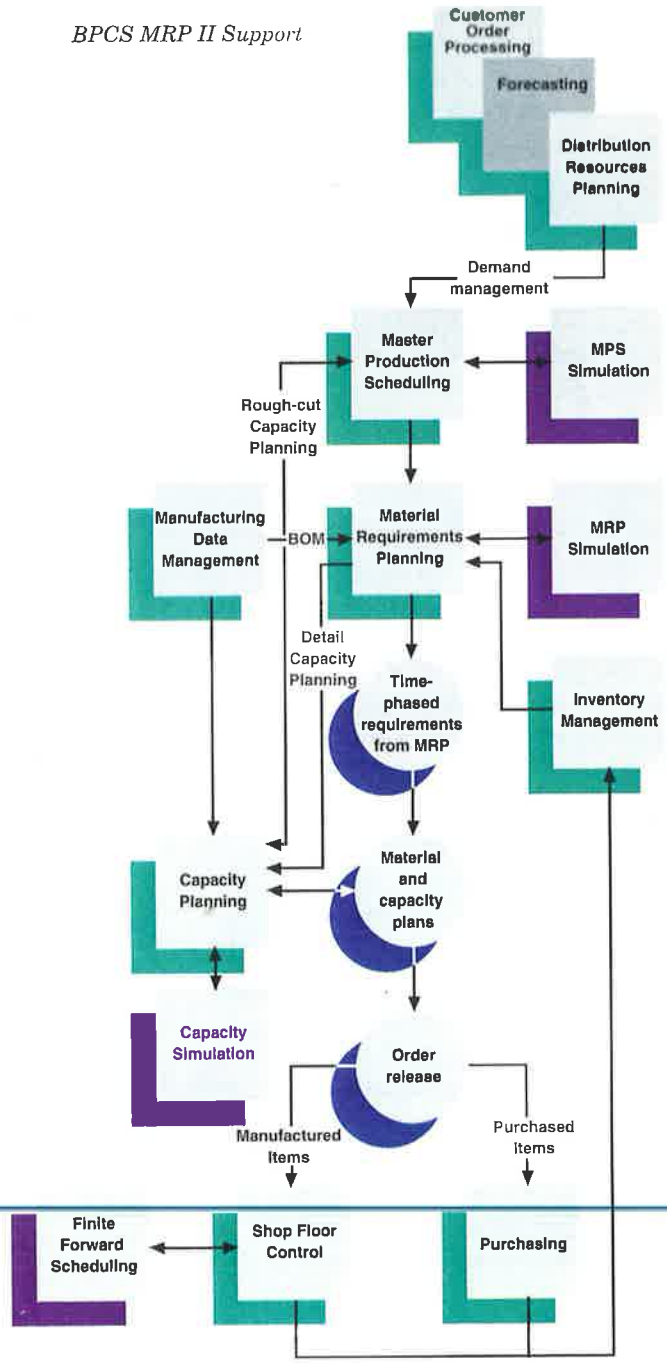
To implement the closed-loop process of a Manufacturing Resource Planning (MRP II) system, the user must integrate both planning and execution functions of the manufacturing business enterprise. The American Production and Inventory Control Society (APICS) represents the closed-loop MRP II work process according to the APICS MRP II Model shown.

BPCS integrated products, including Master Production Scheduling (MPS), Material Requirements Planning (MRP), InventoryManagement (INV), Manufacturing Data Management (MDM), Capacity Planning (CAP), Shop Floor Control (SFC) and Purchasing (PUR), contain the required functionality to effectively implement and execute the closed-loop MRP II work process.

APICS MRP II Model



BPCS MRP II Support



Other system application configurations are shown in Figures 11, 12, 13, 14 and 15 to compare with those previously shown.

Figure 11 MENTAT MANUFACTURING SYSTEM [68]

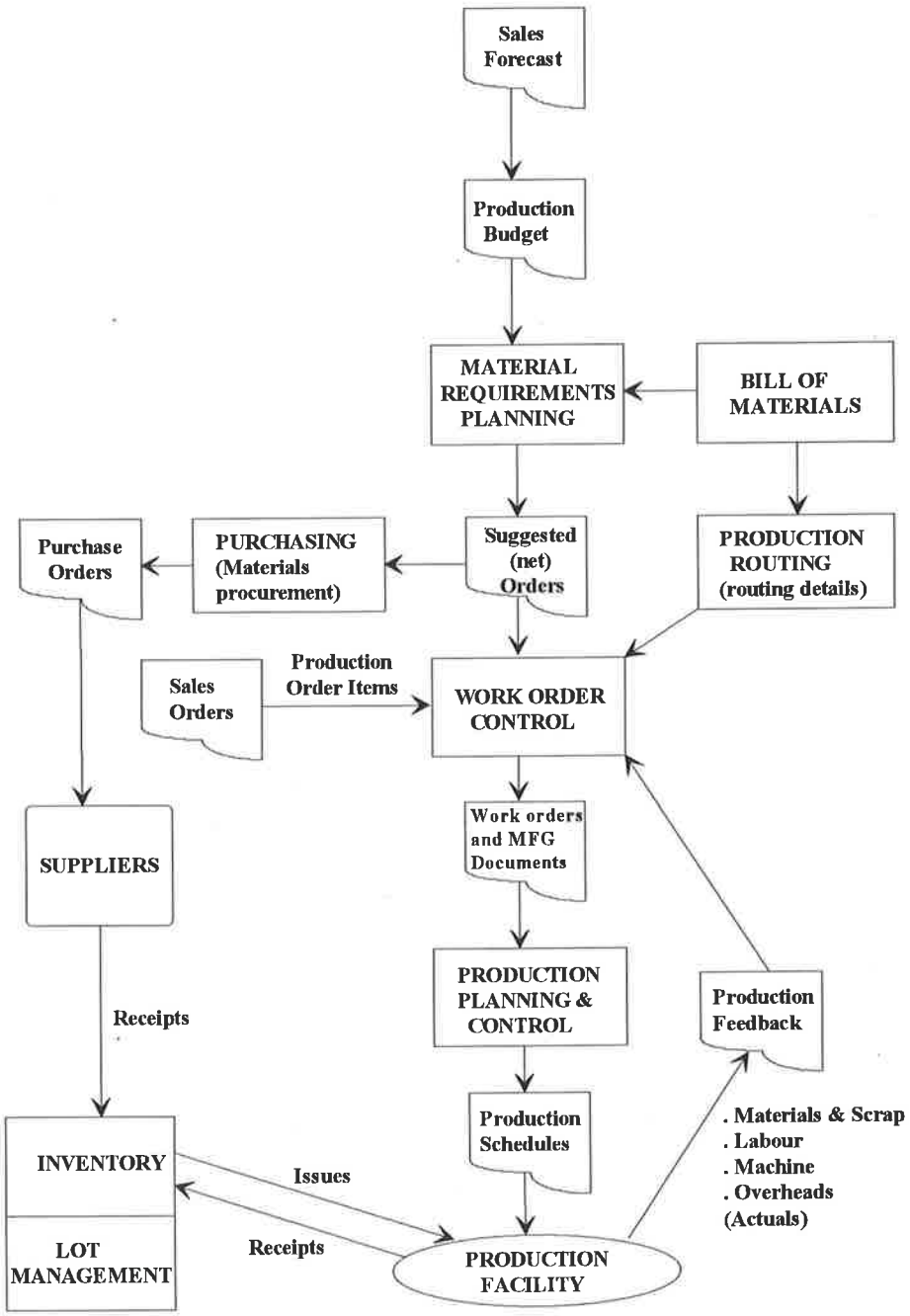


Figure 12

BPCS Computer Integrated Manufacturing

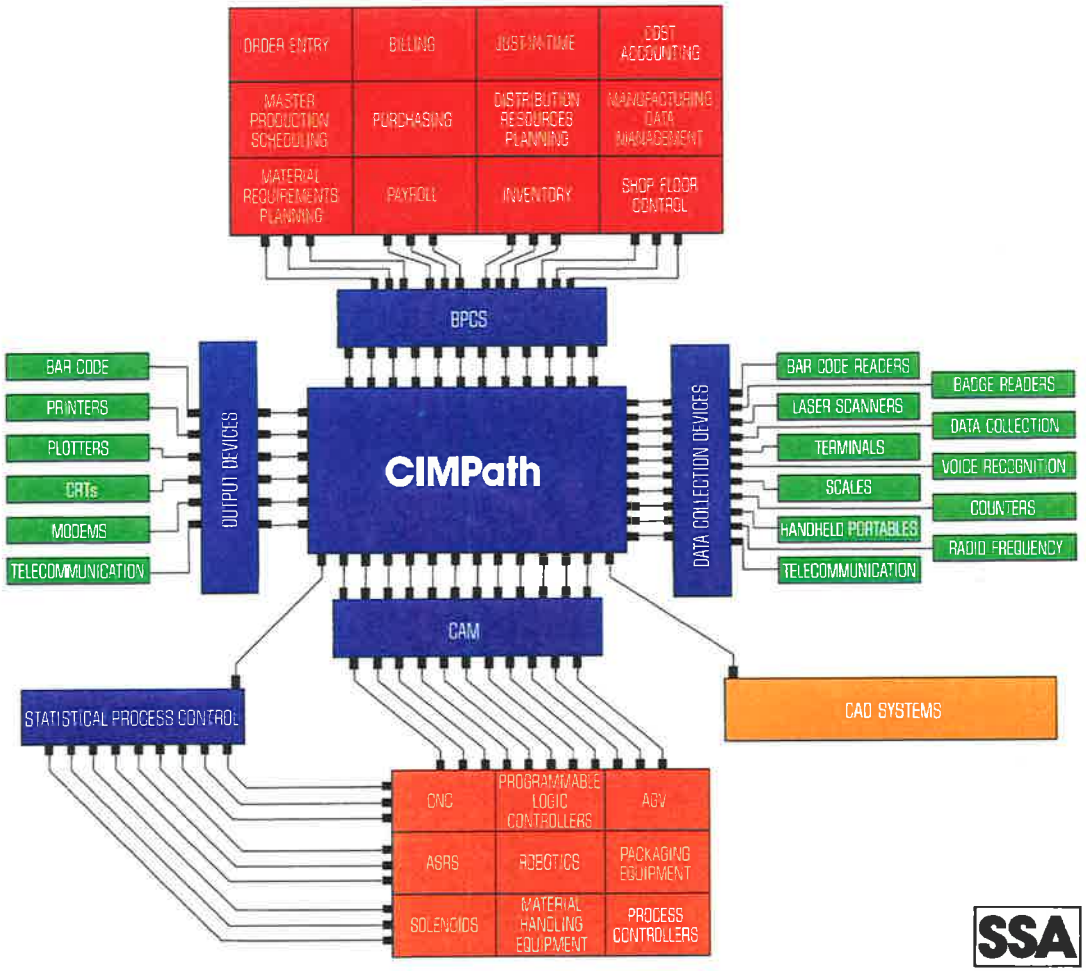
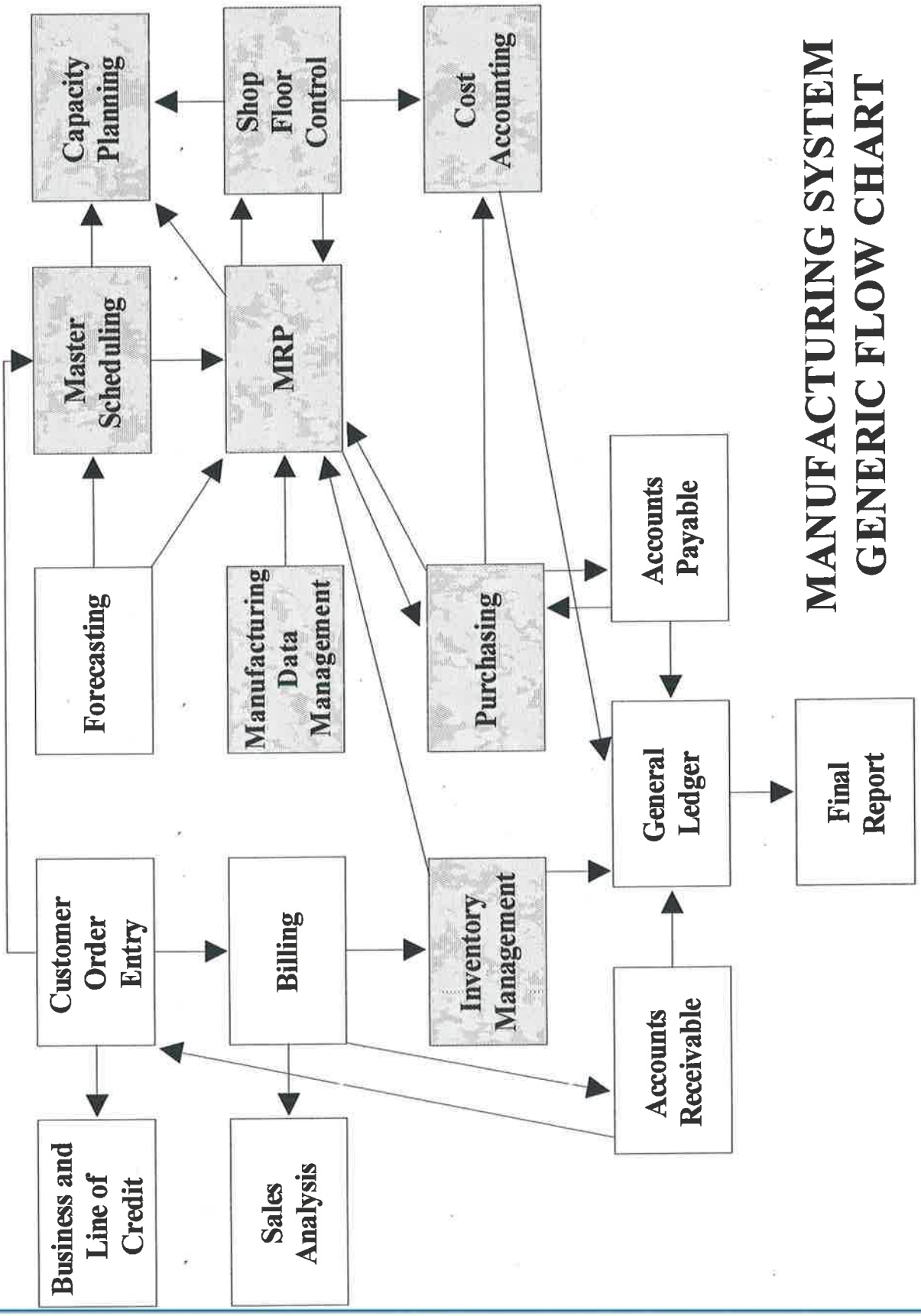


Figure 13


MANUFACTURING SYSTEM
GENERIC FLOW CHART
Capacity Planning
Shop Floor Control
Cost Accounting
Master Scheduling
MRP
Forecasting
Manufacturing Data Management
Purchasing
Accounts Payable
General Ledger
Final Report
Customer Order Entry
Billing
Inventory Management
Accounts Receivable
Business and Line of Credit
Sales Analysis

MRP Manufacturing Systems Flow Chart [69]

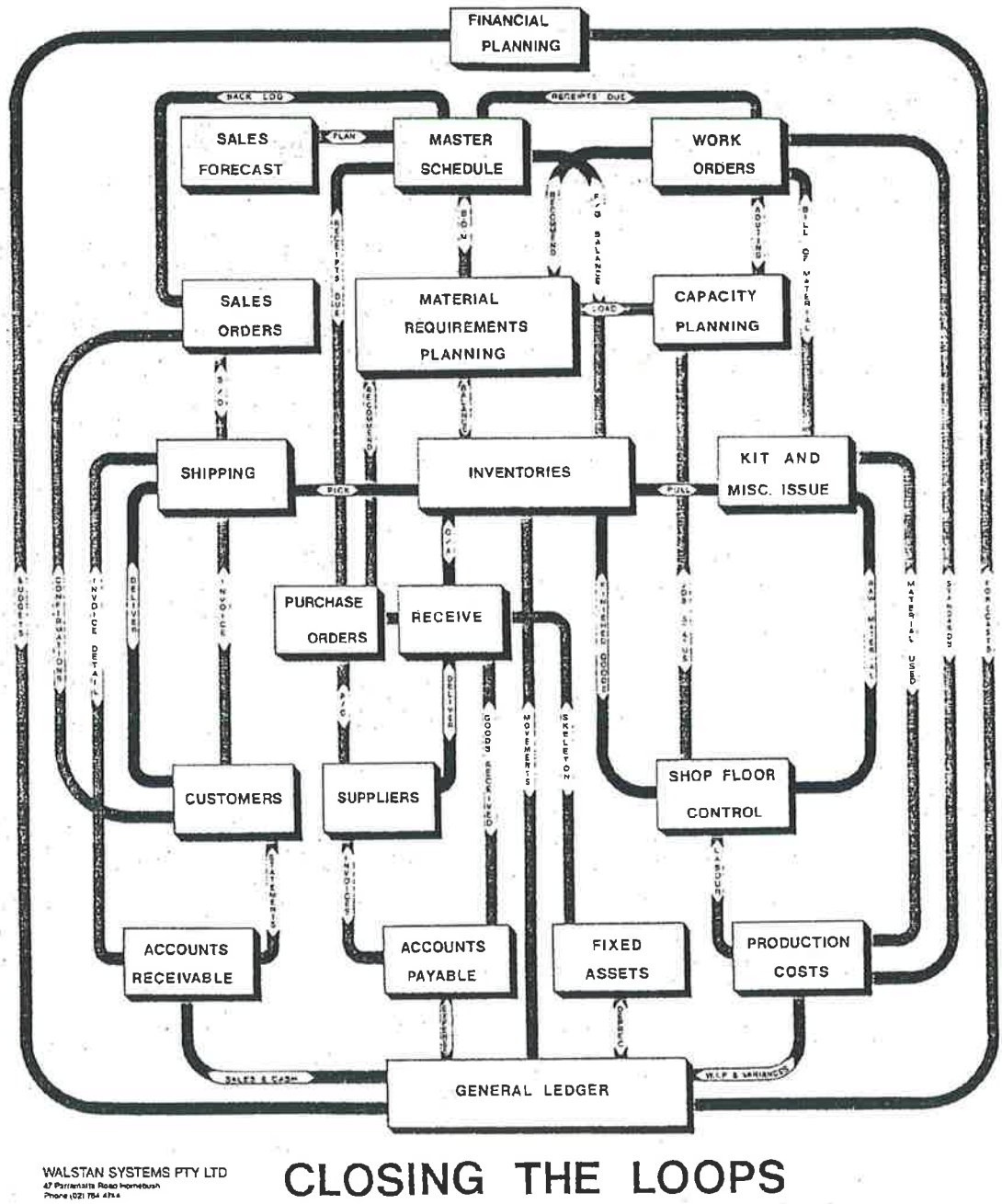
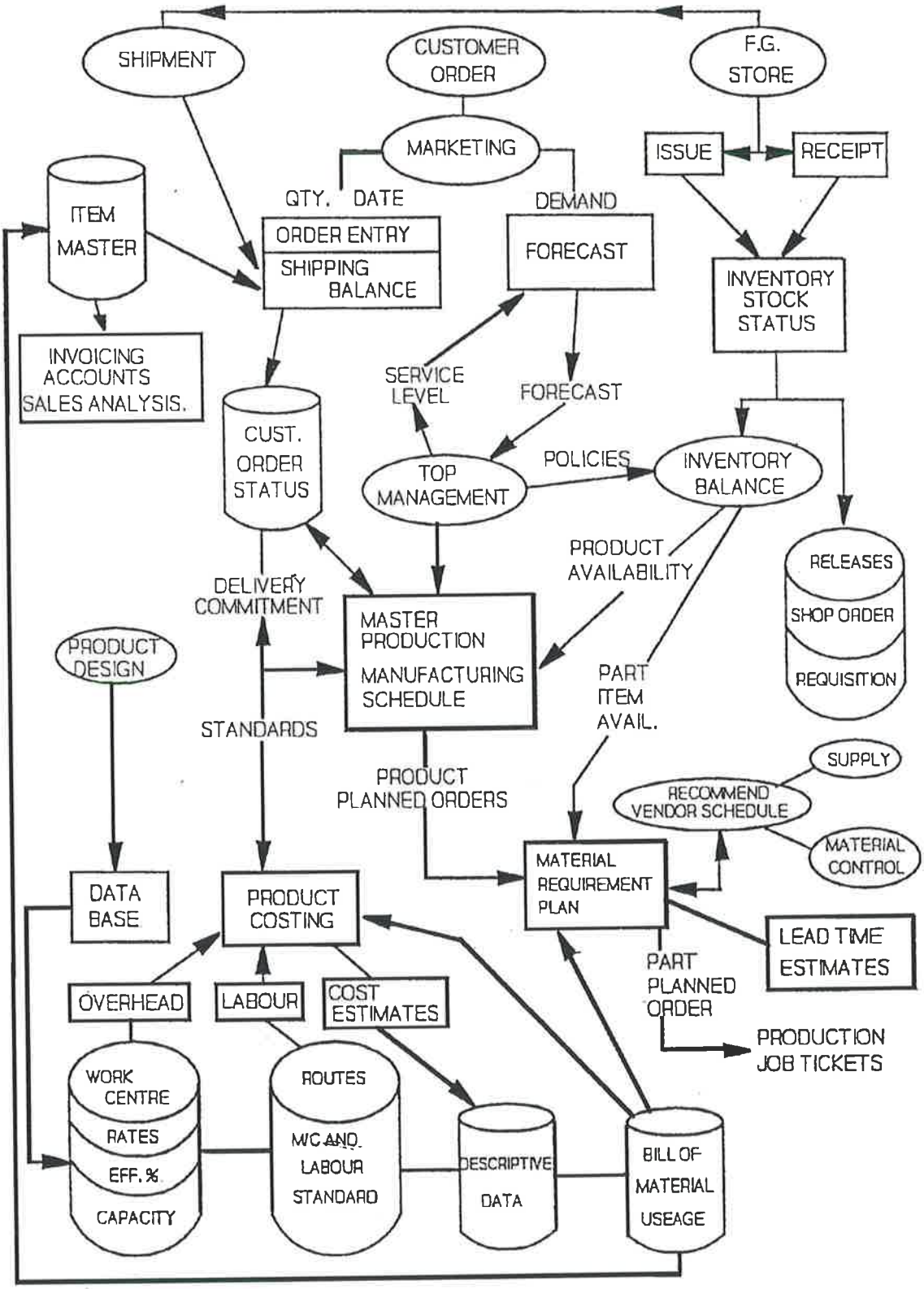


Figure 14

A Manufacturing Systems Overview [70] developed for TAFE students is shown in Figure 15.

It is used to enable students to learn relationships of different applications and inputs required in a manufacturing system.

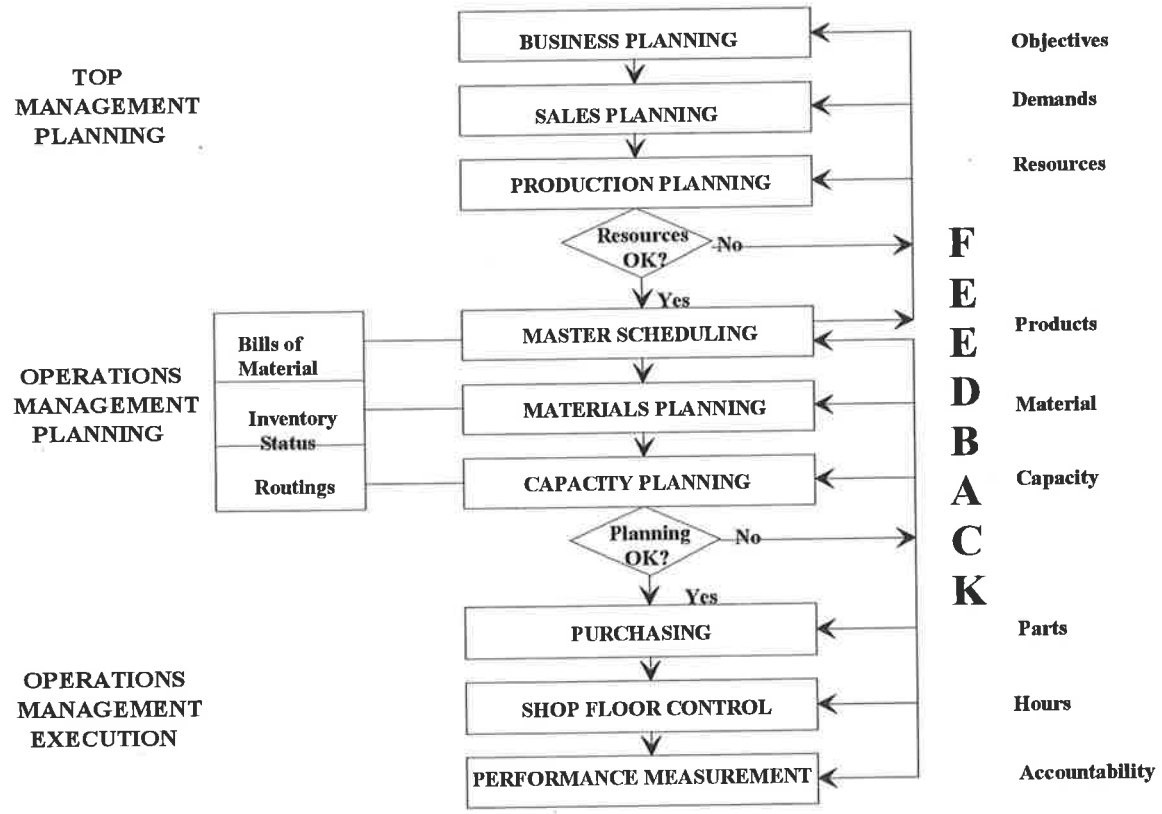
Figure 15 **MANUFACTURING SYSTEM OVERVIEW**



7.8 MRP - Closing the Loop (MRP II)

In terms of manufacturing systems it could be said that for MRP closing the loop is when Capacity Planning is installed but for MRP II closing the loop is when there is feedback through the system to the business plans. This is demonstrated in the chart, Figure 16. [71]

Figure 16 **MANUFACTURING RESOURCE PLANNING**



Using MRP II top management can be assured that their strategic objectives in the Business Plan are, in fact, driving the detailed operating plans. There is now an inter-relationship between top management planning and operations management planning and execution. No longer is the translation in the plan lost somewhere between the President or General Manager's office, and the activities on the manufacturing floor.

7.9 MRP II Systems - People Prepared to Spend

Australian National Industries [72] announced a $5 million integrated manufacturing resource planning, financial and distribution system in March 1991. The system, an MRP II system expected to lead to better materials management and stock control. The system used a UNISYS U6000/80 mid-range UNIX installed at ANI's manufacturing centre in Newcastle. Timeplex statistical multi plexons networks the 250 user UNIX host system with 160 Unisys terminals in 13 locations across Australia, including foundries, structural steel manufacturing plans and warehouses.

This demonstrates the initial investment company's have to consider to obtain some technology advantage in their business. The system cost is only a part of the project costs as user education, debugging the system, learning to manage with MRP II discipline will require several times the $5 million investment.

7.10 MRP Why Not Universally Successful?

Hal Mather [73] a world recognised specialist on logistics management writes in a special publication submitted for a conference in Australia for Wang Computers in 1986 that MRP

II will never run tomorrow's factories because it is too slow, cumbersome, illogical and people dependent. Mather claimed new technologies would defunct MRP II from 1989 onwards. He was correct except MRP II can still be used as a planning tool, but shop floor execution is better using Kanban.

It seems so easy, looking at an advert from M and M (Figure 17) Systems Pty Ltd [74] for MRP II all a manufacturer has to do is buy Micro-Max and they'll get:

- ability to meet customer schedules
- lower manufacturing costs
- enhanced productivity
- increased profits

What the advert does not tell the reader is the discipline required to use the system, the skills required for users to get those designated benefits, the accuracy of data, (rubbish in, rubbish out), and of course the training and continuous formal management of the new way, the MRP way!

Figure 17 MRP ADVERTISEMENT

7.11 International Standards for MRP

The most recognised International Standard of MRP usage is Oliver Wight's assessment. [114] It is widely used in the United States, and figures from the American Production Inventory Control Society indicate the following:

Oliver Wight, USA, do not publish from their surveys the number of respondents who are Class A, B, C or D level. They publish their survey results of MRP/MRP II/JIT as graphics of various performances. (Examples: Company Performance, Measurable Benefits, Cost and Benefits, Implementation Activities and so on). Note: Survey compiled every four years.

The survey is compiled from Oliver Wight mailing list (can assume that respondents are interested in some form of assessment of their MRP system). The latest survey available was published in 1990 and included responses from 1241 companies who were using MRP or MRPII, 315 using JIT and 255 using both.

Generally the responses showed that it paid to be Class A. The measures used showed that Class A companies out performed all other categories, an example of two measures is shown in Figure 18 and Figure 19.

Figure 18 **CLASS A, B, C & D COMPANIES**

Measurable Benefits

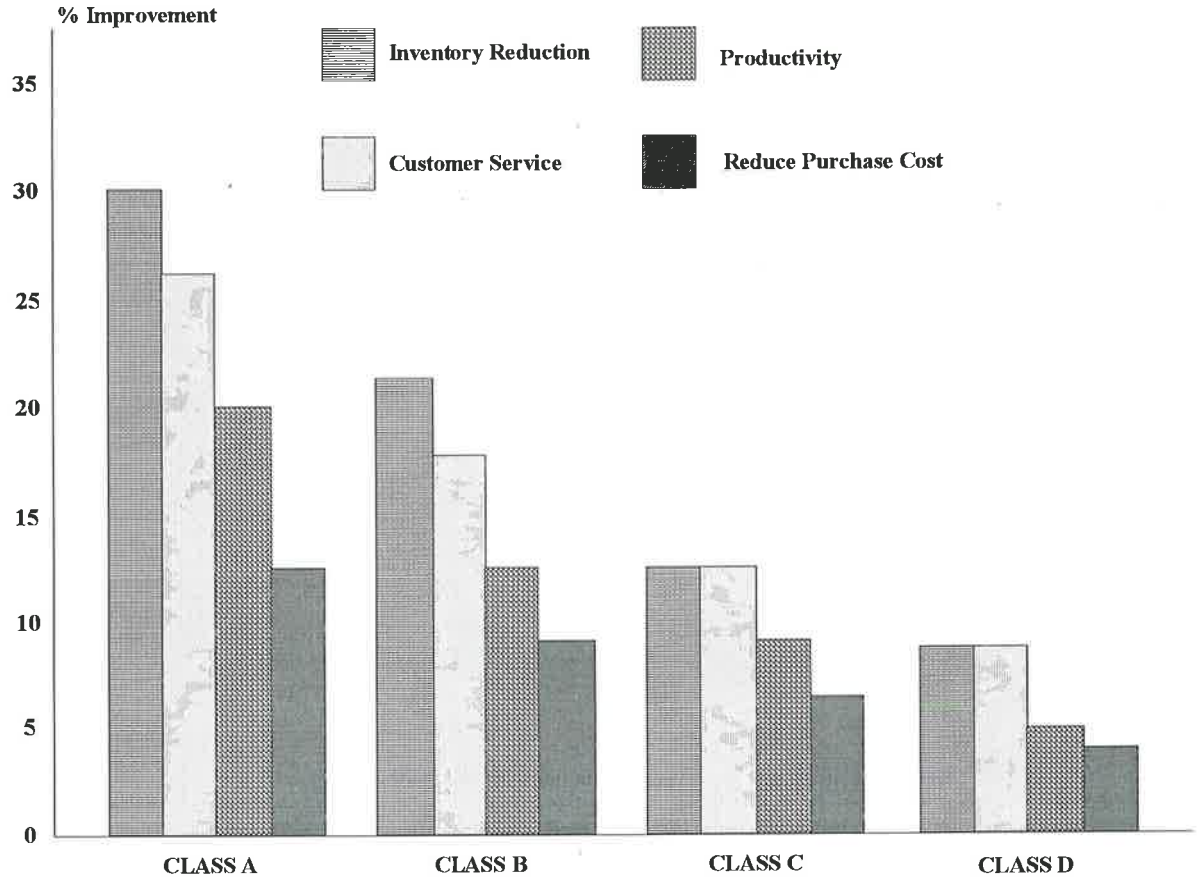
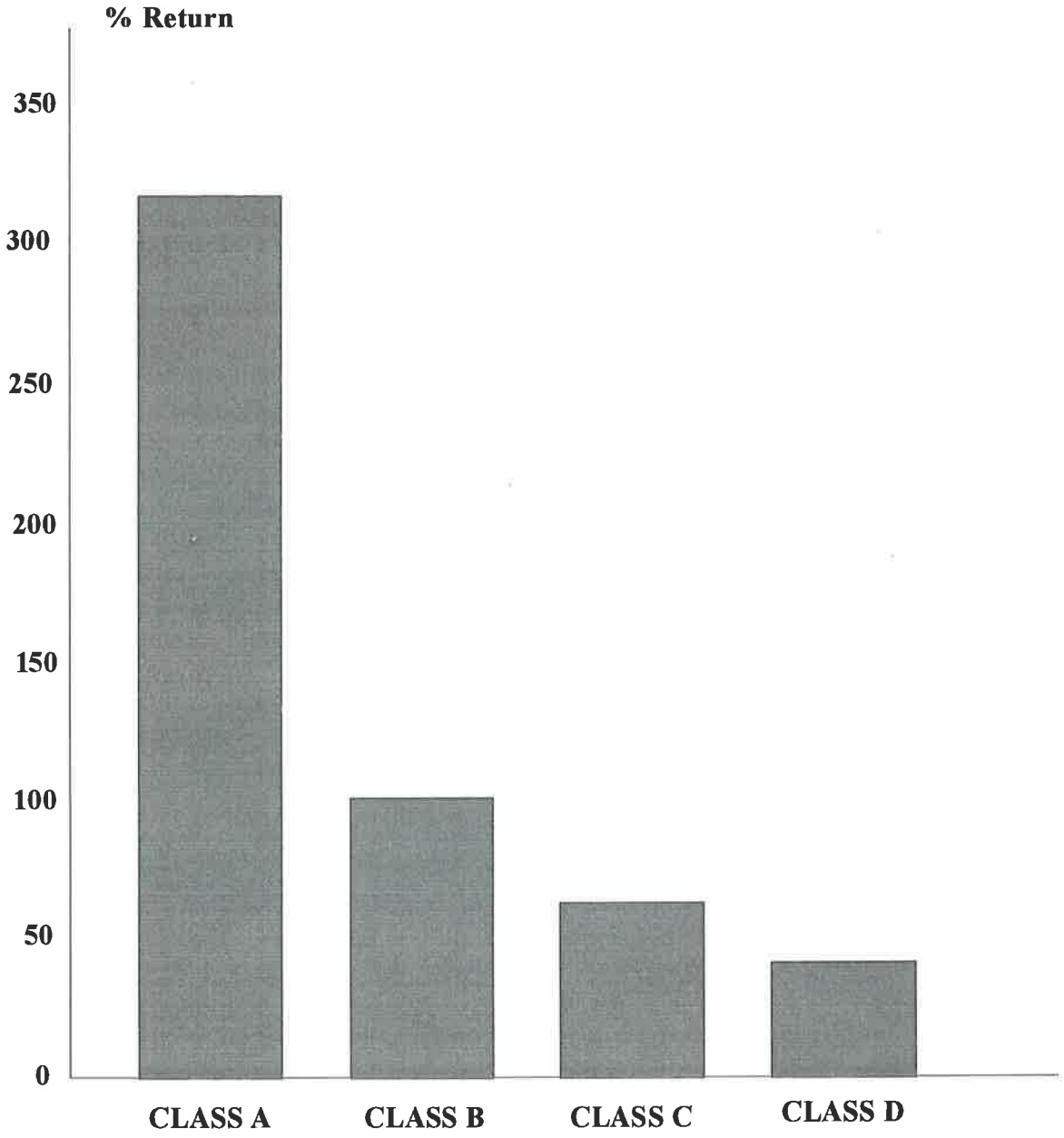


Figure 19 **CLASS A, B, C & D COMPANIES**

Return on Investment



Source - Survey Results MRP/MRPII

The Oliver Wight Companies

Essex Junction, VT, USA, 1990

In their client magazine Message Pacific, an Australian affiliated company of System Software Associates of the USA included in articles by George Howes [75] about MRP the importance of Class A accreditation. Howes explains, when George Plossal and the late Oliver Wight first proposed an ABCD checklist in the mid 1970's, it was as a device to identify important actions needed and to permit companies to evaluate how well they were performing. It was never intended to define excellence or to set goals. Important factors like cycle-time and flexibility were not mentioned. They felt it was too soon to overstress cutting leadtimes. You could then be a Class A company with improvement in two of the three major objectives - customer service, inventory turnover and profits.

In North America 'A' Class accreditation is both a much sought after and a sometimes maligned process. At least three American companies publish ABCD checklists - Buker [115], Garwood and Wight[114] (Wight checklist now much changed from the first 1977 checklist). A checklist selection criteria is shown in Figure 20.

Some large organisations have their own customised checklist and use internal audit teams to carry out regular assessments.

'A' is the premier grade in the ABCD range. Accreditation is putting your company through interviews and observations by an independent consultant. Points are scored for a variety of topics and the final total is used to determine whether you are excellent (A) or very good (B) or just getting started on the right path (C) or awful (D). The idea is to use the checklist as a tool for company wide performance monitoring.

Figure 20 CHECKLIST FOR OLIVER WIGHT CLASS "A" ACCREDITATION

Checklist selection criteria for attainment of Oliver Wight Class A accreditation. Australian Defence Industries attained Class A MRPII accreditation after meeting in full, the 16 performance measurement criteria outlined below:

1. Planning & Control
- ☑ Management
- ☑ Supply
- ☑ Demand
- ☑ Product Development

2. Data Management
- ☑ Bills of Material
- ☑ Routings
- ☑ Inventory Records
- ☑ Change Control

3. Performance Measurement
- ☑ Planning and Control
- ☑ Quality Service Cost
- ☑ Velocity
- ☑ Management

4. Continuous Improvement
- ☑ Education
- ☑ Employee Involvement
- ☑ One Less at a Time
- ☑ Partnership

In Australia/New Zealand there are 12 organisations that were recognised as A Class users of MRP in Oliver Wights' ABCD survey, included:

ADI Munitions Missile Factory

Ciba Geigy

Crown

Cyamid

Kraft

Merck Sharp Dohme

Uncle Toby's

Formica (NZ)

Mainland Cheese (NZ)

For those achieving 'A' class the rewards have proven to be substantial, a 200% return on investment is often quoted.

8. SURVEY COLLECTION OF DATA ON AMT MANAGEMENT

8.1 Introduction

The main thrust of this Thesis has been reviewing an established AMT; that is Manufacturing Resource Planning, known as MRP II and Material Requirements Planning, known as MRP. Of particular interest is how management have used their MRP II systems, how management have measured their successes and to demonstrate how failures in operating such systems has some commonality of causes. Also as previously mentioned, information was gathered on SMWT (as part of Socio Technical Systems) and Activity Based Costings, with which it was hoped to demonstrate that only companies applying the use of people skills were successful AMT users.

8.2 Survey Methodology

Preliminary discussions with several Logistic Managers, who were responsible for their companies MRP System, revealed the depth of questions that were required to leech out of each organisation their true position as regards to their standard of operation of the system. The detail of the questions, their cross functional integration and understanding were points considered in drawing up a Questionnaire.

The Questionnaire (Appendix III) was prepared and tested with a couple of MRP users, refinements were made and the final questionnaire circulated throughout Australia only.

Contact was made with many software suppliers and consultants to manufacturing industries and after many weeks a comprehensive list of MRP users was drawn up. Finally over 126 companies were selected to complete the questionnaire of which 42 replies were received. Some respondents to the survey failed to answer some questions, hence the

variety of quantitative answers for each question.

Most company's were contacted personally by the author who received some assurances that the surveys would be returned completed. However, on receipt of the survey itself some people obviously got cold feet and didn't return the survey. Disappointing, but a return of 42 of 126 was deemed satisfactory to get sufficient trends to make some definitive comments of the respondents replies.

The replies were developed into a format that consolidated the information which is shown in Section 8.4 of this thesis. Comments have been made by the author after each question to help clarify views. The survey questions are shown in bold print and numbered Q1, Q2 and so on.

Verbal questioning was also done to help confirm results responded in the questionnaire, over 37 people involved in MRP systems and manufacturing generally were interviewed. The results are discussed in the following sections.

8.3 Companies and People Involved in the Survey

COMPANY INVOLVEMENT: Many companies generously donated their time to assist in completing the questionnaires. Besides completing questionnaires personnel from some of the companies were also involved in personal feedback on a one to one basis.

PERSONS COMPLETING SURVEY

MRP SECTION

Listed below are the job titles of the people who completed this section. This in itself is interesting because of the various descriptors people use for very similar jobs.

Logistics Material Manager, Demand Manager, Specialist in Production Control Systems, General Manager, Information Systems Manager, Production Control Manager, Materials Manager, Managing Director, Project Manager, Production Manager, Purchasing Manager, Master Production Schedular, Master Schedular, Business Systems Manager, Data Processing Manager, Manufacturing Support Manager, Information Technology Manager, Production Systems Manager,

WORK TEAM SECTION

This section was completed by the following job titles: Production Manager, Consultant, Specialist Production Control Systems, General Manager, Superintendent of Manufacturing Resources, Operations Director, Production Clerk, Improvement Manager, Training facilitator, Business Systems Manager, Materials Manager, Production Control Supervisor, Data Processing Manager, Master Production Schedular Supervisor, Manufacturing Support Manager, Production Systems Manager.

ACTIVITY-BASED COSTING SECTION

This was completed by the following functional descriptors, as listed below: Financial Controller, Cost Account Manager, Specialist Production Control Systems Supervisor, General Manager, Management Accountant, Finance Director, Accountant, Production Planner, Production Manager, Cost Accountant, Production Cost Accountant, Business Systems Manager, Materials Manager, Cost Accountant, Data Processing Manager,

Manufacturing Support Manager, Production Systems Manager.

Comment: It is interesting how various organisations have adopted so many different descriptors for the functions involved in controlling MRP, Self-Managing Work Teams and Accountancy. It could be said that these functions were just given the task of completing the questionnaire. However, it could also be argued that these people were selected because of their direct functional knowledge.

8.4 Companies Main Products

The following lists the products that the companies are manufacturing who completed the survey.

automotive exhaust products, handyman products, frozen and dried foods, beverages, food ingredients, pine furniture, tickets, electrical accessories, self-adhesive materials, injection moulding, glass and plastic valves, plastic irrigation fittings, power generation equipment, holloware, automotive mirrors, motor vehicles, rubber sealing components, garage lubrication products, power steering, air-conditioning, washing machines, clothes dryers, diesel generator sets assemble

Figure 22 and 23 show the sales volume per year companies achieve and the number of people employed in the industry. This information was used to calculate the mean dollar sales per employee which could become a basic goal for organisations using MRP systems. It certainly is not a benchmark because it does not show the dollar value of assets involved in production of the sales volume.

Figure 21 **SALES VOLUME PER YEAR**

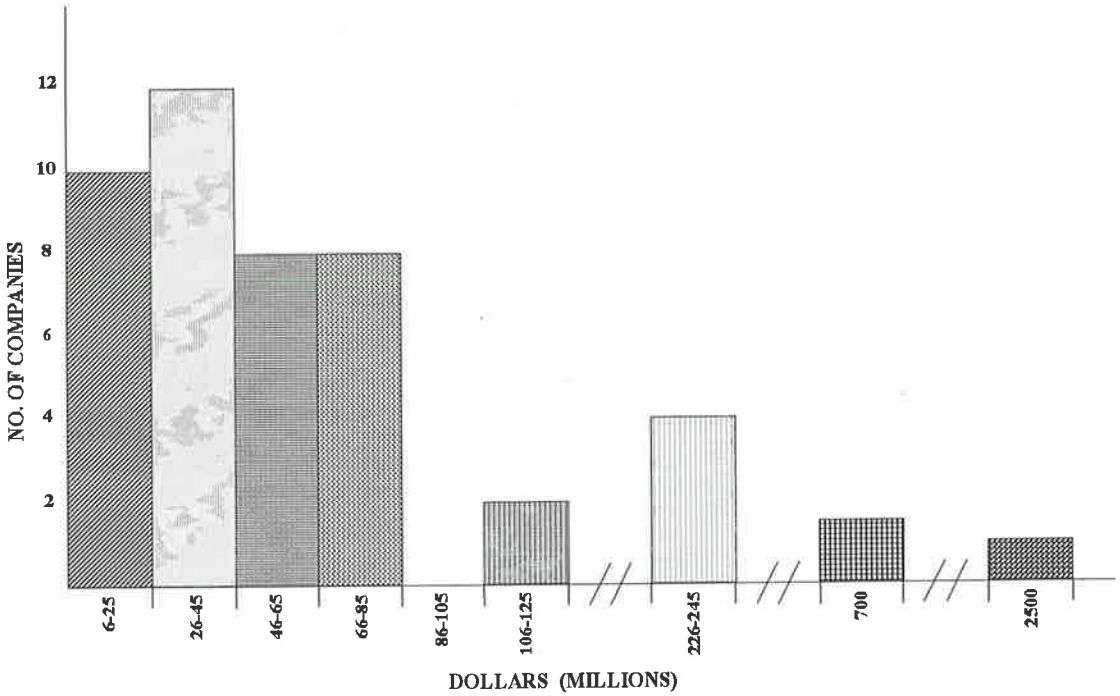
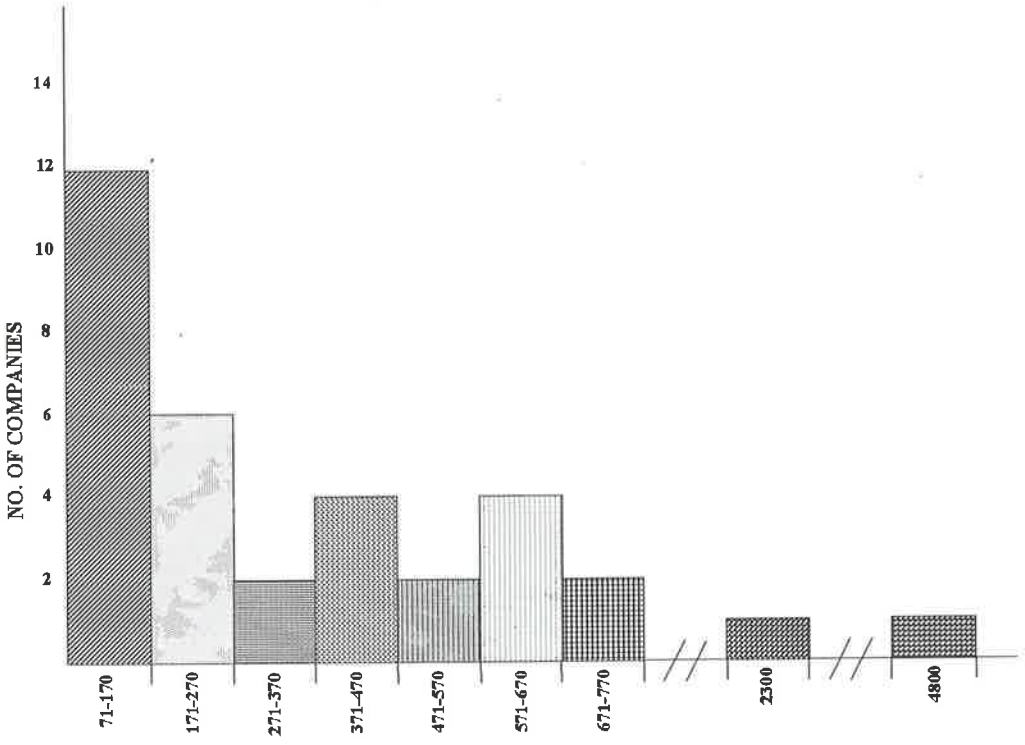


Figure 22 **NUMBER EMPLOYED**



From the information gathered the mean dollar sales per employee calculated is $244,888.

It needs to be recognised that when looking at this figure in the raw, is it acceptable, are we comparing apples to apples? The answer is no, because some companies are only assemblers of products and therefore only have the functions associated with assembly. Other companies design, manufacture, assemble and distribute. Other companies have design carried out overseas and therefore they did not show numbers employed in those functions in this survey. Hence their sales dollar per employee is substantially higher than those companies who do the design function. Removing this anomaly from the figure, the sales dollar per employee is reduced to $199,143 (Mean).

8.5.1 MRP System - Survey Results/Comments

Q1. Please name your MRP software.

SOFTWARE	*NUMBER OF COMPANIES*
BPCS	9 companies had BPCS
CHAMELION	1
CAPRMS	1
HPMN3000	3
MANMAN ASK	2
MFC/PRO	1
IN-HOUSE DEVELOPED SYSTEMS	3
MAPICS	6

Comment:

A good place for any company to start researching available MRP software are with

suitable computer services organisation. One such service, Homer Computer Services [76] offer Manufacturers Software Buyers Guides, that provide referencing to manufacturing applications software available in Australia and the Asia Pacific Region. Their guide details over 125 software products and uses a standard framework for ease of comparison.

An international group doing similar work is the Plant Wide Research Group in the USA.[77]

Q2. Please name your computer hardware that carries your MRP system.

IBM-AS400	13
ICL-DRS6000	2
IBM SYSTEM 38	2
IBM SYSTEM 36	6
HP9/22LX	3

Comment:

Many recipients of the questionnaire failed to answer this particular part. This highlights the lack of knowledge of what they really have and what they are using. This is highlighted right through this document.

Q3. When was MRP first installed?

YEAR OF INSTALLATION OF MRP

Prior	1982	8 installations
	1983	1
	1984	
	1985	1
	1986	5
	1987	2
	1988	2
	1989	1
	1990	
	1991	2
	1992	2
	1993	2

Comment:

As can be seen there were 8 systems installed prior to 1982 and the majority of systems seem to have been installed in the year 1986 and these were all BPCS. Some companies were on their second software system, the main reason for this change is indicated in question 5.

Q4. Are you using the same system as original installation with up-dates?

Comment:

This is split evenly; 50% were using the same system, 50% were using a different system.

Q5. Indicate previously used systems and reasons for changing the system.

Comment:

Five companies have stated it was an upgrade, 4 companies had changed owners, and therefore they had to get in line with the software of the new owner; 1 company had a change of policy of which computers they use and had changed to a different hardware.

Q6. Do you believe you are using your MRP at an MRPII standard?

Yes - 9

No - 10

Comment:

This question leaves some degree of interpretation to the skills of people answering the questionnaire. To those skilled in the knowledge of MRP systems it is recognised that MRPII standard signifies that you are using the whole business planning and manufacturing planning of MRP, and they have what is called, "closed the loop" and are using capacity planning. Although the results indicate a fairly general split, further questioning of users shows that where some people have said yes, there is some doubt whether respondents fully understood what "closing the loop" meant.

Q7. Are you familiar with Apics/Oliver Wight categorising of users of MRP standards?

Yes - 11

No - 8

Comment:

This is of significant concern. From all the information gathered during the process of this project the most frequently used system for assessing the standards of users of MRP is the Oliver Wight system. To have over 42% saying that they are not even aware of that international system is of concern.

The survey shows that half of the respondents were not aware of Wights ABCD Standard. This is a concern but what is the relevance. In an article in Computers in Manufacturing, Llewellyn and Bosma [78] suggest that ABCD standard is outdated. The term Class A now has very little meaning because it is not precise, it has as much meaning as that of other well used marketing word 'new' and should be treated in exactly the same way. Coming upon us quickly is a new term 'World Class'. As yet it is undefined and should remain so because it indicates a direction not a destination.

Q8. If you answered "yes" to question 7, what standard do you think you are at?

A - 1

B - 7

C - 2

D - 0

Comment:

One user in this whole survey thought it was what one would call a world class standard

of an MRP user. This is of great concern to industry, it is of great concern to manufacturing; it should be of great concern to management. However, there is some feeling that the Oliver Wight method of categorising user's standards is too complex and is not totally relevant to companies ability to use MRP. The recommendation in Chapter 12 shows a simplistic form of assessment for users in Australia.

In some literature offered by the Oliver Wight Company, a Class A, MRP user should get the following typical improved results. [79]

Throughput Time	50% Less
Work in Progress	50% Less
Scrap and Rework	⅔ Reduction
Setup Times	90% Reduction
Space	40% Reduction
Inventory Turns	10 Fold Improvement
Quality	10 Fold Improvement

Q9. Do you use Capacity Planning or Rough-Cut Capacity Planning?

Capacity Planning	Yes - 6
	No - 11
Rough-Cut Capacity Planning	Yes - 11
	No - 8

Comment:

It has been said that when consultants run seminars and workshops in MRP, they claim that companies who use capacity planning very rarely use anything other than rough-cut

capacity planning. This was substantiated by this project. However, it has been claimed that 90% of companies only use rough-cut planning. The above figures indicate that this is not true in the Australian context. The difference between capacity planning and rough-cut capacity planning is that capacity planning or full capacity planning takes into account all work centres and lead times, whereas rough-cut capacity planning may ignore most work centres and only look at bottle-neck work centres, it may ignore the bills of materials and only use family bills of materials. It uses no lead time but is considered a very useful guide, but is certainly not a detailed capacity that covers each work centre.

Q10. What time buckets do you currently have in your system?

Bucketless - 3

Daily - 8

Weekly - 5

Two-Weekly - 1

Monthly - 1

Comment:

In today's environment of short lead times and better control on the shop floor, it should be mandatory that companies use a bucketless system. A bucketless system allows calculations of the time required to complete a job from the information routes and schedule requirements.

Example: If you have to produce 10,000 parts, from the information in the system it may take 8 days. If you use a bucketless system, that will calculate the start date and the due date accordingly to that information. If you do not have bucketless system and say have weekly buckets, all the weekly system will do is issue a job ticket that is due in that week.

Hence your information is poor, the system allows you 3 days less than is needed (1 week equals 5 days.)

Similarly, companies that have weekly time buckets only without daily or bucketless systems, are legislating in today's environment to hold a lot more stock than they should be doing to become world competitive. The system only generates job tickets on a weekly basis, it means that everything you have in your shop is going to be allocated one week for production. This is not modern manufacturing. You will see that daily buckets is the most frequently used time frame; this gives better control, but it is not the ultimate.

However, companies are comfortable with this and there seems to be reasonable acceptance on the shop floor operations level.

Q11. Do you have time fences in your system for:

Manufacturing lead time	-	Yes	-	12
Raw material lead time	-	Yes	-	14
Planing lead time	-	Yes	-	11

Comment:

These results show that companies are being more disciplined in their operations of their manufacturing planning. If injections of orders are made within normal lead times into systems, constant human interference in the running of a plant is required to keep jobs on time and produced by the due date requirements.

By putting in time fences, it is possible to control the business more efficiently. If product is injected into the schedules that has not been recognised, for whatever reasons, it always means that the system is being interfered with and it needs people to expedite or it may

need production runs to be shortened or changed. It may allow less time to plan, because interfering in the manufacturing planning processes by short-cutting your lead time that the system has, always creates inefficiencies in use of work centres and the utilisation of labour. Duplication of effort is a problem whenever you are interfering with the manufacturing planning process.

In a paper presented at an International Mechanical Engineering Conference in Sydney,[80] a view was expressed about the nervousness of MRP, one cause of MRP nervousness is manufacturing environments which change their production plan frequently due to changes in customer demand. This is a normal state of affairs for part suppliers. All too frequently customers who manufacture end products change their order for parts, with little notice to suppliers. When MRP is run under such circumstances it recommends numerous changes to 'firm' (released) work orders. These recommendations create what is called 'a nervous system' and the amount of manual work caused is sufficient for such changes to be avoided if at all possible. Variations in scrap and rework from existing production orders, work stoppages or delays, and late deliveries from suppliers are also causes for a 'nervous system'. MRP systems do not generally perform well in these constantly changing conditions.

Hence the need for disciplined management policies, inclusion of planning time fences, improving quality by avoiding rework and scrap go hand in hand with a successful MRP installation.

Q12. Did your system meet your expectations?

3 companies said the system achieved a high level of expectations, 19 companies were satisfied, and 3 companies were disappointed that the system gave them low levels.

Comment:

The 3 companies which claimed high levels of expectations were regarded as highly efficient users of their MRP system with good knowledge of the management required to control the system.

In their paper on MRP: An Adaptive Approach, All-Hakim and B.W. Jenny[81] point out that many managers have made extensive attempts to implement an MRP system but have often been disappointed with the results --- the main reasons behind the failure of MRP at operational level are:

(a) MRP ignores capacity constraints to a large extent, which inevitably results in unrealistic plans. Rough Cut capacity Planning (RCCP) is a good check at planning stage but in many cases this is not enough.

(b) MRP cannot cope with the dynamics of the shop floor.

(c) Predetermined parameters such as batch sizes, safety stock or fixed lead times result in rigid implementation.

Their paper also suggests that in the United States some 50% of systems are said to have failed.

The survey results in this Thesis suggests that more fundamentals affect MRP utilisation than RCCP or shop orders. It supports basic data integrity as a basic problem, followed by lack of management knowledge of how to use a formal computer assisted manufacturing system!

In an article Woodrow Chamberlain[82] writing for APICS claims the demise of MRP II has

been grossly exaggerated. In fact, misinformation and general lack of understanding about how MRP II works and what role it will continue to play in our nation's (USA) manufacturing organisations are running rampant among both manufacturing professionals and vendors of MRP II solutions.

This statement underlines the prognosis of this thesis, that MRP II systems have abilities well beyond most user's understanding and knowledge of what their system can do.

8.5.2 MRP Installation Phase - Survey Results/Comments

Q13. When your company started the evaluation process of using MRP, did you form an:

MRP system selection committee

MRP installation steering committee

Yes to both questions - 12

No to both questions - 4

Comment:

The results indicate that the majority of companies do use committees to select which type of systems they are purchasing, and they also follow the generally accepted course of having an installation steering committee. Those companies that said no, they did not use such committees were generally found to have fairly reasonable expertise in their management team that had some prior knowledge to MRP systems.

A useful source of information for any organisation going into MRP is APICS.[83] Most capital cities of Australia have their own chapter and they are linked to the founders, the

American organisation. They publish regular quarterly proceedings of papers and a monthly magazine. They also produce a Bibliography that enables the reader to review all papers presented by their Society.

Much has been written about starting into MRP, about details of modules in an MRP system, about early surveys (early 1980s) of implementation and practice, but little has been written about gauging or benchmarking useability success of MRP. The most frequently used international barometer on MRP usage is Oliver Wight's ABCD analysis.

This is a complex document and is not used extensively in Australia, in fact this research has shown many so called practitioners of Australian industry do not know of the Wight documents.

Q14. Did your company employ a consultant to help the installation process?

Yes - 12

No - 5

Comment:

Companies generally said "yes" to employing a consultant. The results of this question do show the influence consultants have on MRP installations. They are widely used throughout MRP installations.

The question remains: are those consultants totally capable of installing MRP systems if their background or experience has only been in computer software and not in manufacturing. Therefore the term "consultant" which tends to underline some form of expertise, is questionable. This is again questioned later on in this report.

Q15. Did your company have the ability to use MRP literate personnel from other divisions of your company?

Yes - 9

No - 8

Comment:

The above results indicate a fairly 50-50 split on this answer. The question was asked to establish how many companies have been able to draw in MRP expertise within their own company.

Q16. Did your company use combinations of the following:

Consultant, steering committee or other division expert

Consultant, steering committee

Consultant

Others

The results from this question were misleading and not really indicative of answering the questions in an appropriate manner. The only comment that really can be made is that generally, companies used consultant and steering committee, and if they had the availability, a divisional expert.

Q17. What modules of the MRP system were installed first? Please rank in order of first four modules.

	BOM	ROUTES	L.T.	SCHEDULES	INVENTORY	ITEM MASTER
Rank	3, 2, 2, 1 3, 2, 4, 2, 3, 2, 1, 2, 2, 2, 2	4, 3, 1, 4, 3, 4, 3, 2, 3, 3, 3, 3, 5	4, 3, 4, 4, 4, 4	3, 4, 4, 6, 4, 3, 4	4, 1, 1, 2, 2, 2, 3, 2, 1, 4	1, 1, 1, 1, 1, 1, 5, 1, 1, 1, 1
Mode	2	3	4	4	2	1

Only four modules were asked to be ranked, hence ranking above four is eliminated when using the mode figure.

Comment:

This is a good result, installations have been done in a sensible procedure, Item Masters being ranked 1 in predominance. Inventory module being ranked 2 in predominance. Bills of Materials and Routes being ranked equally next. These are generally followed by lead time modules and then scheduling modules.

Q18. What was the last module installed?

Lead Time; Distribution Requirements Planning; General Ledger; Rough-Cut Capacity Planning; Schedules; Routings; Materials Requirements Planning; Shop Floor Control.

Comment:

A variety of modules to suit individual companies and pace of installations, no conclusions can be drawn from the survey.

Q19. Have you more modules to install?

Yes - 5

No - 18

Comment:

Most companies feel that they have completed all the modules that they intend to install, and therefore must feel satisfied that they have completed the tasks that they have set themselves with MRP.

An observation can be made that many companies using MRP never intend to be MRP II or World Class users.

Q20. Timing of installations, did your plans for implementation of your MRP System extend beyond the following times?

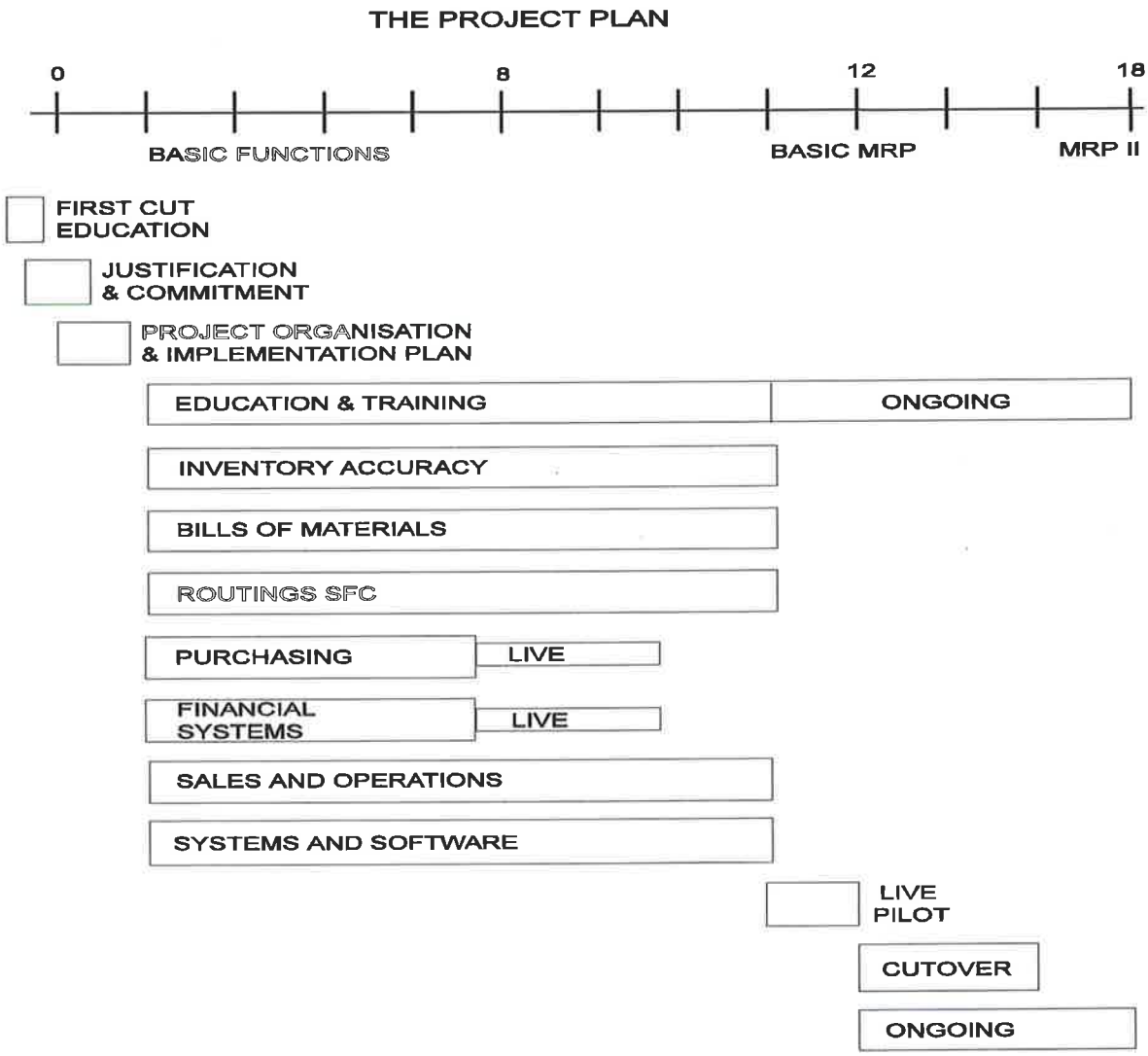
Installation Time	No of companies responding
12 months	6
18 months	2
24 months	7
36 months	2
Unknown	5

Comment:

In today's environment with the skills of installation available, the plethora of information, books, brochures, consultants, it is stated that installations that take longer than 18 months are really not being driven and managed properly.

As previously discussed many consultants to the manufacturing industry suggest that installation from commencement to closing the loop of an MRP II system should not take more than 2 years to be effective. Shown in Figure 23 is an Australian consultant's view of timing of the installation process.[84]

Figure 23 **THE MRP PROJECT PLAN**



It can be seen from this research that some companies had installed their modules within the first 12 months, however, predominance shown in this overview is in the 24 months category, which is probably a reasonable expectation for installations.

One company had the total installation including capacity planning, up and running within six months from scratch. This is an exceptional result and was driven by some fairly determined management in a very sophisticated industry.

Q21. Was your implementation timetable achieved?

Yes - 17

No - 9

Comment:

A fairly good result. Companies have claimed that in general they are satisfied with their installation progress. The question really remains though, that they may be satisfied with the installation, but is their installation at an MRPII standard or are they being satisfied with using an MRP system that is ineffective, and is only doing a very small part of what the package they have purchased could do. Perhaps selecting MRP for their system was a wrong choice?

It tends to say that companies are installing MRP, getting some basic information from it, using it in a format that is acceptable to them with their amount of knowledge, and then are saying let's stop here because it is too complicated to go any further. These companies when questioned on some of the basic requirements of the systems, such as scheduling, bill of material accuracy, inventory accuracy, indicate that they have a poorly managed basis for using a computer-based manufacturing system.

Q22. If your answer to question 21 was no, briefly describe your problems.

The listing below is typical comments made by some recipients:

- Lack of knowledge and experience of users and system installers.
- No manual control before materials requirements planning. Still working on installation, decided on "gently, gently" process.
- Lack of external support.
- No consultant used.
- Lack of understanding by steering committee and lack of manufacturing

knowledge.

A typical recommended checklist for successful implementation is listed below.[85]

1. First Cut Education
2. Cost Justification and Commitment
3. User Controlled Project Team
4. Full Time Project Leader
5. Executive Steering Committee
6. Professional Guidance
7. Education of the Critical Mass
8. Pilot Approach to MPS/MRP
9. Close the Loop
10. Finance and Simulation
11. Dedication to Continuing Improvement

8.5.3 MRP People - Survey Results/Comments

Q23. Did the person driving your installation have a function background from:

FUNCTIONS	RESPONDENTS																			TOTAL
Engineering			x												x			x		3
Production Management	x		x	x	x	x	x	x		x		x			x		x			11
Computing		x	x		x					x	x	x		x		x		x		9
Finance								x	x			x	x					x		5
Sales																				
Production Systems	x	x	x		x					x		x								6

* (How to read this chart - see page 108)

NB: Q23. Chart is read: The left hand column shows various functions that are employed in manufacturing, the respondents to the survey have indicated that the person driving the installation has skills of functions nominated by X. Example, first company indicated their "driver" had functional experience of Production Management and Production Systems, the second company person has experience in Computing and Production Systems and so on.

Comment:

Function or background for the person installing the MRP system is desirable to have as broad a function knowledge as possible, but the results show that there is a significant lack of overall cross-functional understanding; there have been some systems installed where there has been production management and computing experience together with production systems, but generally the results show that the persons do not have enough depth of understanding of all the relevant inputs required into a computerised manufacturing system. They require knowledge of production management, computing, finance, sales and production systems. Failure to have that knowledge, failure to be aware of the requirements of those areas, can and does lead to acceptance of a sub-standard system.

The data shown above does not really substantiate those comments. However, the information shown in questions 24 and 25 continues to underline that there is insufficient cross-functional skills of people who have prime responsibility for installing, chairing or being directly responsible for the computer system itself.

Q24. Did the person chairing your installation steering committee have skills in:

Computing	x	x		x		x				x					x						
Production Systems		x		x	x			x		x											
Production Management			x	x					x	x		x	x	x	x	x					
Finance		x					x	x			x										
Engineering				x										x							
Sales		x																			
MRP Systems	x	x	x	x		x				x					x						

NB: Chart to be read similarly to Question 23.

Similar comments can be made to question 23 here from the above data. It is significant that the chair predominantly has been someone from a production management background. Some of those have a reasonable disbursement of cross-functional skills, but it is also interesting to note that we have five financial background people chairing the installation committee who have very little cross-functional skills.

Q25. Did the person directly responsible for your computer systems *(M.I.S.) have skills in the following areas prior to implementing your system?

* (M.I.S. Manager Information System)

MRP System	x	x			x			x	x		x			x	x		x				
Computer Systems	x	x	x	x	x	x	x	x	x	x	x		x	x	x		x				
Manufacturing Systems	x	x			x			x	x		x			x	x		x				
Production Management					x			x						x							
Financial Computer Systems	x	x		x	x				x			x		x	x		x				
Accounting	x	x			x			x				x		x	x	x	x				
Sales		x			x									x							

NB: Chart to be read similarly to Question 23.

Comment:

What was interesting in this category question was the background skills of the computer system people. It shows that under categories listed that they have computer skills, some manufacturing systems skills and some MRP system skills, but virtually no production management skills. This is a significant skills gap in the majority of installers using a computer-based manufacturing systems. A general comment that could be made over the last three questions, 23, 24 and 25, is that systems installation and usage that do not have sufficient broad-base functional experience of the chairperson or the installers or the MIS person, tend to be of a lower user grade than those systems that are installed by people that have good cross-functional understanding. If the basics of any production system is not available and people not disciplined to an acceptable world class standard, the whole system will always be blamed for the lack of credibility of the MRP. Consultants who, as we have seen in previous questions, have been predominantly engaged in helping companies install their systems, often do not have ownership, nor should they, of changing the discipline in a company to operate with a computer-based system, this is a company problem. Perhaps this can be highlighted by a very simple example; if the inventory accuracy is below 95% you will always have a problem in maintaining good customer delivery, good production efficiency. The consultant's responsibility is to advise companies of the required accuracy, the company has to obtain it.

This is just one example. If we then look at BOM accuracy, routing accuracy, scheduling security, that is maintaining schedules without interferences by accepting orders within lead times, working hard on reducing lead times, which is a significant part of world class businesses, then the systems that are being used could be said to be undermanaged. That undermanagement is usually due to lack of cross-functional understanding, lack of

understanding of the discipline required, lack of understanding that computer systems rely on accurate data. But all is not lost; things are changing, and this is commented on in Chapter 9.

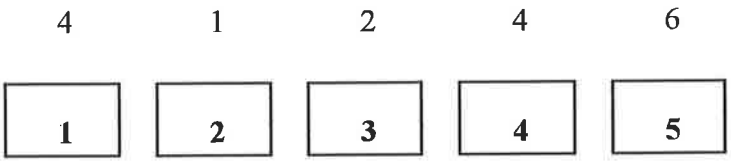
Q26. What level of experience does your MIS Manager have of MRP Systems?

Years of Experience	No of Companies responding
1 Year	1
2 Years	1
3 Years	3
4 Years	2
5 Years	1
> 5 years	10

Comment:

This is a pleasing result that MRP experience of MIS managers is significant. However, the question begs itself, if over 60% of MIS managers surveyed have over 5 years experience of MRP systems, or should that experience, be not only with the MRP system, but also in the production management area to give those people a balance of their understanding. Comments above concentrated on the manufacturing part of the MRP system, the same could be said for the accounting part of the MRP packages. MIS personnel require rounded functional experience in a manufacturing company.

Q27. What level of knowledge does your current Production Manager have of your MRP System?

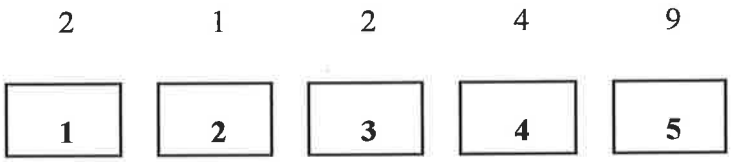


Where 1 is low and 5 is high.

Comment:

It appears from the results of this question that companies generally are satisfied that the Production Managers know how to use the MRP system. Of concern, when you talk to these Production Managers, is the lack of confidence that they exhibit on the basic standards that should be achievable and the discipline involved in gaining accuracy of data. Therefore, from an observer's view, it could be reflected that experience gained in MRP systems by Production Managers may be of an inappropriate standard and that "experience" alone is not an accurate measurement.

Q28. What level of knowledge does your current Production Control System Manager/Supervisor have of your MRP system?



Where 1 is low and 5 is high.

Comment:

Similar to the previous question, data indicates that satisfactory experience is available.

In his book about Operations Management[86], Roger G Schroeder points out that it takes a great deal of effort to make MRP successful. As a matter of fact research indicates that five elements are required for success:

1. Implementing Planning
2. Adequate Computer Support
3. Accurate Data
4. Management Support
5. User Knowledge

Too many companies jump in and start implementing MRP without adequate preparation. Later, confusion and misunderstanding occur as problems arise.

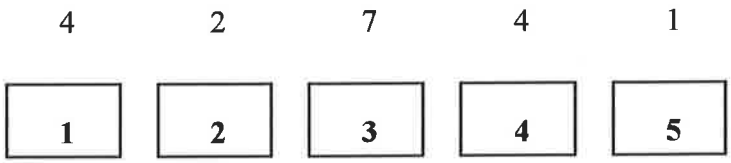
An adequate computer system is probably the easiest of elements of MRP to implement. Many companies use (these) standard packages rather than writing their own computer programs.

An MRP system requires accurate data, which is very difficult to obtain. Many companies are accustomed to lax record keeping in manufacturing because the company has always managed by the informal system. But accurate data is required when decisions are made from information supplied by the computer - an MRP system will need to create accurate BOMs as a first step. Once the BOMs are accurate, a system will be needed to keep them that way. Inventory records must also be accurate to support the MRP system. All other MRP system data - such as shop routings, shop floor status, and costs - must be initially screened for errors and then maintained in an acceptable state of accuracy. Keeping MRP data accurate for system integrity is one of the most important tasks in operating an MRP system.

As Schroeder pointed out data accuracy is paramount to running successful MRP systems, yet the results of the survey made in this Thesis show data accuracy and maintenance to be a problem. Even understanding the need for accuracy could be debated by some organisations. Why is this, when so much information like Schroeder's is available to organisations to get 'it right'.

8.5.4 MRP Training - Survey Results/Comments

Q29. Was your company's implementation training adequate for MRP?



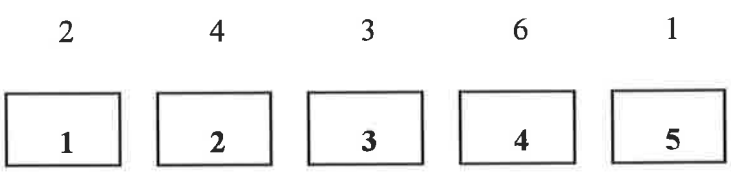
Where 1 is not adequate and 5 is totally adequate.

Comment:

It is disappointing to note that only one company's training was totally adequate, and that four companies said it was not adequate. Many courses of training are available, following is typical training being offered by some universities.

The University of Technology in Sydney was given a comprehensive manufacturing software system, Manman from Ask Computer Systems. The computer was installed in the University's Centre for Industrial Technology. The Managing Director, Dr Frank Swinkels was quoted as saying in an article by Bob Jackson [87] that "Manman will be used in education, training and consulting services. The software will be used for a MRP II subject in engineering courses at the University. Short training courses will also be developed and offered for personnel employed in MRP II."

Q30. Is your company's ongoing training adequate for MRP usage?

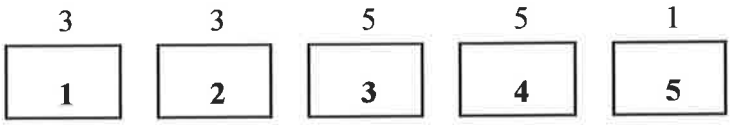


Where 1 is not adequate and 5 is totally adequate.

Comment:

The results of this indicate a reasonable spread of satisfaction, but again, there was only one company totally adequate and it was disappointing to see that there was a large proportion in the area of not adequate.

Q31. Is your company's training for new employees adequate for MRP usage?



Where 1 is not adequate and 5 is totally adequate.

Comment:

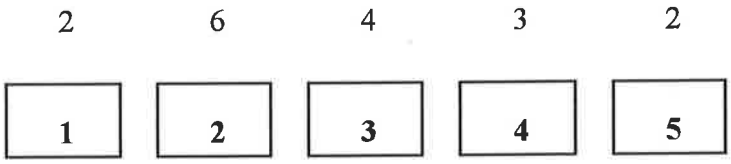
A broad spectrum of results. Interesting to note that with the requirements for quality to the Australian Standards 3900 series or the International Standards 9000 series requires documented proof of adequate training in all of the company's systems and procedures Therefore it was significant that some recipients of the survey indicated a change in attitude to training of employees in recent times to meet these standards.

The author of this Thesis is a TAFE Lecturer and viewed a paper by the Labour Market Analysis Group of TAFE on AMTs as relevant and instructional.[88] The paper discusses the advent of relatively cheap and abundant information technology and its widespread diffusion throughout almost all industries over the next decade. The paper later observes that the rapid diffusion of Advanced Technology over the next decade is likely to lead to a continuation of a very strong growth in employment in specialist computing occupations. Also importantly for TAFE this trend will also alter the skill requirements of occupations unrelated to these professional computing jobs. The changes for non computing jobs will involve 'skills deepening', involving computing related competencies and 'skill widening'

in specific non computing related competencies, such as problem solving, communication and teamwork skills.

This is another example of a paper supporting training of human factor skills to enhance the AMTs skills.

Q32. Is your training documented adequately for MRP usage?



Where 1 is not adequate and 5 is totally adequate.

Comment:

Again, it could be stated that the trend of these results is that documentation was inadequate.

Q33. Has any of your company's in-house training been videoed for MRP usage?

Comment:

Only three companies reported that they have used video as a mechanism for training people. The belief of the author of this report is that substantial resources are required to train new operatives in the knowledge of MRP. For instance, a production controller uses a significant amount of working time involved with MRP system, then being trained in that system with all the screens that can be used, can adequately be done with the use of a video camera. People can be filmed using the system, showing the screens available; people can then have the video tape at the side of their desk. When they have got continuous questions and are not sure of the direction in which they should go, they can refer back to the video tape. It becomes a standard operating procedure for the use of the system. It is a very powerful tool, very highly under-utilised.

Q34. During installation phase, were you supported by a consultant?

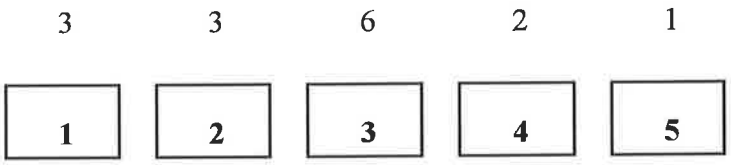
14 - Yes

4 - No

Comment:

This is somewhat of a duplication of previous questions involved in implementation stage, but it re-emphasises the fact that most companies use a consultant to assist. It is interesting when discussing with consultants how they grade their successes, no companies in the 1980s really surveyed the success of installations. They only surveyed the satisfaction of the clients about their provision of services. In other words, they didn't link the standard of MRP system usage to that of the knowledge skills gained from the consultant. Of course, this is great for consultants, they can then tell everyone that they survey all their customers and their general customer satisfaction rating is extremely high. They can, and do, continue to poorly service MRP users. However, there are exceptions and there are some excellent consultants in this area.

Q35. Was adequate training of your company's personnel arranged or carried out by your consultant?



Where 1 is not adequate and 5 is totally adequate.

Comment:

This chart shows that the trend is on to the "not adequate" side. This is often reflected poorly against the consultants, but the consultants will then claim that the company would not provide sufficient funds for training. It is believed that this could be regarded as serious strained relations between consultants and organisations. A consultant has to

advise. If the company then chooses not to take that advice, in later years if the system is not successful due to that initial lack of training provided by the consultant, then whatever disclaimer is made, the consultant or the system itself tends to be blamed, rather than mismanagement within the company. Therefore consultants should have some standards for themselves when they are approached by companies. If companies decline to make sufficient commitment to training, then perhaps consultants should start saying - and this sounds like Utopia - if you are not prepared to install it properly, I can't help you. But who would turn dollars away? Hence in general there is some malaise in business organisation about MRP systems, that the MRP system is the problem, not management. Whereas it is not the MRP system that is the problem. The problem is with the management and the usage of the system.

Q36. Has your company experienced resistance to training needs of MRP users?

Results indicate there has been little resistance to training on any level. This is pleasing to observe, although one observation was made by a production manager who was approached to send some supervisors to a basic workshop on MRP, and was quoted as saying, "They know all what they need to know about the system. They know how job tickets are issued with the due date that they have to complete the job by, what else do they need to know?" If this is a typical thought we are in big trouble. What about accuracy of data, reception or orders past "due dates," achievement of schedules, continuous improvement in lowering operational times, updating information in the system, and so on.

8.5.5 MRP Scheduling - Survey Results/Comments

Q37. Which function of your business has responsibility for scheduling your MRP system?

Sales/Marketing													x								x	x	x	
Production Management				x				x	x				x								x	x	x	
Production Control	x	x	x	x	x	x	x		x			x	x	x	x	x		x	x			x		
M.I.S.											x													
Some Combination of the Above					x																			
Accounting General Manager																						x	x	

NB: Chart to be read similarly to chart on Question 23.
Comment:

It can be seen from the above that the production control function has the majority role in this area. Whilst other areas have indicated having some responsibility for scheduling the MRP system, when discussing the implications of the recipient's answers to the questionnaire, it indicated that the question had some ambiguity. Further questioning indicated that production control are the people responsible for scheduling and inputting data into the MRP system. The other functions represented were purely set up as advisers before schedules were installed by production control. The answer to this question can then be seen as somewhat similar to question 43, ie, who is represented on a master production scheduling committee. Therefore, question 43 and this question can be seen as somewhat co-joined. It is known that some companies top level scheduling is installed directly from customers' schedules by sales/marketing people with no reference whatsoever to production control, or production management. This is of concern because a general understanding of the manufacturing system is weak in the sales area, and therefore,

because sales people generally want to keep the customer happy, they are often prepared to accept schedules within normal lead time, which creates poor company operating efficiency. Any injection of schedules into a system that is within a normal lead time, constitutes requirements for extra resources to enable that order to be met within its due date. That extra resource is not reflected in standard costing, except as an overhead content whereby overtime and extra set-up costs and so on, which is a part of the traditional way of accepting this cost burden. If activity-based costing is fully utilised in the production area it would be found that this cost activity is driven significantly by interference in lead times, knowing this would change a lot of people's attitude to accepting work within lead times.

When production schedules are invalid, that is not achievable, it causes many problems. The guru of MRP education Oliver Wight writes in his book MRP II [89] "because of scheduling problems, the right material is not made or purchased at the right time, there will be too much inventory, and at the same time, customer service will suffer. Productivity of direct labour will be affected by shortages, and constant expediting will require the jobs that are currently being run to be stopped while others are run to cover shortages. Poor scheduling shows up in overtime. Overtime is often a way to cope with problems after they have occurred because they could not be seen far enough in advance to prevent them."

This has been exemplified by a recent review of one Adelaide company who has some factory staff working in excess of 30 hours overtime per week to try to keep up with customer schedules. Review by the author of this Thesis revealed, no capacity planning, no MPS Committee, no company dedication to meeting the schedule; it was a production

control problem. (Problem observed in August 1994). MRP system installed in 1989.

Q38. Do you enter customer's orders/schedules directly, or use a master production schedular (MPS) to massage?

Directly - 8

MPS - 15

Comment:

This is a good result that companies are using master production schedulers to derive their production schedule. This should be contingent on all companies, so whilst we have 15 companies using it and 8 not, it would be highly desirable to see that changed in a short period. After all, customers don't run the plant; the companies do.

Q39. How frequently do you run a full MRP generation?

Daily	-	2
Three times a week	-	0
Weekly	-	13
Fortnightly	-	0
Monthly	-	4

Comment:

This result would be typical of MRP users that generation is run on a weekly basis in a majority of cases, but interestingly two companies stated that they are doing a full generation on a daily basis. Further investigation showed that these two companies had significant daily orders being received in their areas and this would lend itself to requiring installation of a Kanban-type procedure for a shop floor control. In fact, these two companies have started installing Kanban. Once the Kanban is up and running, daily generation requirements should be deleted and the shop floor should be driven by Kanban

system. MRP does not work well because of the time required to push the job tickets out into the shops. It is often problematical. This is why MRP is being more and more closely linked with Kanban, because Kanban as a shop floor procedure is much more effective than MRP job tickets. So the integration of the two is and should be the significant driving factor of the early part of the 1990s.

Q40. Do you run a "what if" generation?

Only two companies replied that they were using this facility.

Q41. Do you ever run a net change generation?

Three companies only said they are using a net change generation.

Q42. Do you have a master production scheduling committee?

Yes - 14

No - 6

Comment: As stated previously the master production scheduling committee is an absolute must. Anyone who does not have a steering committee should change it, yesterday!

Q43. What functions are represented at your MPS Committee?

Sales/Marketing	x	x	x	x	x	x	x	x			x	x	x	
Accounting	x	x	x	x								x		
Production	x	x	x	x	x	x	x	x	x		x	x	x	
Production Control	x	x	x	x	x	x	x	x	x	x	x	x	x	
Plant/General Manager	x	x		x	x		x	x	x					
Production Engineering	x													
Quality		x												
M.I.S.	x													
Purchasing		x								x				
Distribution		x								x				

NB: This chart should be read similarly to Question 23.

N.B. The last five function descriptors were added by various respondents to the survey.

Comment:

As previously stated, it is highly desirable for cross-functions to be represented on this committee, and it should be and it is recognised that the plant or general manager should chair such a meeting. What is disappointing from the chart, in that it shows that only 20% of those committees have that representation. The MPS committee is the driver of the MRP system; these are the people that make all the decisions of what the company is going to do with the schedules, how they are going to produce it; what stocks they are going to carry; what safety stocks, if any, are needed; what sort of lead times that they can have in the systems, what their vendor performances are; these are the key guys, the key people, the key functions of a successful MRP usage system.

Q44. How often does the MPS committee meet?

Weekly - 4

Fortnightly - 1

Monthly - 7

Ad hoc - 1

Quarterly - 0

Comment:

From the results it demonstrates that the majority of companies are using an MPS committee on a monthly basis. This would appear to be adequate with most companies, the only areas that would require more frequent meetings are those companies that have significant changes in their schedules on a daily/weekly basis. When using the word "significant," if past history is available of schedule changes or fluctuations or trends this should be a "known data" into the company's organisation. Therefore a monthly MPS meeting should be adequate with most companies given that they have sufficient data to

work on, and significant changes should be minimised.

Q45. What percentage of your orders are accepted within your *normal* manufacturing lead times?

Results

10	-	4
20	-	3
30	-	0
40	-	0
50	-	2
>50	-	5

Comment:

These results can be ignored. Recipients when being questioned on their understanding of the stated question were not aware of what was being asked and therefore the results can be discounted. The question was intended to reflect that all systems have or should have lead times installed and that they would become the normal lead time in the system. If companies that were therefore accepting orders within lead time and most companies do, the question was intended to find out what percentage of orders were accepted within that normal lead time. Unfortunately, some misunderstanding by recipients on what was being asked occurred. However, a general comment can be made that data on manufacturing lead time is poor and management of lead times needs more emphasis.

Q46. Achievement to schedules, what percentage (%) of your orders are delivered on time?

<30	40	50	60	70	80	90	>90
		1			4	5	10

If you ticked >90 what actual % are you achieving?

90	91	92	93	94	95	96	97	98	99	100
		1	1		3	1	2		2	

Comments:

In today's environment, the results shown in the charts are fairly pleasing. World class standard for delivering schedules on time is greater than 98% Only two companies record greater than 98%. However, there are several companies, as nominated above, in the above-90% range. The only disappointment in the chart is one company is indicating that they only achieved 50% of delivery on time. It is a matter of whether they survive. It is totally unacceptable. Some companies, in fact, do not measure their achievement of on-time deliveries. Most of those companies are associated with building a basic product into a stock range, and then fine tuning or final assembly to a modified customer's specific requirements. Building to stock, they do not worry about; they only worry about recording whether they are meeting their customer's requirements on time. Of course, there is a link between delivering on time and receiving orders within normal manufacturing lead time. If companies are continuously accepting orders within their normal manufacturing lead time, they are constantly expediting what one would call special orders or back logs through their system. With modern systems there is an ability to put time fences into the system that will not allow the system itself to accept orders within planning lead time, manufacturing lead time or procurement lead time. While this all sounds very theoretical, in practice the use of such systems is not well managed, and we tend to continuously say we will give the customer what they want regardless of the fact that our delivery expectations are probably not in line with our customer's expectations. The other point here to consider is that costings of product is taken on as standard costing data, and whilst we build into our overhead situations, working overtime, expediting jobs

and so on, it is not a real situation to continuously accept orders within lead times, particularly if it is a significant part of your customer's order receipt. Real costs are not reflected in the activities involved in expediting through your system in what one calls non-normal lead time - shortened lead time. Most companies do not record any data to show orders received within their normal lead time, nor do they actively pursue a cost differential to indicate to their customers that this is my normal lead time, say four weeks, you want it in two weeks, there is a premium cost.

Q47. How has your delivery performance improved in the last five years for whatever reasons (MRP, JIT, TQM, NEW BOSS)?

0-5%	5-10%	11-20%	21-30%	31-40%	> 40%
.5	1	3	1	3	6

Comment:

As you can see from the results, the improvements are spread across the spectrum of percent increases in delivery performance from zero over to > 40%. However, it is pleasing to note that several companies have improved their delivery performance by greater than 40%.

8.5.6 MRP Forecasting - Survey Results/ Comments

Q48. For your long lead time items or your seasonality of business cycles, or marketing promotional activity, do you use forecasting techniques?

Yes - 17

No - 2

Comment:

This is a pleasing result to see that companies are using some statistical data to help them procure or produce their long lead time items. Good result.

Q49. Is your forecasting manually compiled or computer assisted?

Manually - 4

Computer - 13

Comment:

Whilst the results indicate that companies are using their computers to assist them in analysing their requirement for long lead time items, as can be seen from question 50, only six of the respondents are using modules available in the MRP system. Others are using PC-based products.

Q50. Do you forecast using modules in your MRP software or use other software that can interface with your MRP system?

MRP modules - 6

Other software - 7

Named software for

forecasting;

home grown - 2

focus - 2

lotus 123 - 3

Comment:

Nothing particularly startling here. The indication is that there is a broad understanding of the use of forecasting.

Q51. When you manually forecast do you use any checking methodology or accuracy?

Mean average deviation - 5 respondents said yes.

Basic chart of forecast v actual - 11 respondents said yes.

One respondent replied for another type which was netted for year to date plus promotional effects. If you then consider that we only had four people indicated in question 49 that they use manual techniques, and this question relates to manual techniques, we had 17 responses, again indicates there is a lack of understanding either of the questions or of what people understand their systems are doing.

8.5.7 MRP Bills of Material - Survey Results/Comments

Q52. When you started your MRP installation, did you have your BOM in a status that was satisfactory for transfer to your data base with little or no massaging?

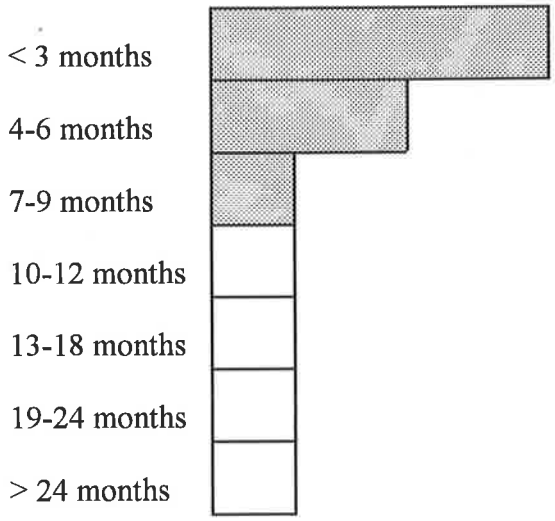
Yes - 11

No - 7

Comment:

In this area of the questionnaire, Bills of Material, interpretation of results has been rather difficult. Some companies reported on their second installation, others reported on their initial installation. Others had no personnel available to comment on the installation phase because of the time lapse between the installation and the time of this survey. There was no knowledge of the installation. Therefore, all the comments associated with the bills of materials sector cannot be taken as clear factual data, but more on interpretations by the respondents.

Q53. How much time elapsed before you were satisfied BOM were detailed and accurate enough to use in generating your MRP?



See chart, no significance interpreted from these figures. The results may not be accurate enough to comment on. The chart shows that some companies had been successful in installing their BOM to a satisfactory level in under three months, but again this is dependent upon the number of bills they have in their data base. Question 54 reflects the vast variation in installed bills of material.

Q54. How many BOM do you have in your database?

Q55. How many of your BOM are active?

Q56. Accuracy of your BOM are critical to running MRP effectively, the following question relates to your BOM accuracy.

Comment:

These questions will be commented on together and charted in one chart Figure 23 (A):

Figure 23(a) BOM Data

No. of BOM in Database	8 500	2 000	1 000	350	5 200	60 000	3 000	550	3 911	3 500	20 000	500	2 500	12 000	2 500	1 600	2 143
No. of Active BOM's	2 000	1 000	1 000	350	5 200	60 000	3 000	500	3 911	2 900	20 000	500	600	10 000	2 500	1 600	2 143
% Accuracy BOM at Start Up	90	?	99	50	60	?	75	85	92	50	90	98	60	98	99	98	?

? Indicates Unknown

Comment:

As can be seen in Figure 23(A) many respondents have indicated that the quantity of bills of materials they have in their databases are the same quantities of BOM that are active. There is some claim on the accuracy of the bills when they started. When questioning people more closely after receiving the written questionnaires from respondents, some were asked for more detail about their active bills of material, compared with their listed database quantities. It is observed by some respondents they were not really sure how many bills were on the system, or how many were current. Only one respondent had accurate data and was also very active in pursuing elimination of BOM that were not used. They used their MRP system to indicate BOM that had no requirements for, say, 12 months. These were reviewed and eliminated. Companies that said their BOM were 98-99% accurate before transferring their bills into MRP system are dreaming, because very few companies achieve that level of accuracy with a highly disciplined current MRP system. See the next question. It is also interesting to note the goal for accuracy for BOM. Many are saying that 95% accuracy will be acceptable. However, there is a much stronger inclination to say 98-99% plus would be their aim for accuracy. This is how it should be. However, in the recommendations of this report, the author believes you can optimise the pursuit of accuracy of BOM, using a selective technique.

Q57. What types of BOM do you use?

Single level	15	-	Yes
Indented	16	-	Yes
Phantoms	11	-	Yes
Dummies	6	-	Yes
Families	3	-	Yes

Comment:

Results reflect an expectation that there are spread of uses of different types of bill of materials through different organisations.

Q58. When (and if) you are using Capacity Planning (CP) modules did you find your original configuration of your BOM satisfactory?

Yes - 9

No - 3

Comment:

The following comments were made by respondents to the survey as reasons for BOM being unsatisfactory. Original BOM did not reflect how product was made. Lack of power in the system. Some companies did not reply at all to questions 57 and 58. It appeared that they had a lack of knowledge of the different formats of BOM. One company stated that they were only just using capacity planning after 17 years of usage of MRP.

8.5.8 MRP Part Numbering Systems - Survey Results/Comments

Q59. Was your original part numbering system converted into your MRP system?

Yes - 14

No - 5

Q60. Do you use an Alpha-numeric, numeric only or alpha only?

Alpha-numeric - 10

Numeric only - 9

Alpha only - 0

The following examples list the significance of some part numbering systems as responded by recipients of the questionnaire.

Example 1

A - Component Group or Type

B - Shape Description

C - Physical Size

4,5,6 - Identifying Part Numbers

Example 2

A - Type

B - Component

3,4,5 - Identifying Part Numbers

Example 3

1 - Level of Manufacture

2 - Component F.G. or Glass

3,4,5,6 - Identifying Part Numbers

7,8 - G.I.P.L. Check Digits

Example 4

1,2	-	Generator Controls
3,4,5	-	AMP (Size)
6,7,8	-	Phase/Options

or

1,2,3	-	Kw (Size)
4,5	-	Engine Family (Alfa)
6	-	Frequency (Alfa)
7	-	Alternator Size (Alfa)

Example 5

1,2,3	-	Product Type
4,5	-	Status, F.G., Assembly
6,7	-	Identifying Part Numbers

Example 6

1,2	-	Purchased (Alfa)
3,4,5,6	-	Identifying Part Numbers

Example 7

1,2	-	Category of Part
3,4,5, 6,7	-	Feature of Part
8,9,10	-	Identification Part Numbers
11,12	-	Various Features

Example 8

1,2,3,4 - 5,6,7		Identifying Part Numbers
8	-	Level in Manufacture (Alfa)

Example 9

1,2,3,4 - Part Code

5,6,7 - Product Code

8,9,10 - Variation Electrical/Mechanical

Example 10

1,2,3 - Product Descriptor

4,5,6,7 - Reference Number to Model of Vehicle

8,9 - O/E to factory, After Market (Alfa)

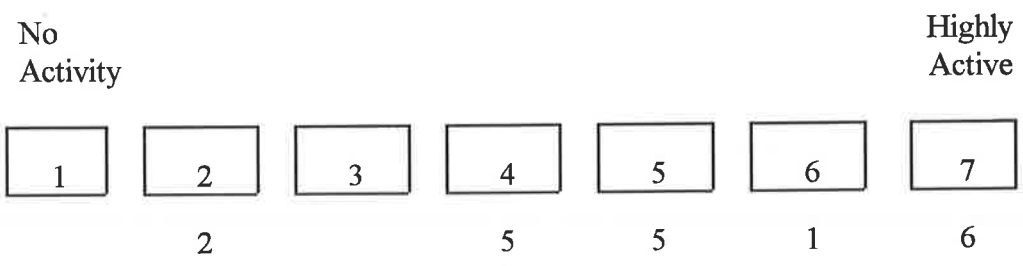
Comment:

No respondents recognise the validity of using their part numbering systems for managing their data. Part numbering systems were purely there for identification. This is a significant flaw in logistics management, particularly as we are moving more and more to cellular manufacturing, group technology and families of parts. The part numbering system could play a significant role in easing the manipulation of data. Obviously much more research and training of the use of such systems should be carried out. See recommendations in Chapter 11.

Q61. Please list the significance of your part numbering system.

This was answered in the previous comment.

Q62. Are you active in cancelling your obsolete BOMs?



Comment:

You can see from the chart that six companies were highly active, and generally there was

a mediocre or average response.

Q63. Have you a program of auditing your BOM accuracy?

Yes - 14

No - 5

Comment:

Some companies had reported a high activity in cancelling their obsolete bill of material, but interestingly did not claim any program of auditing their bills of materials. It is difficult to explain how companies actively pursue cancellations without any auditing process, unless it is done by total in-house people knowledge, rather than using the system.

Q64. Who carries out the BOM audit?

Production People	11
Production Control	5
M.I.S.	7
Special Audit Group	4
Finance	2
Production Development Engineer	4

Comment:

You can see that "generally" the audits are carried out by production people whom the author considers should be the appropriate people, because inaccurate BOM will affect them the most, by auditing they will have ownership of the problem. There is a significant spread of responsibilities of identifiable function groups for BOM audit as shown in the above chart, which demonstrates a lack of understanding of the importance of the task.

Q65. What would be the maximum number of "levels" you have in your BOM?

AND - - -

Q66. What would be the number of levels in your BOM that you would call typical (average) of your products?

BILL OF MATERIALS																			
Maximum Levels	8	4	6	7	6	15	4	6	5	5	5	5	3	8	10	9	5	10	8
Typical levels	6	3	5	2	3	6	3	3	3	4	3	3	3	4	4	5	4	4	6

Comment:

The chart shows a broad spectrum of maximum levels and typical average levels which would be expected from the variety of products being manufactured by the respondents to the questionnaire.

Q67. Have you a problem for reducing the levels in your BOM?

Yes - 1

No - 18

Comment:

The majority of users indicated no problems on reducing levels of BOM although comments made by other observers of MRP systems is that this area of utilisation of the system, is a very difficult area to accommodate. Whilst there are 18 respondents who said no, no problems, it is doubtful whether many of them have actually tried reducing levels. No problems because they have not tried it. That is the view taken from the respondents.

Q68. Please estimate your resources required for getting your BOM up and running in your system.

Comment:

The answers to this question are irrelevant because of the great variety in the number of BOM, the different levels that the companies were situated in prior to start up and so on. Therefore the data obtained from this question is not consistent.

8.5.9 MRP Inventory - Survey Results/Comments

Q69. How do you check the accuracy of your inventory quantities and location?

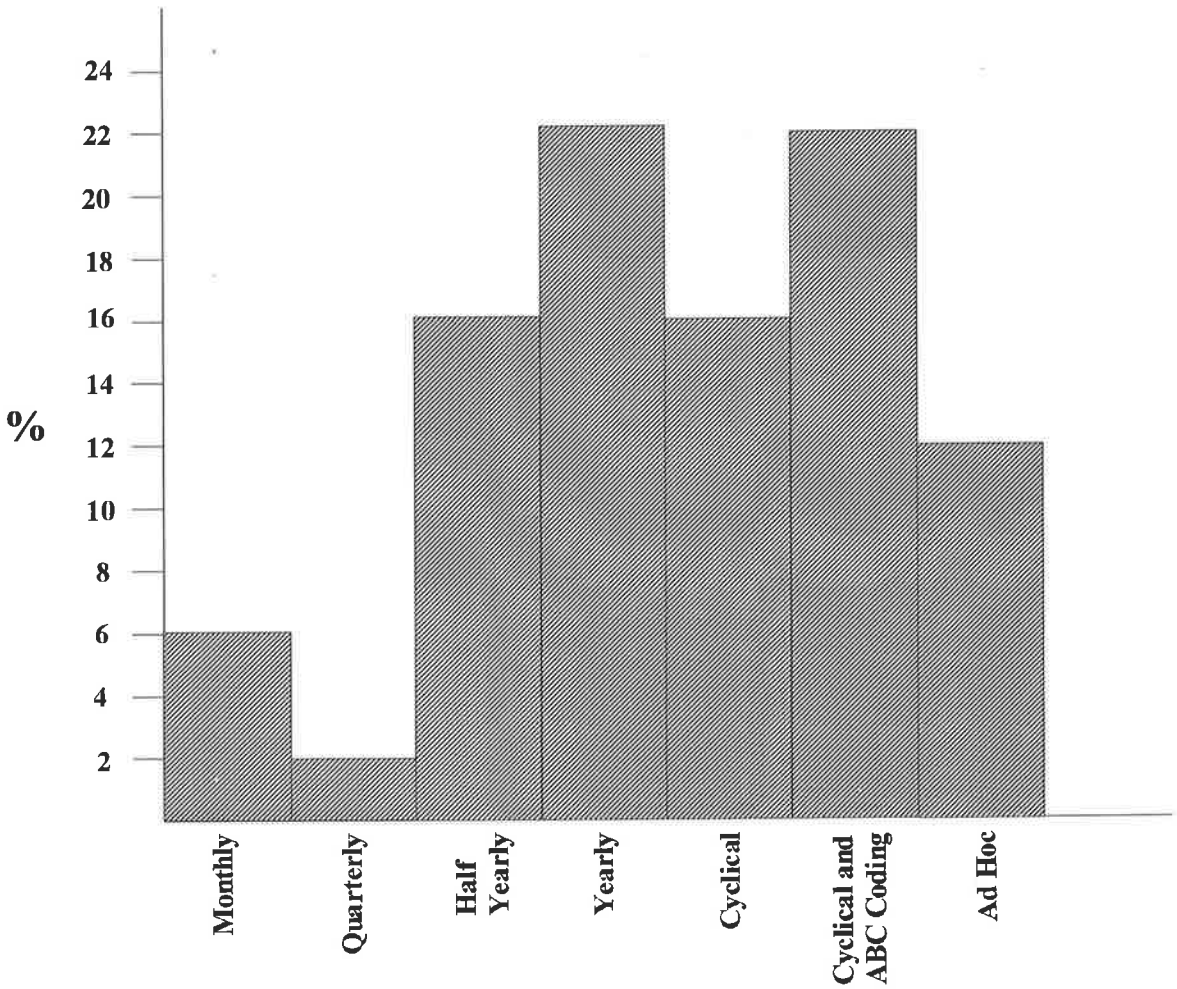


Figure 24 **COUNTING**

Comment:

Many companies used several of the nominated methodologies for checking the accuracy of the inventories. Some companies used counting half-yearly, counting on a cyclical basis, and counting on a cyclical basis using ABC_1 coding. Others used ad hoc checks and counting yearly. Only one company reported that they used counting on a cyclical basis

and an ABC_1 coding only, as the only method of checking their stock accuracy. This is a very poor result and indicates that there is insignificant amount of management of inventory accuracy. Inventory accuracy is paramount, absolutely paramount to running successful MRP systems. The results above indicate that inaccuracy is an acceptable way of using MRP systems.

An observation made by one consultant of MRP systems is that many accounting auditors for financial statements at the end of the financial year, will not accommodate counting on a cyclical basis and an ABC_1 coding as an acceptable practice. In other words, the financial people distrust that methodology. It is probably not the methodology that they distrust. It is the fact that the data gathered when they do their own ad hoc audits indicates so much inaccuracy of the counts that the only way they will accept financial data is the half-yearly or full-yearly stock take.

Q70. What levels of accuracy of quantity counts do you maintain?

RAW MATERIALS					
			x		
			x	x	x
		x	x	x	x
		x	x	x	x
	x	x	x	x	x
%	< 79	80-90	91-95	96-97	> 98

W.I.P.					
			x		
			x		
	x	x	x		
	x	x	x		
	x	x	x		x
	x	x	x	x	x
%	< 79	80-90	91-95	96-97	> 98

RAW MATERIALS			
			x
			x
		x	x
		x	x
		x	x
	x	x	x
	x	x	x
	x	x	x
%	90-95	96-98	> 99

Comment:

It can be seen that for raw materials there is a fairly general spread across the 91-95% level, although it is slightly skewed to the top end which is good. WIP results indicates that companies aren't quite so concerned to the same degree as they are with raw materials, as the skew is to the lower end of the spectrum. Finished goods: if companies cannot ever get this accurate they have problems, therefore the results that the majority responded in the greater than or equal to or greater than the 99% is good.

Q71. Do you stop production for inventory status checks, eg annual inventory?

Yes - 14

No - 5

Comment:

Average time of stopping was 12 hours, often worked with a rostered day off as part of the cycle.

Q72. For reporting levels of inventory status, do you use stock turns for a measure?

Yes - 12

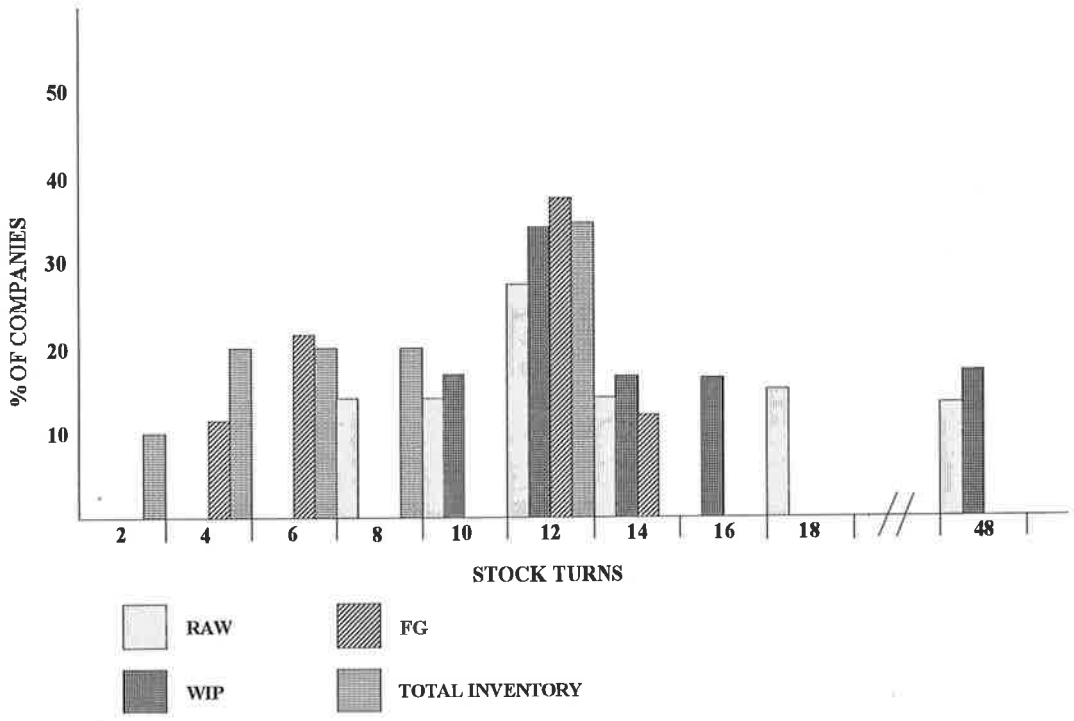
No - 7

Comment:

Some respondents were not aware of the term "stock turns" although this is generally used as an international measure of comparison of effective control of stock.

Q73. What levels of stock turns are you achieving?

Figure 25 STOCK TURNS



Comment:

Again it can only be said there is a broad spectrum of returns here, but comparing world class bench marks, these levels of stock turns are well below the required standards. Some companies are only indicating total inventory turns of 2.6, they should be re-evaluating their strategies.

Q74. After running MRP for one year, did you achieve your planned increase in stock turns? and,

Q75. What % of reduction of value in inventory have you achieved? and,

Q76. Do you believe MRP will give you savings in inventory reduction that you originally planned?

Comment:

These three questions were difficult to relate to in any standard format as so many companies

did not have their initial data available, they did not have people involved with the initial installation, and therefore the answers gained from the respondents are not considered adequate or accurate. However, it would be complimentary to the questions to state some of the comments made by respondents giving their views of success or otherwise, as follows:

- " Changing MRP to Kanban requires more than MRP; it needs TQM, Just in Time, Problem Solving to reduce waste."
- "Inventories have been reducing year by year since installation in 1986, but no figures available."
- One company reported only running on an MRP trial basis and this has been going for 14 months until accuracy levels have been improved!
- One company reported that in the last 25 years of using an MRP system, they did not use stock turns as an indicator, but they are now using that indicator for finished goods as a bench mark.
- "After implementation of MRP, inventory went up by 30%, accuracy and forecasting was the major problem."
- "MRP helped in overseas planning of procurement and spacing of local delivery but did not significantly reduce inventory."
- "MRP was not successful as BOMs were not accurate."
    - That was one company's comment after 11 years of use of MRP.
- "Kanban and new management and new owners were the reason for saving on inventory, not MRP."

Q77. Do you use your inventory data together with MRP modules to list and manage slow moving stock?

Yes - 17

No - 3

Comment:

Significant use can be made of the requirements planning modules to indicate when parts have been used or have not been used. The follow-up to the answers gained from this question indicated that respondents have claimed that they do use data to manage their slow moving stock, but when asked for listings or how slow moving stock was managed, respondents became vague and showed little real knowledge or understanding, particularly when pressed about whether they provided dollar write-offs at certain rates of non-use. Example: when product had not been used for six months, did they provide 5% contingency write off? When stock had not been used for nine months did that increase to say, 40%? Up to say, 18 months where practically 90% of write-off was provisioned for. No respondent indicated wide knowledge of the use that can be made in this area.

8.5.10 MRP and Kanban - Survey Results and Comments

Q78. If you have integrated your MRP system with Kanban for shop floor control, have you subsequently improved your stock turns?

Five respondents claimed some improvements to the turns of about 30%, 12 respondents claimed no integration of their Kanban and MRP systems, although two of those had claimed to start using Kanban but were not integrating with MRP?

In his book 'The New Manufacturing Challenge', Kiyoshi Suzaki [90] suggests that MRP can be utilised with other production control techniques to make it a true JIT system.

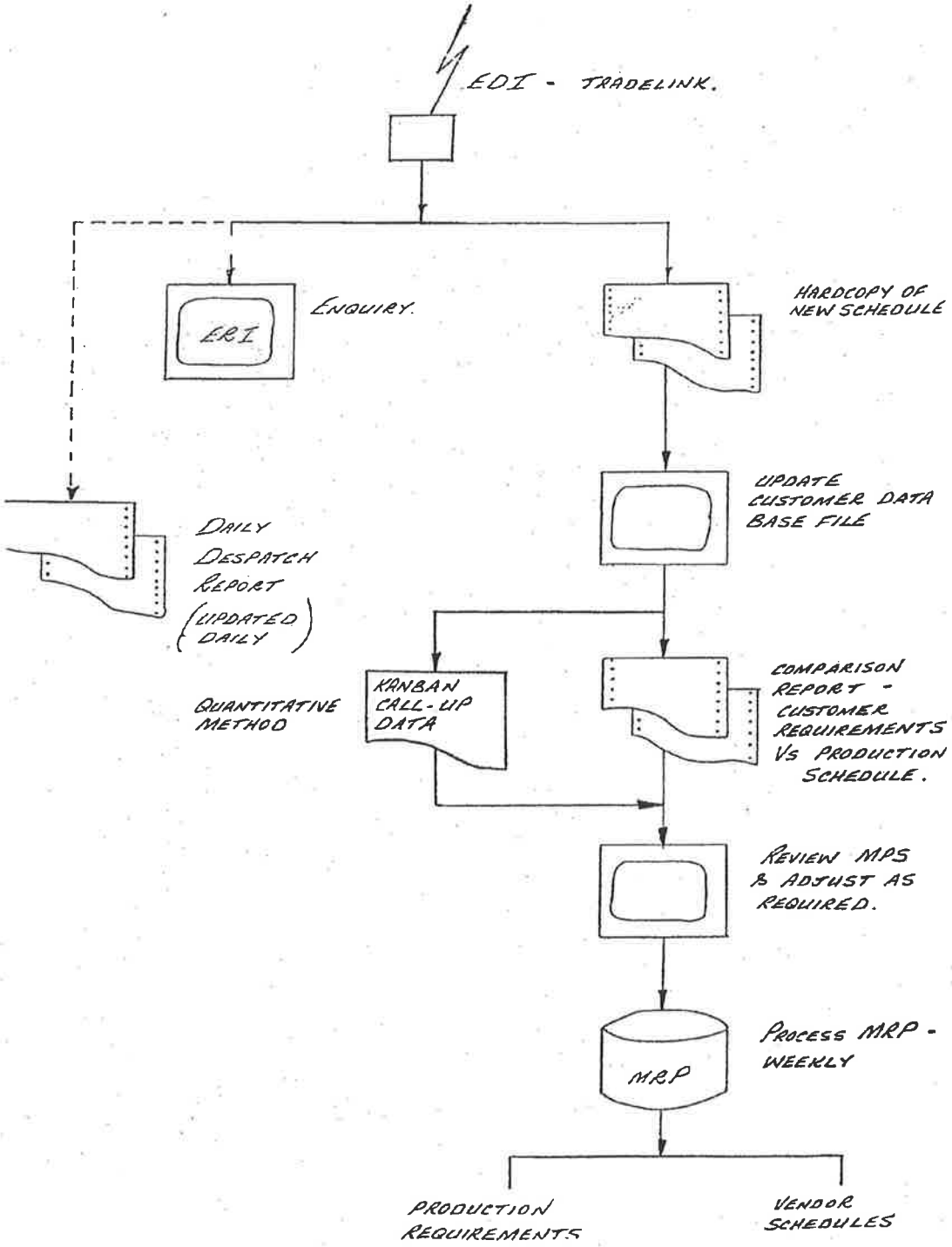
A number of miscellaneous production control techniques can be used together with Kanban. While monthly production levels and daily production plans may be developed with the levelled/mixed production concept, such tools as cycle tables, the reserved seat system, finished goods inventory status board, Kanban sequence tables, labels, the golf ball system, and the broadcast system are also used to fine tune the system. Whether or not production characteristics differ from automobile manufacturers or whether MRP is used for production control purposes, these techniques will help develop JIT production.

The flow chart[91] shown in the diagram demonstrates how the customer schedule is entered via EDI link into Rainsford computer system, MPS review, MRP generation and Kanban call up. The output is production requirements and vendor schedules, (see Figure 26).

MASTER SCHEDULING PROCESS FLOW CHART

CUSTOMER MATERIAL RELEASE SCHEDULES

Figure 26



8.5.11 MRP Lead Time - Survey Results/Comments

Q79. Do you acknowledge that lead time control is an integral part of your business?

99% of the respondents indicated that it was an integral part of their business.

Comment:

Wonderful news!! Recognition that lead time is a significant integral part of the business, and as indicated below companies have many programs that enable reductions in lead time.

See Chart in Figure 27 that describes the ingredients of Lead Time.[92]

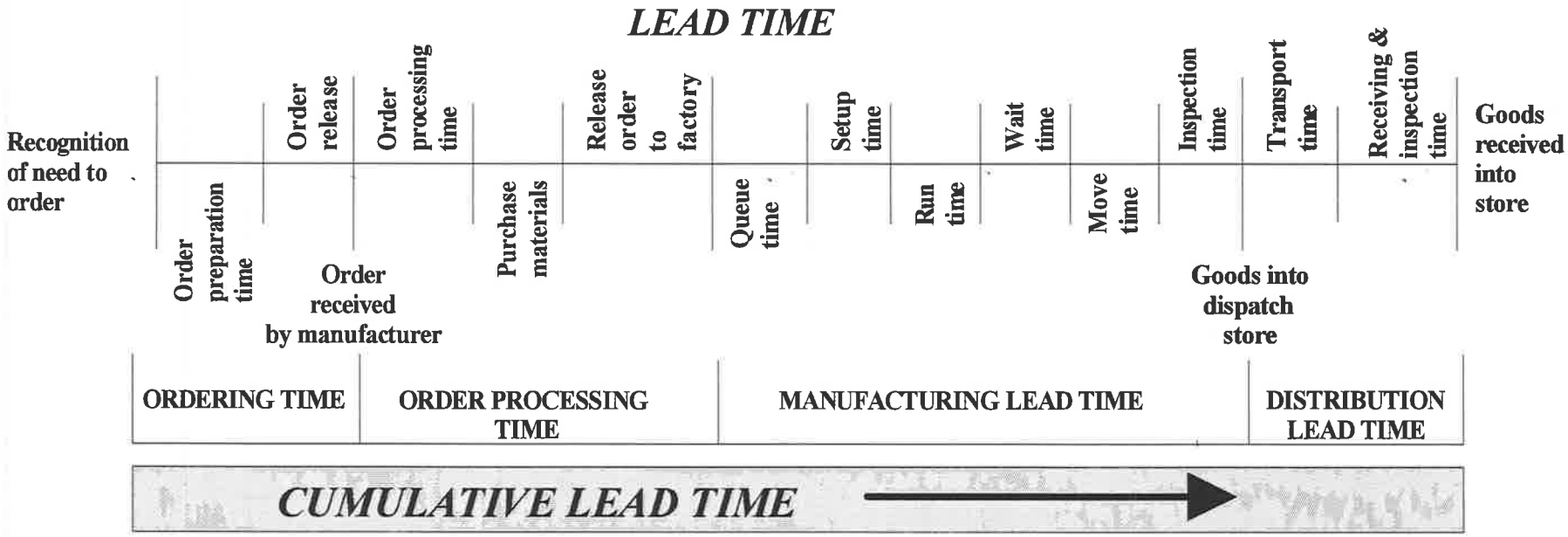


Figure 27

Definitions - APICS
6th Ed. Dictionary 1987

Lead Time A span of time required to perform an activity. In a logistics context the time between recognition of the need for an order and the receipt of goods. Individual components of lead time can include: order preparation time, queue time, move or transportation time, receiving and inspection time.

Move Time The actual time that a job spends in transit from one operation to another in the plant.

Purchasing Lead Time The total lead time required to obtain a purchased item. Included here are order preparation and release time, vendor lead time, transportation time, receiving, Inspection and put-away time.

Queue A waiting line. In manufacturing, the jobs at a given work centre waiting to be processed. As queues increase so do average queue time and work-in-process inventory.

Run Time The planned standard time ot produce one or multiple units of an item in an operation. The actual time taken to produce one piece may vary from the standard but the latter is used for loading purposes and is adjusted to actual by dividing by the appropriate work centre efficiency factor.

Setup Lead Time The time needed to prepare a manufacturing process to start. Setup times may include run and inspection time for the first piece.

Setup Time The time required for a specific machine, line, or work centre to convert from the production of one specific item to another.

Wait Time The time a job remains at a work centre after an operation is completed until it is moved to the next operation. It is often expressed as a part of move time.

Q80. Have you a program of reduction of manufacturing lead time that includes any of the following?

Technique	Number of Companies using Technique																		Total
Set up Reduction	X	X		X	X	X	X		X	X	X	X	X	X		X	X	X	15
Making small batch sizes	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	16
Speeding up paperwork of manufacturing system		X	X	X	X		X	X		X	X	X		X		X	X		12
Installing Kanban on shop floor	X							X	X	X	X	X		X	X	X		X	10
Reducing wasted time between operations	X	X		X						X			X	X		X		X	8
eg Changes in layouts	X		X	X	X	X	X	X	X	X		X	X	X		X		X	14
Grouping M/C's together (cells)	X		X		X	X	X		X	X		X	X			X			10
Reduction of material handling	X		X	X	X	X	X	X	X	X		X	X			X		X	13
Management of queue times				X			X	X		X		X							5
Standardisation of components				X															1
Total plant being cellurised										X									1

Comment:

As previously indicated in question 79, many companies are pursuing improving their manufacturing lead time. The problem with this reduction as indicated in the next question is that they are not measuring the lead time reduction itself as a measure of their improvements. Measurement is done in a third party-type recognition by measuring vendor's improvements, stock turn improvements and inventory reductions. Therefore, it really poses the questions when companies are reducing their lead times using a significant number of programs are they really serious in knowing what they are doing, or are they doing it because these are the programs that other companies have successfully used for improving their profitability and customer service.

Q81. Have you a program of reducing your vendors lead time?

Yes - 12

No - 7

Q82. If you answered yes to question 81, how do you measure your improvements?

Comments received:

- Number of vendors on Kanban.
- Not measured but we have a program.
- Continuous improvement program with vendors against set goals.
- Vendor performance on quality and schedule delivery, and local sourcing.
- The actual lead time versus the data base lead time.
- Vendor lead time reduction commitment.
- Vendor review meetings.
- A number of deliveries per month on an ABC basis where A is 4 per month, B is 2 per month and C is 1 per month.
- Percent of vendors on schedule.
- Percent of parts supplied on schedule.
- Kanban department was established and it reduced inventory but generated more clerical information for production control, but the plan is to reduce this extra clerical effort as bar coding is introduced.
- Check against targets of on-time delivery only.

Q83. When you run your MRP do you have time fences?

Comment:

This question was already posed in question number 11.

Q84. Does your MRP system have restrictions in your "buckets" of time?

Comment:

The answers relayed in this question indicate that the majority of users have the ability to use daily buckets, weekly buckets and monthly buckets as they require. Only five respondents indicated that they had "bucketless systems" and were using it. However, on closer questioning of two of those respondents, it was clear that they did not understand the term "bucketless" and in fact, they were using daily buckets of time in their system. Again it raises concern of understanding terminologies and use of the systems.

Q85. Has your MRP system been changed or modified so you can change the length of your "time bucket"?

Comment:

Only one respondent claimed that they had changed the length of their time bucket and that was in their vendor schedules, where they had changed to a monthly schedule.

Q86. Managing lead time reduction is a complex task. How have you reported your overall lead time reductions?

Comment:

This also relates to previous question numbers 80 and 82. General comments from respondents are as follows:

1) Reducing batch sizes.

2) Reviewed assembly lead time on a typical product.

3) Not yet reported.

4) Monitoring in days.

5) Measuring time of customer order to delivery.

6) Management by objective targets by individual material controllers.

7) Monthly plotting on-time delivery of raw material compared to stock holdings.

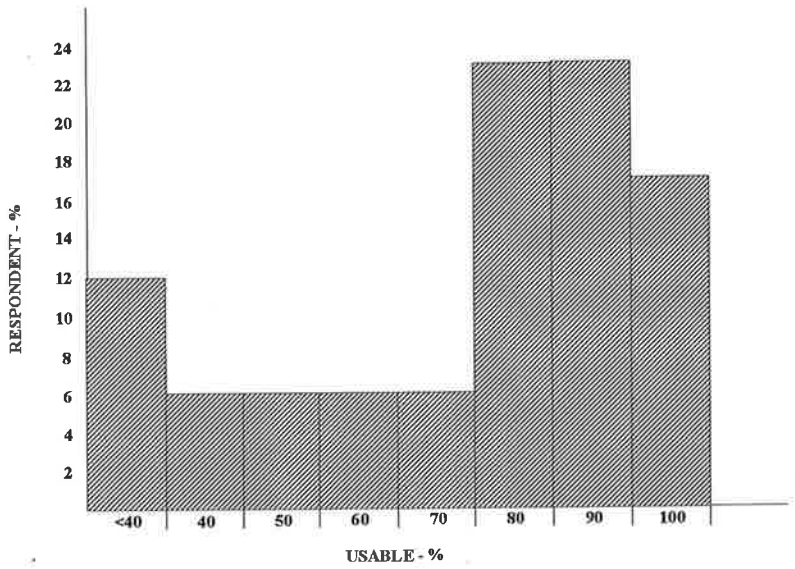
8) Quick die changeovers measured.

9) The predominance of replies were in the "not yet" category.

8.5.12 MRP Routes - Survey Results/Comments

Q87. When you commenced using MRP were you satisfied with your quality, accuracy of your routes?

Figure 28 ROUTES



Comment:

The chart shows that routes were significantly useable in their existing format, and that companies found generally that they were acceptable, although this is contradicted by the answer to question 88.

Q88. Most routes include a pathway of a manufacturing process, a set-up time and operation times. Were the set-up times accurate?

Only three said **yes** and 12 said **no**, which is contrary to the information supplied in question 87, and again begs the question, do people really know what their system is capable of or what their system accuracy is.

Were the operating times sufficiently accurate for your MRP system?

Satisfactory - 11

Unsatisfactory - 6

How long after commencement of using your MRP system were you satisfied with the accuracy of your routing data?

Comments:

The majority seemed to be satisfied after six months, although equal number of respondents claimed that it was greater than 24 months before they were happy with the accuracy.

Q89. How many routes do you have in your data base?

Some typical quantities:

50; 500; 550; 800; 1,000; 3,000; 3,911; 5,500; 7,920; 10,000; 20,000; 24,000; 50,000.

Comment:

The listing showed a great variety of quantities of routes which is only natural from the disbursement of types of manufacturing and assembly companies responding to this review. Again, on follow-up questions about the accuracy of information supplied, many respondents said that they had guessed the number, rather than being fully aware of what the system contained, or to what accuracy levels they were working with.

Q90. Who plans your routes?

FUNCTIONS PLANNING ROUTES									
Production Planner	x	x	x						
Shop Floor Personnel	x								
Combination of (a) & (b)	x	x	x	x	x				
Engineering Department	x	x	x	x	x	x	x	x	x
Finance	x								
M.I.S.	x								
Manufacturing Support	x								

Comment:

The chart speaks for itself; it shows that generally there is engineering departments and production planning-type people involve. Due to the enormous diversity of descriptors of functions as indicated with the people completing this questionnaire, (see page 88) some people would call production planners; engineering departments, and other people would call production planners; controllers. It is not possible to draw conclusions from this question.

Q91. Do you use your current routes and BOM within your MRP system to help estimate new work?

Yes - 15

No - 3

Comment:

Good result!! Lots of useful data in existing systems that save considerable time if looking at new products, whereas you can capture existing BOM, routes, and quite often massage this data by adding very small complimentary data to come up with a new quote for costing.

Q92. Do you have in place an audit system for checking the accuracy of your routes?

Yes - 12

No - 6

If you answered yes to question 92, who does the auditing?

AUDIT SYSTEM FOR ROUTES					
Shop Floor Personnel	x	x	x	x	
Production/Planners/Controllers	x	x	x	x	x
Estimators	x				
Supervision	x				
Design					
Production Management	x	x			
Finance	x	x			
M.I.S.	x	x			
Industrial Engineers	x	x			
Manufacturing Support	x				

Comment:

Disappointing result because 50% of respondents had claimed that there was no auditing of routes, and if auditing was done it was by a large cross-section of people functions. It is believed that the only people who should do the auditing are the users of the routes, and that is the shop floor people. But as the chart indicates, these people, or these functions, are only partially used. Very disappointing.

8.5.13 MRP Capacity Planning - Survey Results/Comments

Q93. At what level do you use capacity planning?

Comment:

This question was used to help validate the users knowledge of using different levels of the BOM in capacity Planning. For instance most Capacity Planning is done using the top level, but some manufacturers use Level 1 of BOM to plan their capacity. In testing the questionnaire, validation was possible but with circulation to all respondents, most indicated confusion in answering this question, hence results not valuable.

Q94. What time horizons do you use for your capacity planning?

Comment:

No significant answers were obtained from this question, but generally it could be claimed that horizons for rough cut capacity planning was between three to six months.

Q95. It is often quoted that using rough cut capacity planning, that 80% of your work occurs in 20% of your finished goods parts and therefore you can apply your rough cut capacity planning of that proportion to your situation. Have you found this to be applicable to your situation?

Comment:

The predominant answer to this question was no, it was not a significant comment. In other words, companies did not use 20% of their finished goods parts as a source for their rough cut capacity planning, but generally used their full compliment of finished goods parts in assessing their capacity requirements. A few companies used family BOM to help them in their rough cut capacity planning, but this was the exception rather than the rule.

Table 2 **CAPACITY PLANNING COMPARISON** [93]

	ROUGH CUT	**CRP**
LOOKS AT:	KEY RESOURCES	ALL RESOURCES
TIMING:	AFTER PP/MPS	AFTER MRP
INVENTORY NEEDED:	NO	YES
LEADTIME OFFSET:	USUALLY NO	YES
FOCUS:	PROD'N PLAN/ MASTER SCHEDULE	DETAIL SHOP SCHEDULES
HORIZON:	MID TO LONG TERM	SHORT TO MID TERM
FREQUENCY:	MONTHLY	WEEKLY
USERS:	TOP MGT. MASTER SCHEDULER	CAPACITY PLANNER SHOP MANAGER

Q96. When using rough cut capacity planning did you select special BOM of "typical" products and if so were they initiated in the original planning process of setting up your MRP system or were the rough cut capacity planning bills added later as you gained experience with the system?

Comment:

Generally, the answer to this was no, they used their ordinary BOM. They had no significant changes in their bills for doing rough cut capacity planning.

Q97. Using full CP you can have your capacity calculated for all your work centres or for only your bottleneck work centres. What do you do?

Comment:

Although only a few respondents had claimed to use full work centre capacity planning, there were some respondents who claimed that they used all their work centres in capacity planning, and two companies even claimed to be using bottleneck work centres only. The questions were set up to test some knowledge of understanding between the whole process of linking the MRP system together, and because of the divergence of answers between one section and another, although there should have been similarly structured replies, indicates once again a lack of understanding of how to use the system.

Q98. If your work centres are overloaded what action do you take to bring load back into balance?

Short Term (say up to 6 months)	Number of Companies responding								
(a) Work Overtime	x	x	x	x	x	x	x	x	x
(b) Rearrange work schedules	x	x	x	x	x				
(c) Unexpedite orders	x	x	x	x					
(d) Ask customers for extended delivery dates	x	x							
(e) Contract work out	x	x							
(f) Put on extra shifts (if possible)	x	x	x	x	x	x	x	x	
(g) All of the above	x	x	x						

Comment:

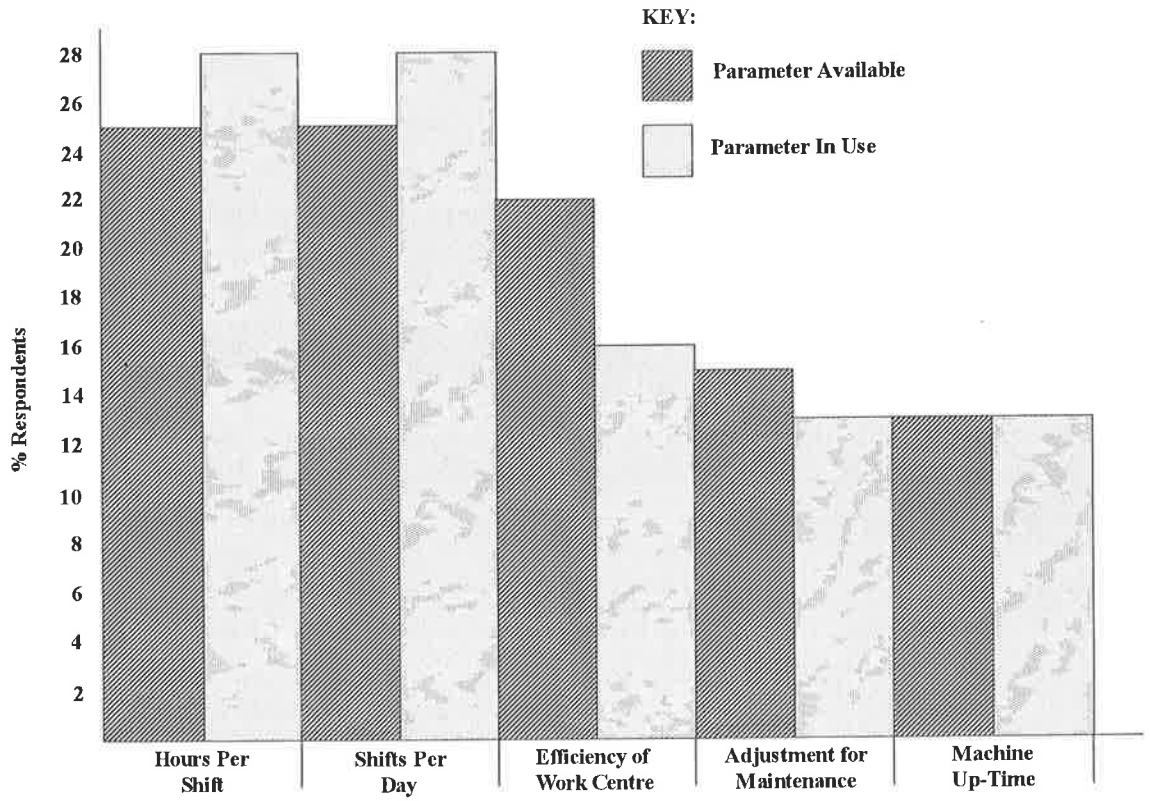
As can be seen, different actions are taken at different times to suit the circumstances. When capacity planning is used in an MRP II environment the (CRP) capacity requirements module calculates the load generated for each work centre from the MPS and drops the load into week number. The loads are aggregated and compared to available capacity. Where excessive overload occurs an attempt is made to re-date schedules and spread the loads.

According to Mike Harrison[94] those who have tried load redistribution over any significant period usually exhibit strong signs of stress. Load redistribution is an attempt to make realistic a plan based on this flawed process. Either the overload will be satisfactorily reduced but a peak will occur somewhere else, or faced with pressures of time, planners will simply issue work on an unachievable schedule, hoping to sort it out through expediting, overtime or sub-contracting.

Since this article was written in 1991 systems have emerged that with computer power make the task of load rescheduling easier. Finite capacity scheduling (FCS) helps re-loading because FCS can look simultaneously at plant, people, machines and material availability and decide a sequence of work to be loaded that is realistic and practical.

Q99. What parameters can you adjust in your available capacity, and which ones do you use?

Figure 29 ADJUSTING CAPACITY



Comment:

As can be seen the most frequently used parameter for adjustment is the hours worked per shift, the number of shifts worked per day, and efficiency of the work centre. Some people who use efficiency of work centre parameters in this category also adjust for up-time or maintenance time of machinery or equipment.

Q100. Do you use capacity planning for both labour and machine capacity?

Respondents who answered that they are using capacity planning all have both categories covered. They use both labour and machines.

Q101. Time for using the information generated by RCCP and CP is critical. How successful (gut feeling will do,) do you think your company has been in using your information?

Again, the results obtained from this question were fairly lose, and it can only be observed that some 90% of the respondents felt that they were adequately using their rough cut capacity planning.

8.5.14 MRP Survey Summary

The aim of this thesis was to pursue how management of AMT's was effected by the ability of organisations to manage that AMT and what was lacking or successful in using AMT. MRP was chosen to review in detail how it was managed. What the survey in Chapter 8 revealed is that there is a serious lack of management knowledge of the attributes of MRP, lack of knowledge of basic disciplines required to run a successful system, lack of knowledge of benchmarks and a tendency to blame the system not the people. Integration of AMT's by deploying Socio Technical Systems (STS) was further investigated by reviewing organisations commitment to Self Managing Teams in the next section.

8.6. WORK TEAMS - SURVEY RESULTS/COMMENTS

This part of the survey questioned the change to the Socio Technical Systems by reviewing the introduction of Self Managing Work Teams.

Q102. Have you started using SMWTs?

Yes - 12

No - 9

(Survey completed July 1993)

Comment:

This is an interesting situation for work reorganisation. Many world class companies have been moving to integrate their organisations more completely by changing their organisations to empower their people. Particularly the shop floor associates. To do this there has been throughout the western world a universally accepted term of self-managing teams to distinguish this reorganisation. The results above show that 60% of the companies were using teams.

Q103. How many teams have you at present, what percent of your organisation staff does this represent?

Comment:

The answers to this question were responded in various ways. The number of teams went from two to a maximum of 16; other people just said there were lots of teams, and it represented between 5% and 90% of the total organisations staff. The average percentage of staff covered by teams was 36%.

Q104. When did you start your first SMWT?

The listing below shows start-up times.

1990, 1991, March 92, April 92, May 92, May 92, November 92, February 93, April 93, April 93

Comment:

As can be seen, self-managed teams is a recent innovation, much in the embryo stage. Self-managed teams is about evolution of empowerment and some companies are finding it very useful. One commentator indicated they have had a bad experience with a consultant very much involved in initiating the change, but that they expected to reinvigorise the movement towards self managed teams using a different process.

Q105. It has been claimed that once SMWT become experienced that the structure of the organisation is able to be changed, particularly reducing management involvement. If you consider you have over 50% of your staff in SMWT that are experienced, have you been able to reduce the number of management or change their roles?

Comment:

The results from this question were not sufficiently documented to be able to come to any resolution. The question probably was much too early for the recipients. It talked about reducing number of management and so on. Whilst there is an overwhelming view that SMWTs will flatten structures, organisation for actual recording of the change is difficult because it is an evolutionary process. Another view expressed by one company was that it is difficult to tell staff that they are not going to have a job, perhaps in three year's time, and therefore recording is done at a senior management level and not generally publicised.

Q106. Are you planning to start SMWTs?

Comment:

Of those respondents who did not confirm they had started teams, there were six recipients who said they were going to start and there were four recipients who definitely said they would not; the general consensus being they would start late 1993 or early 1994.

Q107. Training people for working in teams is claimed to be essential, what training if any, are you planning?

Comment:

Listed below are courses planned by the various companies showing the hours of training associated with each.

Train the Trainer	-	40 hours
Train Team Leaders	-	8 hours
Team Member Training	-	20 hours
Facilitation of Work Teams	-	24 hours
Quality and Productivity Improvements	-	24 hours
Continuous Improvement Teams	-	16 hours
Team Building and Problem Solving	-	16 hours
Workplace Reform	-	24 hours
Team Members Training	-	16 hours
Team Leader Training	-	40 hours
Management Awareness of Self-Managed Teams	-	8 hours
Team Supporters	-	16 hours
Conflict Resolution and Team Building	-	24 hours
TQM and Continuous Improvement	-	100 hours

Team and TQC Groups at

½ per week for 40 weeks

Self-Managing Teams - 16 hours

Team Facilitators involved full time

to help SM teams developed.

Comment:

This is a very interesting review of the number of hours companies are putting into training people before they become self-managing. Because of the cultural changes required in organisations and people's mind sets, it indicates in the listing above, that it is expected to change people's hearts and minds with say, 24 hours training! This is virtually impossible. However, there is the avenue of constantly keeping people aware of changes through company newsletters; information that is available through the television media; information from videos made by trainers and general discussion between people who work in different organisations; the message of self-managing can be spread. One consultant nominated that it is far easier in 1994 to introduce the concept of self-managing teams than it was in 1989, because of the spread of information in respect to success of people changing into teams and enjoying their work much more. Also there is some news, but only little at this stage, of successful teams sharing more of the productivity gains that they have nominated. Sharing the wealth. Riccardo Semler in his book, Maverick, the current management guru for manufacturing, indicated that they had arrived at a figure of sharing 23% of their profit amongst all staff, and the staff decide how it would be distributed.

Dr Lester Thurow[95] suggests that in manufacturing in the 21st century we will be rewriting the rules of the game, due to four events, the collapse of Soviet communism, the shift from a single pole world revolving around the US as 75% of the post war economy to a three pole

world with the US as only 23% of world GNP, technological revolutions profoundly changing how you get strategic economic advantage, and an outbreak of capitalistic madness in the 80s that wiped out hundreds of billions of dollars. Thurow says the only way to maintain an advantage is by being a master of process technology - one step ahead of your competitor in manufacturing processes and equipment. If anyone can buy raw materials, borrow capital and copy technology, however, what's left as a source of long run competitive advantage? Skills of your workforce.

Q108. For those companies already using SMWTs, what training was undertaken before commencement?

Comment:

The following describes the listing of courses and hours associated with each course.

QAE and Problem Solving Methods	-	20 hours
TQM In-House Team Building	-	20 hours
Lean Manufacturing	-	24 hours
Management Overview of Lean Manufacturing	-	8 hours
Facilitator Training	-	16 hours
Team Building	-	8 hours
Quality Concept and Tools	-	16 hours
K-zone Skills	-	15 hours
Team Leadership	-	24 hours
Communication Organisation Change	-	25 hours
Quality and Productivity Improvements	-	25 hours

Most companies used a combination of three or four of these topics listed. One company used the following:

Production Systems, Customer led Quality	-	16 hours
Train the Trainer	-	24 hours

It made the effort to train selected people in the concepts of self-managing and change of organisation. They gave them the opportunity of being trained as trainers and were then able to use their own people in an ongoing facilitation role to introduce SMWT concepts to the rest of the staff. Another company used the following:

Communications and Organisational Change	-	25 hours
Quality Improvements	-	25 hours
Methods Improvement	-	25 hours
Manufacturing 1 or Management 1	-	25 hours
Problem Solving	-	25 hours
Team Dynamics	-	25 hours

This company then felt it was possible to really move into self-managing teams which they did in 1993. Another company used the following:

TQM - Continuous Improvement and Elimination of waste training	-	100 hours
Keyboard Data Entry	-	8 hours
Pneumatics	-	40 hours

Another Company used Conflict Resolution and Team Building	-	24 hours
Concept of Self-Managing Work Teams	-	4 hours
Drawing Skills, Reading Drawings Skills	-	16 hours

As can be seen from the above and comments made in question 107, there is a combination of courses companies are using for SMWT. Other companies have made a decision to change to self-managing teams, have not had the opportunity or the time to give any people training except perhaps for a 6-hour introduction, and then have asked teams to begin being self-managing, fill in data sheets in selected functions of their areas and to start solving problems. For instance: data on attendance, quality, productivity, customer returns, health and safety. By this means they have gathered some information which teams will discuss, with an expectation that by discussing the results, where problems have arisen, the team will start trying to fix those problems. They have also specifically trained over a 16-hour period the team leaders to take a leadership role in helping those teams move towards self-managing.

Q108(b) What other training is being undertaken by self-managed work teams since their formation?

The following is a list:

Performance Measures	-	8 hours
Machine Introduction	-	8 hours
Die Changing	-	16 hours
Occupational Health and Safety	-	8 hours
Statistical Process Control	-	4 hours
Flying Starship Factory Course	-	8 hours
Team Building	-	6 hours

Facilitation - 26 hours

Comment:

The integration of self-managing teams into an organisation seems to be much like the problem of introducing computers in the late 70s and early 80s, where few managers have had prior experience. Some are using consultants, some are doing the necessary research and background reading themselves. Others have got the international grouping of companies to rely on some prior experience, but it appears that the majority of companies are trying it, learning from their mistakes and moving down a fairly unstructured path. To investigate how training is co-ordinated, the author of this report reviewed some companies training plans with training officers and manufacturing managers. In the majority of cases the observation made was that there was little regard to planning of training in line with organisational change structures. Yet another big gap in managing effectively.

Q109. Have you had or do you have another form of SMWT in your organisation that have previously been set up to help in productivity and quality improvements?

Yes - 14

No - 5

Comments:

Some interesting results to this question and listed below are some of the other teams that could be construed as self-managing:

Task teams

Quality teams

AQP teams

QUIP teams

8-D teams

TQM

Project teams

Continuous improvement teams

VAM teams

Quality circles

PIT

Design and Quality teams

TQC

Kaizen teams

Quality improvement teams

Coaching committees

8.6.1 WORK TEAMS SURVEY SUMMARY

The results of this part of the survey demonstrated that organisations were moving to involve their people into teams which would empower them eventually to be more involved in the business. Training varied greatly between organisations but appeared to be short in commitment from management if a changed culture was required. Training integration into business plans did not seem well organised and certainly no clear advantage was shown that any gains in efficiency of using AMT's would result from Self Managing Teams (SMT). However, it is well documented and observed that SMT's do improve productivity in all areas of operation including AMT's.

8.7 ACTIVITY BASED COSTING - Survey Results/Comments

As part of this thesis the author believed that accelerated change in productivity and use of AMT's would be possible if businesses introduced Activity Based Costing (ABC) together with the Socio Technical changes that was seen to be required. These next questions relate to ABC.

Q110. Is your organisation using full activity-based costing?

100% of recipients said no.

Q111. Is your organisation using partial ABC for its accounting procedures?

Five respondents said yes, 16 said no.

In a paper presented to the International Mechanical Engineering Congress in Sydney in 1991, J.S. Lamond [96] suggested that firms needed to re-appraise their performance measures as existing measures did not adequately let management control continuous improvement policies.

He suggested that in order to improve upon this situation, companies need to consider not only performance measurement, product costing and investment appraisal, but also:

- the factors that drive costs and how to control them.
- how to assess the value derived from overheads.
- how to identify and eliminate waste.
- the impact of major decisions on costs.
- how their performance stacks up against competitors.

Lamond goes on to say, "For measures that are more closely linked to cost, activity based costing is the technique most likely to produce relevant results."

Much is being written about ABC, its advantages to management, its more accurate presentation of real (activity) costs of manufacturing a product, but still few companies are taking up the challenge of ABC. Probably because it is not easy to make a transition from traditional costing systems to a new system. Like anything new, most people will wait to see some experiences of others before embarking on an untried attempt at rationalising the whole costing structure of traditional manufacturing. People understand overheads allocated against direct labour, its much more difficult to conceptualise cost drivers, direct activities, less direct activities put into 'pools' of activities to be allocated on a regular basis, depending on product mix. So companies are avoiding ABC. The author of this research paper believed ABC would be much more stridently taken up by the accounting profession in the global manufacturing business because it sustained their traditional role of 'appearing' to be 'in control' of the whole process. "You can't do any changes unless accounting agrees", was a typical catch cry. But it has not happened. The pace of acceptance of ABC is slow.

Q112. If you answered no to both 110 and 111, do you intend using ABC?

Five said yes, nine said no.

When do they contemplate starting?

Mid-95 and 1995.

Q113. If you answered no to question 112(a), were they aware of possible benefits of ABC?

10 respondents said yes, two said no.

Q114. If you answered yes to question 113, and no to question 112, do you consider the cost and complication of changing your current accounting procedures too difficult?

The answers under this heading were virtually irrelevant because of the types of comments made. There was some claim of not enough benefit and that it was too complicated, but really

it is not appropriate to comment, to use the data provided.

Q115. Do you think cost accounting courses cover ABC sufficiently?

Three said yes, two said unknown and 13 said no.

Q116. If your direct labour input per product or process has reduced in the last five years, by how much has it reduced?

		No of Respondents
Less than 5%	-	4
5-10%	-	4
10-20%	-	6
20-30%	-	4
30%	-	0

Comment:

A reasonable spread of results.

Q117. If your direct labour costs have decreased on average by more than 10% have you changed your method of allocating indirect costs?

Three respondents said yes; one said partially and five said no.

Comment:

This is an interesting feed-back, although companies have indicated they have been successful in reducing their cost by over 10%, in no way has that changed their allocation of overhead costs against the direct labour content.

Q118. Please comment on any change to costing structures you have made.

The comments made by respondents to this question were very interesting, since answering the previous five or six questions was fairly difficult to obtain reliable data, but respondents were very ready and willing to make written comments. Most unusual on questionnaires.

The following comments were made:

(a) Changed base on type of product produced and distributed, rather than historical data.

(b) More focus on activity analysis of overheads to improve resource allocation.

(c) Closer examination and older fixed costs now allocated to direct labour costs.

(d) World-wide review determines use of ABC as an ad hoc analysis rather than an integrated system, using "through put" philosophies which appear more relevant.

(e) Use ABC for marginal and export business. Showed up non-profit in other areas but customers want a one-stop-shop so have continued lines that are not profitable as a customer service.

(f) Technology changed processes, ABC introduced in 1990 as direct labour cost not indicative of allocation of overhead (This company was finding allocation of ABC costing very effective.)

(g) Traditional costing continues but using ABC as a management tool for decision-making.

(h) More specific to product group for allocating associated costs. Still using direct method but reviewing with self-managing work teams which are highlighting excess costs using ABC costing training.

Comment:

These results indicated few companies had embarked on a pathway of ABC. Yet many companies are claiming that they are improving sales, reducing costs but still not making a profit. Perhaps the problem is related to their costing methodologies. One difficulty of introducing ABC is in understanding and interpreting the activities that should be associated with a product. The following is an example written by James Brimson [97] in his book 'Activity Accounting'.

The cost of processing purchase orders can be traced to products on the basis of the number of purchase orders required to build a part. Products with a significant number of purchased components would receive a higher portion of purchasing costs than products with few purchased parts, since additional purchasing activity is required.

8.7.1 ABC Survey Summary

Generally, it was found that ABC was not being taken up as an AMT, this surprised the author of this Thesis. Many company's indicated they were not familiar with ABC, although there was indications that some firms would be reviewing ABC in 1995, let's hope so!

9.0 SURVEY SUMMARY

9.1 Data Review and Thesis Reflection

Data included in this Thesis indicates that management of AMTs is often a haphazard journey, full of minefields, lack of direction, lack of knowledge and lack of basic understanding of the fundamentals of a manufacturing system. New AMTs appear to be avoided that seem complex like Activity Based Costing but something simple to understand like Self Managing Work teams will be tried, or at least given a start. Empowering Self Managing Work Teams is a difficult task for traditional managers who need to change styles from 'X', 'Y' types to 'Z' types, they need to become leaders in the new style.

In her paper, Leadership : The Self-Organising Dynamic of Chaotic Organisations,[98] Dr Helen Sungaila writes about leadership and its commitment to a cause. What the leader wants for the system is personal, but does not reflect any personal selfishness. On the contrary, the leader has a personal dedication to a cause greater than his or her own interests. The leader acts out of deep convictions. Leaders are unreasonable champions of 'the cause', and must have 'all the successful champion's characteristics'.

(1) Energy (2) Passion (3) Idealism

(4) Pragmatism (5) Cunning (6) Towering Impatience

(7) An unrealistic willingness to allow any barrier to set him back, and

(8) Love/hate relationships among his subordinates.

Leadership of AMTs then requires a more educated person responsive to change and people's abilities.

Many managers are overwhelmed by the amount of technologies that they need to keep

abreast with. As more awareness is made available of the whole linking requirements of manufacturing functions, sorting out, evaluating and selecting suitable technologies for a firm's forward planning becomes a nightmare. Paul Swamidass suggest in his paper 'Planning for Manufacturing Technology' [99] that using better information that relates costs of existing technologies and compares to costs of new technologies, by developing a T.C. Curve (Technology Characteristic Curve) firms could make more informed decisions on purchasing AMTs.

To use AMTs requires people with many skills in a manufacturing environment, but the data collected indicated that cross functional experience of people in manufacturing is rare. Educational Institutions have picked up this gap by introducing courses covering a much broader manufacturing base.

There is no excuse for managers to ignore the plethora of courses available to them to bring their manufacturing management education up to date. To revitalise themselves, their companies and their work teams in the move to world class. Education is available from TAFE, Universities, Professional and Sub-Professional Bodies, and now in many companies 'In House' training is provided.

A typical 4 day residential course on Manufacturing Management offered by the University of Melbourne Business School[100] offers topics that include Benchmarking, Best Manufacturing Practice, Quality Management, Technology Management, Supplier Management, Manufacturing Strategy, Capacity Planning, Innovation, Production Control, Vertical Integration, World Class Manufacturing.

Similarly more advanced courses in Manufacturing Systems are now offered in Australia and overseas, that enable education in a whole system of manufacturing, to be undertaken. These types of courses were not offered 10 years ago, but more recognition has been placed on the whole system and education authorities have responded. The following is a typical example of a systems course:

Advanced Manufacturing Systems, MSC Degree[101]

Kingston University, Roehampton Vale Centre, London

Faculty of Technology

Topics:

- Computer Aided Design and Manufacture
- Computer Aided Production Management
- Total Quality Management
- Flexible Automation
- Mechatronics
- Simulation Modelling Techniques
- Processing and Technology of Modern Materials
- Electro-Manufacturing Processes
- Information Systems
- Management of Manufacturing Organisations

9.2 General Comments of Managing MRP

The data indicated that the basics of manufacturing was lacking in MRP environments. Routes and BOMs were not accurate enough or audited. Inventory accuracy was not good enough, and scheduling was insufficiently "owned" by the company but was frequently placed in functional buckets like Production Control. Training in systems generally was insufficient

particularly for established systems. User knowledge of MRP was not at a level that would generate confidence of continuous improvements in the system. Part numbering systems tended to be carryovers from non computer days, therefore usage of the MRP system to help control inventory was restricted.

Discipline in systems was not apparent and demonstrated the misunderstanding of senior management to work in an MRP manufacturing organisation.

Lack of knowledge of MRP rating systems was typical of the poor attitude to the discipline required to run MRP. There is no doubt however that the Kanban system of visualisation of production control will help companies become forced into the computer age as shortages of stock will immediately be apparent. Shortages of stock using Kanban will or should generate immediate questions of why is there none. Often the questions will highlight deficiencies in BOMs, Routes, Lead Times, Scheduling and general management of the computer system that backs the Kanban part of the execution at shop floor level.

Too often we are reminded of management's lack of willingness to integrate AMTs in their business.

Similar to management problems associated with MRP another AMTs mismanagement was attacked in an article by Harry Challis[102] about a book on CAD/CAM. He writes, "Management's ignorance of the implications of advanced CAD/CAM capability has its obverse in the limited horizon of many users."

However there is lots of help available to companies not achieving maximisation of their AMT

system. Some help can be achieved with government assistance through the NIES [103] program. Their bi-monthly magazine The NIES, is constantly reporting on the successes of companies throughout Australia. The reporting is almost totally based on utilisation of AMTs and workplace re-organisation. In an article in the magazine, Kevin L. Nestadt[104] demonstrates successes of the small manufacturer, Brimech Industries has made significant progress through implementation of JIT, so to the article reports, has Enzie Stairs and Everco Wiring Systems.

9.2.1 MRP - What's Needed

Companies need to know how they are measuring up to benchmarks of World Class MRP users. It means bringing a measurement mentality to the company.

The following could be used:

1. $$\frac{Net\ Income}{Number\ of\ Employees}$$

2. $$\frac{Total\ Sales}{Number\ of\ Employees}$$

3. $$\frac{Net\ Income}{Total\ Direct\ Payroll}$$

4. $$\frac{Net\ Income}{Total\ Factory\ Payroll}$$

5. $$\frac{Total\ Earned\ Direct\ Hours}{Total\ Factory\ Payroll}$$

6. Lead Time Performance
   (Calculated using the date order received until shipped.)

7. Stock Turns

(RAW, WIP, FG)

These measures were extracted from a paper by Robert A, Abair in Louisiana, USA.

(RAW, WIP, FG)

These measures were extracted from a paper by Robert A. Abair in Louisiana, USA.[105]

9.2.2 Failure of MRP

Continuing high interest rates, reduced consumer demand, higher energy prices and a range of market threats make the job of controlling costs, both by outright cost-cutting and by doing things smarter, are even more important.[106] When a company starts a concerted program to improve its performance - its cost management systems are frequently a major obstruction. Too often, the response from accountants is that "the system won't cope or conversely the Finance Department continues to provide much data but little information from systems that are complex and expensive to operate.

It is a well known statistic that MRP II systems fail to meet expectations in 80% of cases. Simplification and understanding how to apply modern management approaches, indeed, are pre-requisites to successfully installing a new computer system. Without attention to and understanding of the TQM and JIT philosophies, and the emphasis these philosophies place on bringing accountants into the factory or other value adding areas, putting in a new performance reporting, cost management or similar system will just be like putting whipped cream on garbage.

Lamond recommends some good Performance Reporting Measures:

Days in Inventory

Delivery Reliability

Performance to Schedule

Cost of Quality

Equipment Effectiveness

Profitability and Return

Throughput Time

9.2.3 Japanese Management - Perspective

So much is quoted by western manufacturers of how the Japanese have been so successful and all the lessons that could be learnt from observing and researching Japanese manufacturing management techniques. Robert H Hayes[107] summed it up in an article he wrote in 1981, They (the Japanese) succeed not by using futuristic techniques but by paying attention to manufacturing basics. He writes further about his observations of what he found strikingly different:

1. Factories were exceptionally quiet and orderly, uniforms were clear, machines were clean, floors were clean, there was little stock. Sources of litter were controlled.
2. There was almost a total absence of inventory on the shop floor. The inventory that was there was carefully piled in boxes in specified places.
3. Keeping crisis out of the plant requires stability, ability to achieve schedules, there must be continuity of manufacturing processes.
4. Preventing machine overload. Tools, dies and production equipment were not overloaded. Regular preventative maintenance and cleaning and adjustment of machines meant they last longer (than US) with reduced rates of use.
5. There was comprehensive use of monitoring equipment and early warning systems.

Manufacturing basics, that is the problem with most Australian MRP systems. The basics are missing. Accurate BOMs, accurate inventory, accurate routes, acceptable time fences for schedules. Get the basics right and results will be rewarded.

10. RECOMMENDATIONS

10.1 General Management of AMTs

10.1.1 Checklist

There is a trend in management today to assure compliance to standards AS3900 Quality Standards and Occupational Health Standards for Work Cover are examples of areas that are audited. Auditing is done by using a series of questions in a checklist. A similar approach to AMTs is recommended. A checklist could be developed and updated with emerging AMT. Companies could then evaluate at planed intervals the suitability of AMT to their circumstances. This would ensure that an AMT reviewed say in 1991 and rejected, would still be revisited on a regular basis and not forgotten.

10.1.2 Benchmarks

It is not sufficient to improve a business based on Australian circumstances as external competitors from all over the world and in particular the emerging Asian regions are competing for Australian business. Hence if companies install an AMT they need to be focused on expected results that are world competitive. To assure such results are reached Benchmarks need to be set and monitored as the AMT installation and usage progresses.

10.1.3 Selection of Specialist Help

Much care needs to be taken in selection of specialist help. Careful consideration of 'in house' requirements need to be stated in regard to the AMT being considered. If 'in house' experience is not available some basic research by a Special Project Officer to collate and sort

data on the AMT being considered would be much less expensive than hiring outside specialists. If specialists also have an interest in promoting a product brand, particular care needs to be in place to assure the 'in house' requirements can be met. Often specialists promote the potential savings without underlining some difficult situations that would need addressing before those savings are achievable. An example is MRP where savings of 90% of inventory holding costs were claimed. This figure is more recently quoted a 30% but the real problem in achieving this figure is the need to get basic data accurate and the discipline in reporting every single transaction, these are not easy to achieve.

10.1.4 Keeping up to Date with Change

An enormous problem for the industry sector. Often attendances at International Conferences on Manufacturing is 80% attributable to the academic sectors rather than the practitioners. Training is considered a life long experience therefore all sectors of manufacturing should be considering a 'profile' of what is suitable training to keep in touch with a profession. For example, a Production Manager of a medium size business could be profiled as follows:

PRODUCTION MANAGER - YEARLY TRAINING PROFILE	
Reading Technical Journals	**Yearly Hours**
Society of Manufacturing Engineers Journal	30
Works Management Journal	25
Trade Magazine	15
Work Teams	30
Attending Seminars	
1 x International Conference	20
2 x Local Conferences	12
Training Course	
2 Short Courses in Specialist Areas	60

A checklist of the above could be used as part of the assessment the Manager should receive by Senior Management.

10.1.5 Education

Multi functional understanding workshops cross functional knowledge to make an AMT system work is required if that system is to be used at a world competitive standard (Best Practice). Accounting Managers must be aware of customer's needs as much as a Marketing Manager. Similarly a Production Manager must be aware of customer's needs on quality, price and delivery. So as partnerships develop with customers, supplier's and government's, education awareness of all functions of a business will be critical for the future success.

10.2 MRP

10.2.1 System Basic Requirements

These are Inventory Status, BOMs, Schedules and Routes. If the four areas are not maintained at an acceptable level of accuracy the system will never be completely successful. Whenever possible any audits associated with control of these areas should be made accountable by the users. Examples: WIP Inventory should be the responsibility of Production teams. F.G. Inventory should be the responsibility of Marketing/Sales as they requested the production of the product. Similarly BOMs and Routes are mainly used by Production, they then become the auditors of accuracy of information. Management of accuracy of data should be regularly reviewed equally importantly as reviewing standard costings.

Schedule input, achievement and changes must be reviewed by a Master Production Scheduling Committee preferably chaired by the General Manager.

10.2.2 MRP Rating and Benchmarks

The ABCD checklist by Oliver Wight organisation is much too complex for fundamental management requirements of an MRP system, as demonstrated by the number of respondents to the questionnaire who were not familiar with this checklist. Hence a much more simplistic checklist needs developing that addresses basics only. The basics to be covered should be Scheduling, BOMs, Inventory, Routes and Lead Times.

The following describes such a checklist with data fictitiously completed.

Table III **MRP Checklist Recommended**

MRP BASIC CHECKLIST			
	Results	**Best Practice Standards**	**Recommended Improvements**
Scheduling			
Achievements to Plan	83%	98%	Too many orders inside LTs, install planning fences.
MPS Meeting (Monthly)	Done	Mtg regularly chaired by GM	-
BOM			
No. Current	2890	-	-
No. in Data Base	3620	-	Review those not generated last 2 years.
No. Cancelled Last 6 months	50	-	Not enough.
Audit Accuracy	95%	99.5%	Review methodology.
Inventory Accuracy			
Raw	93%	99%	Problems in weighing steel.
WIP	91%	98%	Training required in plastics.
FG	100%	100%	Good Result.
Routes - Accuracy			
Rolling Audits 20/dept/month	98%	100%	Problem in foundry, records on m/c change not updated.
Lead Times			
Cumulative	6 weeks	4 weeks	Suppliers to attend w/shop.
Manufacturing	2 weeks	3 days	Plan to reduce to 3 days required.
Delivery	1 week	3 days	Geographical variation will achieve 5 days by 1995.
Procurement	3½ weeks	1 week	-

This basic checklist could be used by general management to establish plans to achieve Best Practice. It could also be used on a regular basis to confirm a constantly improving situation in control of the MRP system. It is a listing that can be managed with little time involvement but it will require understanding of the system. It will ensure people are cognitive of the

basics!

10.2.3 Continuous Review - Extended Checklist

Because of changes to personnel over the life of a MRP system it is critical to have in place monitoring of that system. The above MRP Basic Checklist could be expanded to include management of slow moving stock, capacity planning, departmental achievements to planned orders, set up reductions and so on.

Similarly as changes in systems become available as much effort into installing those changes is needed, as was required in the initial installation. For instance, when systems were able to use daily time buckets, companies did not consider the advantages that could be obtained in Lead Time and Inventory Reduction compared to weekly time buckets.

10.2.4 Training for MRP - Video Your Own

Why spend $2,000 for a CD Rom, MRP package from USA when companies can use their own personnel to train others by a very simple system. Video existing users of the system, narrating as they go how information is used, analysed and acted upon. Follow up personnel would then have available an 'in house' very applicable training medium. These can be used at work or in the home environment. They can be hassle free, used at the learner's own pace. They can also be critical in continuity of user good practice. A most under-valued tool.

10.2.5 Cross Functional Awareness

Nobody in a computer assisted manufacturing system can be isolated from the impacts of functions outside their normal sphere of operation. A simple 16 hour workshop can bring about the required awareness. The workshop should include the following topics:

MRP and MRP II explained

Schedules, BOM and Inventory Balance

MRP Logic

Capacity Planning, How it is Used

MPS Committee

Managing in an MRP Environment

10.3 Socio-Technical Systems

10.3.1 SMWT - Task Migration

Success of using Self Managing Work teams will be achieved if the process of attitude change that is incorporated in "Self Managing" is not taken too simplistically. Changing attitudes is not a simple task and it is not related to shop floor personnel only. It is related to all levels in an organisation. A skeleton of the vision for change needs to be established that identifies the tasks that can be accomplished at the level that the information or action is used. Later the tasks need to be clearly analysed to identify training requirements for those people taking on new tasks. Often middle management feel their jobs disappear as their tasks are migrated to teams. This is because their new tasks are not fully identified. Similarly, managing Self Managed Work teams is a different task than managing in a traditional organisation. Different goals and measures need to be set up to monitor progress.

10.3.2 Empowerment

As reported in the text AMTs need people and people need AMTs. As part of that need education and increasingly higher levels of education will be needed for people to be able to use AMTs. As people become educated to higher levels they will have expectations of greater involvement in the decision making process. If that ability to make increasingly more 'powerful' decisions is missing then inefficiencies and frustration will occur. Empowerment is a powerful means in the order of change using AMTs. It is a part of giving authority in Task Migration as mentioned in Section 11.3.1 above.

10.3.3 SMWT - Installation Speed

There is some nervousness in business whether SMWT is the 'way to go' or is something to be avoided. The successes are much in evidence now, to claim it is "the only way to go" and to establish Teams as fast as possible, with or without training. As fast as possible?, one year maximum for any size company.

10.4 Activity Based Costing

10.4.1 Awareness

The survey showed little awareness of ABC in manufacturing. All companies in manufacturing should immediately start a project in their organisation to identify the benefits of ABC. The Project Team should include accounting, manufacturing, marketing and general management functions. A pilot process or product could be evaluated using ABC and compared to traditional costing practices. The results will speak for themselves.

11 MANAGING AMTs - THE FUTURE

11.1 Vision

What do manufacturing companies need to visualise their operations of the future so that they can get their systems in sync with their processes. One article has probably best summed up that vision as The Agile Factory.[108] An Agile Factory is one that can rapidly respond - produce products - to any change in market demand - customer order - or internal conditions. The big question: Will technology systems finally deliver what they have been promising for the last 20 years.

Take an example of a customer order going in a factory now. Customer A has a rush order for tomorrow? We can start it this evening, complete the assembly by tomorrow noon, and ship it in the afternoon. Sounds fine, but use what material? We will use the material reserved for order X, which is due to start in two days. With a 48 hour lead time we can replenish our inventory JIT for order X. The effect on other orders in the system? Two orders will be affected. One can still be shipped on time, the other will only be two hours late.

The decision making process is complex. Both parameters of capacity and material must be taken into account when evaluating possible alternatives. No wonder conventional MRP systems have not been able to grasp these issues in the time frame required for the Agile Factory. To go through multiple iterations of the MRP/CRP loop takes longer than the factory can afford. What is needed in the system for the Agile Factory is:

- It should be able to schedule your plant, taking into account the capacity and availability of all resources; namely machines, manpower, tooling, material (raw and WIP).

- It should be able to plan material requirements (raw and WIP) based on demand and forecast.
- It should be able to re-allocate material (raw and WIP) rapidly from one order to another to fulfil the required due dates. This feature is referred to as 'soft pegging or soft allocation'.
- It should allow the user to manage inventories (raw, WIP, FG) dynamically, taking into consideration the actual demand and the responsiveness of all work centres (dynamic buffering).
- It should take into account the qualification of each resource to accomplish its tasks (qualified labour, set up crews, special tools, etc.)
- It should be able to group jobs by 'characteristics' (colour, width etc.) and balance set-up minimisation versus on time deliveries.
- Finally it should do it all fast enough to allow the user to consider multiple alternatives and achieve the required level of agility.

A handful of systems do exist today that can match the above list, such a system MOOPI is used by Alcan, Canada, a finite capacity scheduling system with raw material and WIP handling functionality developed by Berclain.

Also you can look at the future of manufacturing today by looking at Ricardo Semler's book Maverick.[109]

He reports on how his family company challenged nearly all traditional values of hierarchical manufacturing organisations and over a ten year plus period changed Semler Company of Brazil into a profitable, caring company. Lenore Nicklin[110] quotes in an article on the book

that Ricardo turned (the company) it into one of the most unorthodox companies in the world, where management and staff decide their own salaries, where employees set their own working hours and productivity targets - and share 23% of the profits and where everyone has access to company books.

11.2 Future Trends

Manufacturing companies have to keep abreast with trends in the market place, Adam Bertkowski, Vice President of Product System Software Associates (USA), claims that there are five significant factors that are restructuring the industrial market:

- Radical changes in consumer expectations.
- Redeployment of new technologies.
- Re-architecture of operational and organisational processes.
- Drive to political stability and reduction of trade barriers.
- Global competition and market accessibility.

The third point mentioned above reflects on the team environment and the use of an agile manufacturing solution.

11.3 Enterprise Resource Planning

In an article by David Waldron[111] called 'What Follows MRP II? Enterprise Resource Planning', he suggests that now that departmental barriers are breaking down MRP II may no longer be appropriate and is about to be replaced with enterprise resource planning (ERP). He explains that MRP II was created in an era when the only equipment available for

processing millions of data items was a mainframe computer attended by a platoon of highly skilled specialists. As a single source of the costing data and custodian of the company's entire data base, the MRP II system is incapable of being dismantled and integrated into the new multi-functional structure of the modern manufacturing company. 1990 saw the emergence of a new term - enterprise resource planning - a concept based on the distribution of function, data and processing throughout the organisation. Waldron uses an example to demonstrate why the change from MRP to ERP is required and can be achieved because of availability of powerful and simple to operate processors that could be linked together. Waldron's example is a white goods manufacturer may have one facility providing injection mouldings, another electrical harnesses, a third metal pressings and a final assembly facility bringing everything together.

From a manager's perspective, the features, the look and the feel of a material control, planning and scheduling system will be very different within each of these facilities. The injection moulding department is a process facility where management and co-ordination of the use of dies is of primary importance. Material planning is less complex since there are only a few materials; each used in large quantities. Contrast this with final assembly, which is more concerned with flexible labour teams, and the co-ordination of hundreds or thousands of items made in or bought out materials.

In both cases, the overall philosophy will be one of cycle time minimisation. This in turn calls for finite modelling of capacity and finite material planning. But in terms of the control systems required they could not be more different. ERP by providing a separate processing capability for each facility, while maintaining a common data base overall, allows each management team to create its own personalised computer environment.

11.4 Survival

The management of technology has emerged as one of the key competitive factors for survival and growth in the unforgiving global marketplace,[112] so Bursic and Cleland tells us in Strategic Technology Management.

Managers and teams need to be aware of technological changes, they need to be aware of benchmarks of their use of existing technologies, they need to be aware when one technology must be replaced. Such is an MRP II system. If the basics are operating successfully and the system is used for planning, say using weekly time buckets, which may be no longer appropriate, then comparisons need to be made with an updated system maybe using a bucketless system or sticking to the original system and operating at the shop level with a Kanban system.

Management and teams need to keep pace with any advantages that will keep them competitive.

11.5 People and AMTs

In their book 'Structured Chaos'[113] the authors write that to discover what needs to be done to correct Australia's productivity underhang requires a deep understanding of the fundamental sources of productivity growth. They conclude by suggesting the focus is essentially on the social processes involved in innovation and strong productivity performance. Dynamic performance is a consequence on how people behave, not, fundamentally of capital, or technology or plans. The latter follows as a consequence of dynamic behaviour by people, not as a cause of people's behaviour.

12 CONCLUSION

This thesis is about managing AMT's and in particular MRP. It is about getting the best out of an Advanced Technology, it is about an ingredient that seems so obvious but is frequently omitted or simply under valued, it is about people. Without recognising the impact of technology on societies and the workplace and the people in them, technologies will come and go and be significantly devalued because of their so called inability to deliver the goods, wherein really it is mismanagement if the technology that is at fault not the technology itself. The thesis has demonstrated through the surveys carried out and the documented research that people are an undervalued resource. That technology needs people to be trained in its application, properly and with integration into the big picture of organisational change that must occur when technology or business restructuring is effected.

What surprises most is the plethora of information that is available to management to select, install, use and review a technology but how little of that information seems to be utilised to ensure a best practice approach is made and measured, in any installation.

People make a system work but this thesis shows that people and their skills have not been honed into a true understanding of an Advanced Manufacturing Technology.

Drastic reductions have occurred in direct labour costs in many industries, yet most manufacturers are still clinging to the traditional disbursements of overhead costs against direct labour costs. Even though it can be demonstrated that Activity Based Costing can direct costs much more accurately to the resource consumed by the product or process.

The workforce is becoming increasingly educated and is more willing to share in the improvement processes required to become world competitive. Their frustration is the inability of many organisations to use their talents and skills which would lead to a better working life. The importance of Socio Technical Systems needs much recognition to promulgate an accelerated change to outdated management practices. Perhaps Australia

needs, an Educational Standard for all managers like ISO 9000 for Management Systems but concentrating on people skills. ISO people, that's what it's all about.

Someone needs the vision, application and knowledge to drive in new technologies but it also needs all people involved who will use the technologies and integrate them into their working life. People, then technologies, then people again. Do this right and AMTs, MRP will succeed.

13. REFERENCES

1 Australian Manufacturing Council, (1989), *What Part will Manufacturing Play in Australia's Future?*, Executive Summary

2 ANZ Business Update, (1993), *Manufacturing Exports Surge,* Issue 4

3 Australian Manufacturing Council, (1988), *Manufacturing Industry Revitalisation - Making It Together,* Report

4 Castle, R.D. (1991), *Managing World Class People*, Society of Manufacturing Engineer's Monthly Meeting, Adelaide

5 Henry Ford, (1926), Ford Motor Company

6 Technology Transfer Council, (1992), *World Class*, South Melbourne, Victoria

7 Wantuck, Ken, (1985), *Concepts of JIT*, Technology Transfer Council, Victoria

8 Advanced Manufacturing Technology Centre Ltd, (1987), *Advanced Manufacturing Technologies - An Introductory Reference Book*, Victoria

9 Techline Communications Pty Ltd, (1994), *Busier, Better, Smarter,* Article, The NIES Magazine, Issue 12

10 Reinertsen, D.E., (1992), *The Mythology of Speed*, Machine Design Magazine

11 Sansom, D. Dr., Froggatt, L. Prof., of Manufacturing Management, (1994), *Total Quality Management - Course Brochure*, University of Melbourne

12 Conway, A., (1991), *Government urged to boost total business take up of AMT*, Engineering News, Newspaper of Institution of Mechanical Engineers, UK.

13 South Australian Centre for Manufacturing, (1991), *World Competitive Enterprises (Booklet)*, Woodville, South Australia

14 Kennedy, A., (1992), *Lost Decades in a State of Decay*, Business Review Weekly

15 Munzberg, B., (1992), *How to Evaluate your AMT Investment*, The NIES Magazine Albert Park, Victoria

16 Marshall, P., (PERA), (1982), *Flexible Manufacturing Systems,* European Study Mission to Japan, (UK)

17 Allen, D.K., Prof., (1991), *Using Your Head*, Manufacturing Engineering Journal USA

18 Bivoltsis, V., Editor, (1990), *The Multiskilling of Management*, Factory Equipment News (Periodical)

[19] Steering Committee, (1985), *Improving Australia's Competitiveness*, Department of Industry, Technology and Resources

[20] Samson, D., Prof., Administrator National Conference, (1991), *Manufacturing Strategy and Technology Management*, Graduate School of Management, University of Melbourne

[21] Ross, D.F., (1991), *Aligning the Organisation for World Class Manufacturing*, Production and Inventory Management Journal, Australasian Production and Inventory Control Society, 2nd Quarterly Publication, Vol 32, No. 2

[22] Senate Standing Committee on Industry, Service, Technology, (1990), *People and Technology*, Australian Government Publishing, Canberra

[23] Meredith, J., (1987), *Managerial Lessons in Planning and Implementing Automated Manufacturing*, Cincinnati Milacron's FMS, USA

[24] Zockel, F., Professor, (1992), *Model for Dynamic and Innovative Manufacturing*, Lumen, Vol. 21, No. 5

[25] Evans, P.C., and Koop/Telesis, (1990), *The Global Challenge*, Australian Manufacturing Council, Melbourne

[26] Department of Industry and Technology, (1991), *Advanced Manufacturing Technology Register*, Factory Equipment News

[27] Newell, M., (1994), *How We Measure Up To World Standards*, The Advertiser Newspaper

[28] Smith, R., (1991), *Long and Winding Road Leading to the World's Top Rung*, Age Newspaper, Melbourne

[29] Castle, R.D., (1990), *Managing World Class People*, Society of Manufacturing Engineers, South Australia, Paper

[30] Kracik and MacDuffie, (1989), *Newly Industrialising Economies*, NIES

[31] Warburton, Richard F.E., (1994), Chairman and CEO, DePont (Australia) Ltd, The NIES Magazine, Quote, Issue 10

[32] Johnson, T., Dr., (1988), *New Directions in Manufacturing Financial Planning and Accounting*, Paper, Making It In South Australia, Conference, Adelaide

[33] Robin, L.A., (1989), *Activity Based Costing*, APICS International Conference, Australia

[34] Hunter, P., (1991), *Total Cost Solutions for the Manufacturing Industry*, Journal Institution of Industrial Engineers, Volume 32, No. 1

[35] *Making Costs Part of Your Strategy*, (1992), COZ (A NIES Publication), Published by Australian Government Publishing Service

[36] Hopland, J., Chairperson, (1990), Challenge and Opportunities for Manufacturing Engineers, SME Technology Report, Society of Manufacturing Engineers, Dearborn, Michigan, USA

[37] Socio Technical Systems, (Undated - About 1991), *Technology Transfer Council Brochure*, South Melbourne, Victoria

[38] Warnecker, I. H-J., Dr., Prof., (1991), *Advanced Manufacturing to Achieve World Class Competitiveness*, Paper for Workshops Manufacturing, Australia

[39] Walton, Mary, (1989), *The Deming Management Method,* Mercury Books

[40] Juran, J.M., (1951), *Quality Control Handbook*, McGraw Hill, USA

[41] Challis, H., (1993), *42% of Manufacturers Now Contenders for World Class*, Engineering News (UK), Newspaper of the Institution of Mechanical Engineers, London

[42] Arndt, G., Prof., (1990), *An International Perspective on 'Kaizen' in Manufacturing*, University of Wollongong, Paper, The Institution of Engineers, Australia, Fifth International Conference in Manufacturing

[43] Williams, N., (1993), *Bosses Should Learn Balance*, Advertiser Newspaper

[44] Joukadjian, S., Senior Consultant, (1992), *Socio Technical Systems*, Technology Transfer Council, South Melbourne, Victoria

[45] Hettenhaus, J.R., Kragt, H., Editor, (1992), *Enhancing Industrial Performance - Changing The Way People Work*, Taylor Francis, London, Washington DC

[46] Holpp, L., (1992), *Making Choices - Self Directed Teams or TQM*, Training Magazine

[47] Hood, S.N., (1993), *Implementing Semi Autonomous Work Teams to a Manufacturing Enterprise: A Practitioners Experience*, Paper, 1993 Conference on Manufacturing Engineering, Institution of Engineers, Adelaide, Australia

[48] Musselwhite, E., Executive Vice President, (1991), *Self-Directed Work Teams*, Zenger-Miller Inc. Training Program

[49] Barthorpe, F., Editor, (1992), *Motivate Workforce*, Engineering News (Newspaper) Institution of Mechanical Engineers (UK)

[50] Byham, W.C., and Cox, J. (1988), *Zapp, How to Improve Quality, Productivity and Employee Satisfaction*, Ballantine Books, N.Y.

[51] *Self Managed Work Teams Global Network News,* (1994), Second Edition, Western Australia

[52] Lesses, J.K., Secretary, (1990), *UTLC Circular*, Adelaide

[53] Willbury Pty Ltd, (1993), *Developing Team Goals and Strategies*, Company Hand Out for Actil, Adelaide, Australia

[4] Slater, B., Dr., (1991), AIM, Director of Training and Development, *Empowerment of People*, Paper, Australian Society of Certified Practising Accountants, State Congress

[55] Sinclair, A., Dr., University of Melbourne, (1990), *Myths about Team Work*, Article, Australian Weekend Newspaper

[56] Gaertner, G., (1977), *Everybody is the Boss*, The Age

[57] Dynavac Pty Ltd, (1975), *Self Management*, Report, Melbourne

[58] Naisbitt, J., and Aburdene, P., (1991), *Mega-Trends 2000*, Pan Books Pty Ltd

[59] Everett, E.A. Jr, and Ebert, R.J., (1989), *Production and Operations Management*, Prentice Hall, 4th Edition

[60] Hall, R.W., (1983), *Zero Inventories*, Dow Jones - Irwin, Homewood, Illinois

[61] APICS Dictionary, (1987), 6th Edition, Falls Church, VA

[62] Homer Computer Services Pty Ltd, Arnold Street, East Brighton, Melbourne 3187

[63] Arnold, J.R. Tony, (1991), *Introduction to Materials Management*, Prentice Hall, USA

[64] Hayton, G., and Loveder, P., (1990), *Training for Integrated Manufacturing: Case Studies*, TAFE National Centre for Research and Development Ltd, Adelaide

[65] Buker, D.B., Incorporated and Associates, (1992), *Manufacturing Excellence training Course Notes*, Anitioch, Illinois, USA and Sydney, Australia

[66] *Business Planning and Control System*, (1993), FEN Magazine, Ryder Publication, January

[67] *Systems Software Associates Brochure*, (1985) BPCS for Manufacturing

[68] *Mentat Computer Solutions Brochure*, (1991), Manufacturing Solutions, Oakleigh South, Victoria

[69] *Picman Brochure*, (1991), Walston Systems Pty Ltd, 47 Paramatta Road, Homebush

[70] Castle, R., (1986) Regency Institute of TAFE, School of Mechanical Engineering

[71] Baker, D.W., Incorporated and Associates, (1992), *Class A MRP II Performance Management*, Anitioch, Illinois, USA

[72] *Factory Equipment News*, (1991), Integrated Manufacturing System

[73] Mather, H., (1986), *How to Take Advantage of Trends in Manufacturing to Become Much More Competitive*, Special Publication Fact International and Wang Australia, Australia.

[74] Advert extracted from C'OZ, (1992), NIES Magazine, Albert Park, Victoria

[75] Howes, G., (1992), *Class A Update*, Message Pacific, SSA Client Newspaper, Pymble, NSW

[76] *The Manufacturers Software Guide*, (1994), Homer Computer Services, Asia Pacific

[77] Billerica, N., McSpadden Associates Inc., *Plant Wide Research Group*, MA, USA

[78] Llewellyn, M., and Bosma, W., (1990), *Class A Standards and MRP II - Are They Really Worth It?*, Computers in Manufacturing Magazine

[79] Oliver Wight Company, (1990), *Top Management Training Course*, Manufacturing Resource Planning, Australia

[80] Woxvold, E.R.A., Masood, S., and Thompson, W., (1991), *The MRP Controversy*, Paper, Swinburne Institute of Technology, International Mechanical Engineering Congress, Sydney

[81] All-Hakim, L., and Jenny, B.W., (1990), *MRP: An Adaptive Approach*, Paper, Monash University, Pacific Conference on Manufacturing, Australia

[82] Chamberlain, W., (1994), *MRP II, Don't Write It Off*, Myth and Near Myths, Falls Church, VA

[83] APICS (American) Bibliography, (1987), 500 West Annandale Road, Falls Church, VA 22046-4274, USA, also APICS, South Australian Chapter, PO Box 546, Glenside

[84] Atkinson R.D., & Associates Pty Ltd, (1989), *Manufacturing Resource Planning MRP II*, Senior Executive Seminar Papers, Gosford, New South Wales

[85] Wight, O., Company, (1990), MRP II, Top Management Training Course, Sydney

[86] Schroeder, R.G., (1985), *Operations Management*, 2nd Edition, University of Minnesota, McGraw Hill

[87] Jackson, B., (1990), Software Gift to University, Engineers Australia, Newspaper of Institution of Engineers, Australia

[88] King, P., (1992), *The Diffusion of Advanced Technology over the Next Decade*, Training Implications for TAFE, Labour Market Analysis Branch, Adelaide

[89] Wight, O., (1984), *MRP II*, Oliver Wight Publications, V.T., USA

[90] Suzaki, K., (1987), *The New Manufacturing Challenge*, The Free Press, New York

[91] Britax Rainsford Pty Ltd, (1993), *Master Scheduling Process Flow Chart*, Materials Management Review

[92] Castle, R.D., (1988), Regency Institute of TAFE, Production Planning and Control Subject Notes

[93] Workshop CP, (1989), APICS, SA Chapter

[94] Harrison, M., (1991), *MRP II and Finite Capacity Scheduling - A 90s Combination*, Works Management Magazine, United Kingdom

[95] Thurow, L. Dr., Professor of Management and Economic, (1993), *Rewriting the Rules of the Game*, Massachusetts, Institute of Technology, Manufacturing Engineering, Cambridge, MA

[96] Lamond J.S., (1991), *Performance Reporting in Manufacturing*, International Mechanical Engineering Conference

[97] Brimson, J. A., (1991), *Activity Accounting*, John Wiley & Sons Inc., USA

[98] Sungaila, H. Dr., (1990), *Leadership: The Self-Organising Dynamic of Chaotic Organisations*, University of New England

[99] Swamidass, P.M., (1987), *Planning for Manufacturing Technology*, Long Range Planning Volume 20, No.5, Page 125

[100] Course Brochure: The University of Melbourne, (1994), Business School, Manufacturing Management

[101] Advertised course in Professional Engineering, Volume 7, Number 12, July 1994

[102] Challis, H., Engineering News, (1993), Institution of Mechanical Engineers, UK

[103] NIES, National Industry Extension Services, Offices in all States and Territories of Australia

[104] Nestadt, K.L., (1992/1993), *Creating a Competitive Advantage for Small Manufacturers*, The NIES Magazine, Issue 3

[105] Abair, R.A., (1990), *Super Measurements : The Key to World Class Manufacturing*, Paper, 33 International APICS Conference, New Orleans

[106] Lamond, J.S., Partner Coopers and Lybrand, (1991), *Performance Reporting in Manufacturing - Don't Let Accounting Measures Inhibit Your Success*, International Mechanical Engineering Congress, Sydney

[107] Hayes, R.H., (1981), *Why Japanese Factories Work*, Professor Business Administration, Harvard University, Harvard Business Review

[108] Cassis, S., (1994), *The Agile Factory*, Article, APICS The Performance Advantage Magazine, Falls Church, VA

[109] Semler, R., (1993), *Maverick!*, Century, U.K.

[110] Nicklin, L., (1993), *Set Your Own Salary*, Bulletin Magazine

[111] Waldron, D., (1992), *What Follows MRP II? Enterprise Resource Planning*, Professional Engineering Periodical

[112] Bursic, K.M., and Cleland, D.J., (1991), *Strategic Technology Management*, Engineering Management Journal, USA, Volume 3, No.2

[113] Blandy, R., Dawkins, P., Gannicott, K., Kain, P., Kasper, W., Kriegler, R., (1985), *Structured Chaos, The Process of Productivity Advance*, Oxford University Press, Australia

[114] Wight, Oliver, MRP, ABCD Assessment, Oliver Wight Ltd Publications, Inc. Vermont, USA

[115] Buker, David W., Class A MRPII Performance Measure, David W Buker, Inc, Illinois, USA.

Appendix I

The MRP Computational Procedure

The MRP Computational Procedure uses the input information to calculate the current records for each component and item as illustrated in the following example.

Example

Consider a company that makes kitchen chairs. Their simplest chair, model H, has two frame components, one for the seat and the front legs and another for the backrest and rear legs. To assemble the seta to the front legs, a worker needs four fasteners (see figure 1). Similarly, to assemble the backrest and rear legs, a worker needs four more fasteners. The two frame subassemblies (F and G) are then attached to each other with four more fasteners. When the two subassemblies are combined, the chair assembly is complete.

Figure 2 shows the *product structure* tree and component information including item identification, requirements for one parent item, lead time and description. Each item in the product structure is categorised by a *level code.* the completed chair, item H, is the high-level item (level 0). Level 1 items are those whose parent is item H; these include item E, F, and G. Items A, B C, D, and E are the individual components in level 2. Finally the lowest level (level 3) items are raw materials (RM) for the level 2 components.

Figure 3 shows a material requirements plan for shipping of 500 chairs in eight weeks, and 50 units each of items A and D in three weeks for replacing and repairing chairs in the field (raw materials have been omitted from the figure).

Without concerning ourselves with how this plan was developed, for the moment, let's concentrate on the information available at the current time for each item. We see that 100 units of H, finished chairs, are on hand prior to week 1. However, we need a safety stock of 50 for unexpected demand. Thus, the net available for meeting the 500 requirement in week 8 is 50. Similarly, 200 units if G are on hand, but 30 units are for safety stock and 60 units were previously allocated to other job orders. Therefore, 110 units are currently available for future allocation.

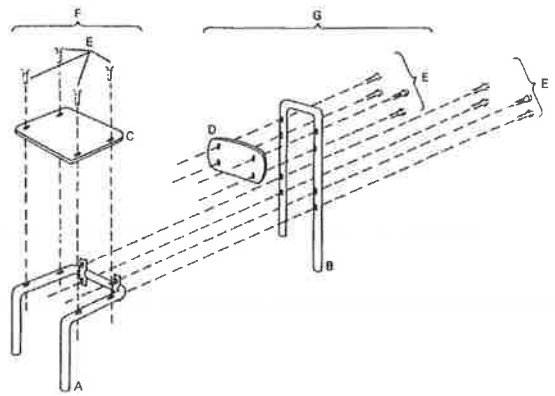


Figure 1
Assembly diagram for chair model H

Information Processing Sequence

The MRP processing logic is applied first to the high-level items (end products) in the product structure, then it proceeds to the items on the next lower level. It continues downward, level by level, until it has determined the requirements for all items in the product structure. In the chair assembly example, the completed chair (H) is the "level 0" (high level) item requiring 500 completed units in week 8. All subsequent information processing is geared toward honouring this schedule. The inventory status file tells us that 50 units of H are currently available from existing inventory; these 50 units are carried forward as available at the end of week 7, resulting in a net requirements listing of 450 additional units of H in week 8. The MRP processing logic then calculates a planned order receipt to occur in week 8 (at the time needed) for 450 units of H. When must this order be placed (released) so that it arrives when it is needed?. The processing system answers this question by "offsetting" by the length of the lead time, one week as indicated in the inventory status file for item H. This process is called *lead-time offsetting*. The result is the planned order release at the beginning of week 7, which, after the one week lead time, will result in a receipt of 450 units at the beginning of week 8

Having determined requirements for all level 0 items, processing commences in the items in the next, either F or G in the product structure (item E at level O is a special case to be discussed soon). level 1 items are considered next, because they are the only items needed to produce the level 0 item. The gross requirements for components G and F are determined by the planned order releases of the higher-level item H, 450 units in week 7. In general, the gross requirements for a lower-level item, must include the planned order releases of the parent item for that time period. Then net requirements for each of F and G can be determined, and planned order receipts can be determined for the period. As was done for H, lead times are offset for F and G to determine planned order releases. The processing logic now proceeds to the next lower level of the product structure and determines requirements for each of items A-E. then raw materials requirements are determined.

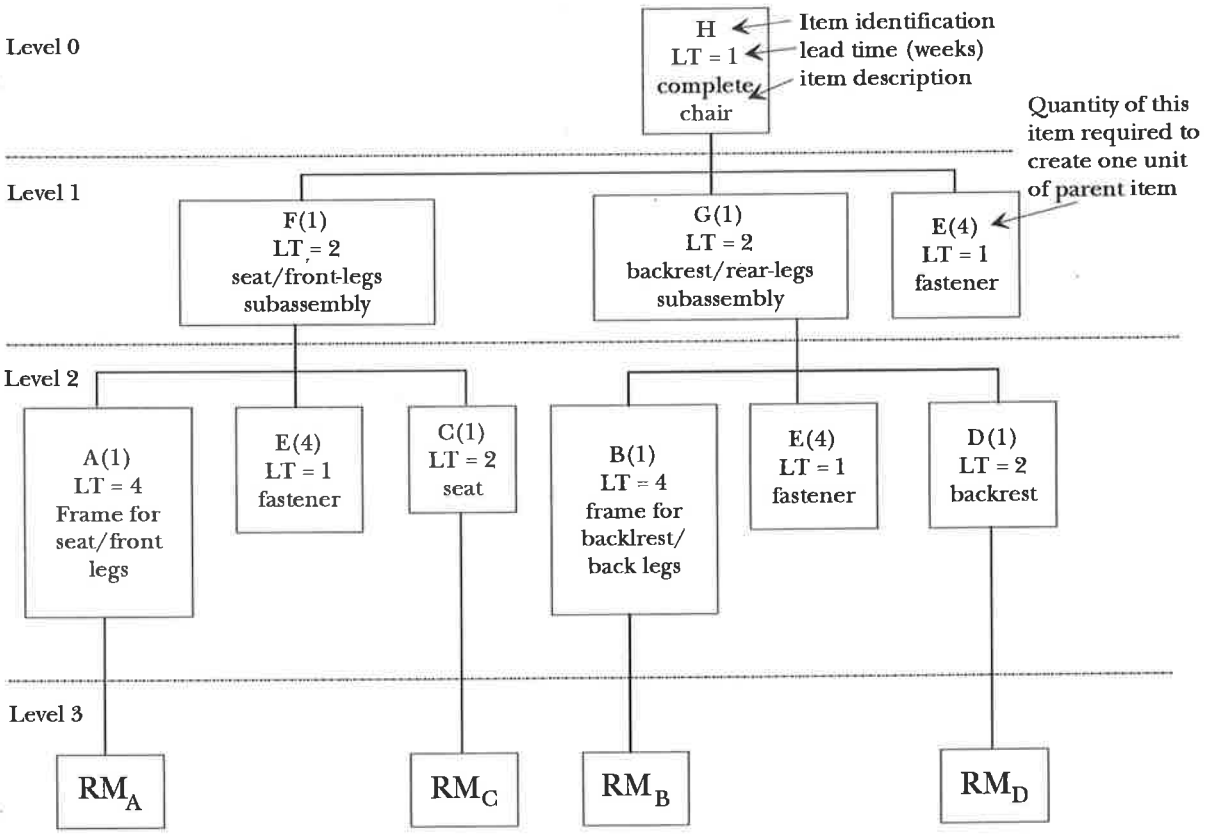


Figure 2
Product structure tree and item information

Indented Bill of Materials

To do its level-by-level calculations, MRP processing logic obviously needs information about an end items' relationship to all its subcomponents. the indented bill of materials provides this information. Our model H chair (the end item) has an indented bill of materials (see table 1) with the same information as its product.

Appendix I

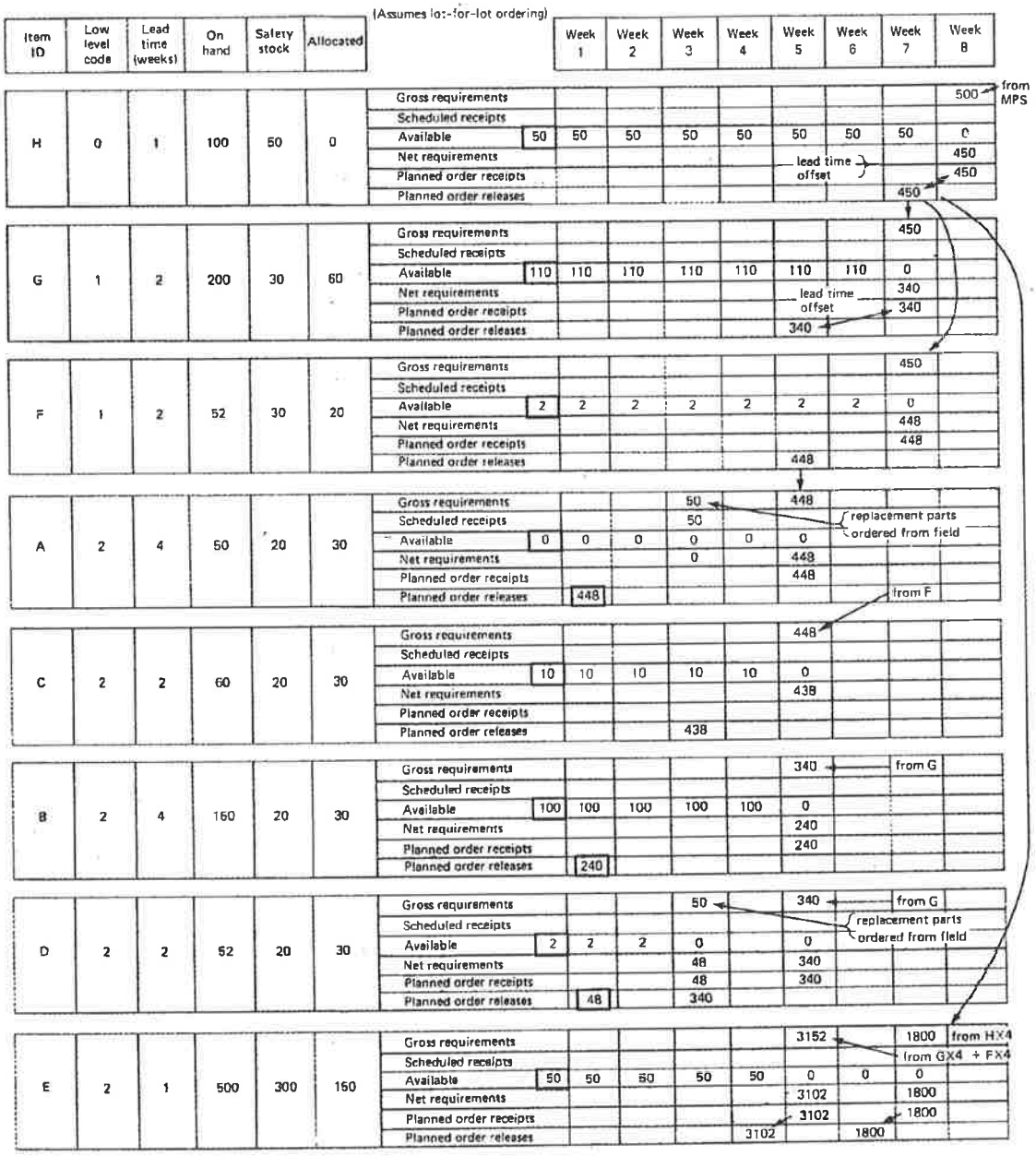


Table 1
Material requirements plan

OW MRP II is literally a simulation of a manufacturing business. It can be used to schedule the factory, schedule vendors, plan manpower far better, plan capacity requirements for new equipment more accurately farther into the future and with more capability of testing various plans. It can be used to generate the planned shipping dollars, it can be tied in with the business plan, and it can be sued to simulate "what ifs" like: "What if we have to get this product out on a rush basis in 30 days, what extra capacity will be needed, what other jobs might have to be pushed aside?", "What if marketing **really** sells what they are saying in the new product line, will we be able to support their sales projection with material and capacity?", "What if we introduce all those new products at once, how much additional inventory will we require?". In short, Manufacturing Resource Planning becomes a company game plane for manufacturing, marketing, engineering and finance.

Exec It sure sounds like MRP II can do some powerful things.

OW You're right, but that's the wrong way to say it. MRP II is just a set of tools that enables management to run a manufacturing business far more professionally. the system itself is just a simple set of logical techniques that the massive data manipulation capability of the computer has made practical. What **people** have learned to do with it is its real power. In the past, for example, there was usually an adversary relationship between manufacturing, marketing, engineering and finance. They didn't have a common game plan, and they typically didn't work together as a team as well as they should have. Now we can have that game plan. Now it's up to management to use the game plan and develop an environment where teamwork is the norm rather that the exception. Americans are very individualistic - "one man, one vote". Our toughest competitors, the Japanese are great team players. They play well together even when there isn't a game plan. We need the game plan, we've git it now. It isn't "miracle requirements planning", but it is the missing link.

Exec I guess one thing still bothers me. Why did you call it "Manufacturing Resource Planning"? Many people are still going to think of it as something that applies only to manufacturing.

OW That was a toughie. We called it something new, but I think the world is getting tired of three letter words and acronyms. It's about time we settled things down and showed management that we have a standard set of tools on the operation side of the business, just as the financial people have standard costs, budgets, cash flow, etc. manufacturing Resource Planning did develop out of material requirements planning and that's still the scheduling guts of the system. And scheduling is fundamental in running a manufacturing business. Fundamental not just to manufacturing, but fundamental to marketing (customer delivery performance is built around timing), fundamental to engineering (without schedules in engineering, new product introduction, engineering change, and the delivery of highly engineered products simply won't take place on time, and the rest of the planning in a manufacturing business won't work well). Some people prefer to call it things like 'Management Resource Planning" or 'Business Requirements Planning", but this is not planning that applies to a theatrical agency or a real estate business, it applies to a **manufacturing** business; not that manufacturing is more important that marketing, engineering and finance, but that **all** of the resources in a manufacturing business must be planned and co-ordinated properly if we're to get the best results.

Exec It sounds more like this has dramatic potential. Why don't we hear more about it? Certainly, there are occasional articles, but you would think that all of the business publications would be doing everything possible to accelerate the adoption of MRP II.

OW Any new technology takes 20 to 30 years to really sink in. The airplane was invented in 1903, commercial airlines became a success a long, ling time later. We have a new industrial revolution going on today. An ability to run a manufacturing business far more professionally. An ability very much akin to the quantum leap in professionalism that came in flying with the development if instruments. Running a business with MRP II is like flying by instruments. It gives the managers far more capability that they ever had before. But when we are in the midst of a revolution, it's difficult to see what's happening, because we are too close to it. I'm sure not too many managers during the first industrial revolution said to their wives, "Skip breakfast this morning, honey. I don't want to be late for the industrial revolution". When the most dramatic things are taking place, we are usually too close to the day-to-day activity to recognise their significance. Nevertheless, we have some powerful tools available today, and if we are going to regain our position as the leader in manufacturing in the world, it behooves us to get these tools adopted and used effectively as quickly as possible.

APPENDIX III

ADVANCED MANUFACTURING TECHNOLOGY SURVEY

This survey is in[3] three sections :-

MRP----------White Paper
Work teams----------Blue Paper
Activity Based Costing------Pink Paper

ALL INFORMATION IS STRICTLY CONFIDENTIAL

Please complete and return to the author by the requested due date, 23 JUNE 1993.

For further information about the author and instructions for completing the survey please refer to the attached letter.

IF YOU WISH TO RECEIVE A SUMMARY OF THE RESULTS OF THIS SURVEY PLEASE TICK ✓ THE BOX BELOW.

COMPANY NAME : _____

PERSON(S) COMPLETING SURVEY :

MRP SECTION	1._____
WORK TEAM SECTION	2._____
ACTIVITY BASED COSTING SECTION	3._____

CONTACT PHONE NUMBER : _____

JOB TITLE OF PERSON(S) COMPLETING SURVEY :

SECTION
1. _____
2. _____
3. _____

COMPANY'S MAIN PRODUCTS :

SALES VOLUME/YEAR : $

NUMBER EMPLOYED :

MRP SYSTEM

1. Please name your MRP software.

_____

_____

_____

_____

2. Please name your computer hardware that carries your MRP system.

_____

_____

_____

_____

3. When was MRP first installed

Please note, if you have used two different software products please indicate dates of installation of both systems
eg 1982 ✓ Mapics
1989 ✓ Fact

prior 1982 - when _____
1983 ☐
1984 ☐
1985 ☐
1986 ☐
1987 ☐
1988 ☐
1989 ☐
1990 ☐
1991 ☐
1992 ☐
Other ☐

4. Are you using same system as original installation with updates.

Yes ☐ (go to Q6)

No ☐ (go to Q5)

5. If you answered no at question 4, please indicate previously used systems and reasons for change.

Date	**System**	**Reason for change**

6. Do you believe you are using your MRP at an MRPII standard?

Yes ☐

No ☐

7. Are you familiar with the Apics/Oliver Wight categorising of users of MRP standards.

Yes ☐ (go to Q8)

No ☐ (go to Q9)

8. If you answered yes to question 7 what standard do you think you are at?

Please circle A or B or C

9. Do you use Capacity Planning

Yes ☐ No ☐

or Rough Cut Capacity Planning

Yes ☐ No ☐

10 What time buckets do you currently have in your system (please tick box for your application)

Bucketless ☐

Daily ☐

Weekly ☐

Monthly ☐

11. Do you have time fences in your system for:

Manufacturing Lead Time	Yes	☐	No	☐
Raw Material Lead Time	Yes	☐	No	☐
Planning Lead Time	Yes	☐	No	☐

12. Did your system meet your expectations

1	2	3	4	5
☐	☐	☐	☐	☐

(where 1 is a low level of expectation and 5 is a high level of expectation)

INSTALLATION PHASE

13. When your company started the evaluation process of using MRP, did you form an

MRP system selection committee Yes ☐ No ☐

MRP installation steering committee Yes ☐ No ☐

14. Did your company employ a consultant to help the installation process Yes ☐ No ☐

15. Did your company have the ability to use MRP Literate Personnel from other divisions of your company. Yes ☐ No ☐

16. Did your company use combinations of the following:

Consultant, Steering Committee or other Division Expert Yes ☐ No ☐

Consultant, Steering Committee Yes ☐ No ☐

Consultant Yes ☐ No ☐

Others (please specify below)

_____

_____

_____

_____

17. What modules of the MRP system were installed first, please rank in order the first four (4) modules

Modules	**Rank**
Bom	
Routes	
L.T.	
Schedules	
Inventory	
Item masters	

18. What was the last module installed. **Module Name** _____

19. Have you more modules to install Yes ☐ No ☐

20. Timing of installations, did your plans for implementation of your MRP System, extend beyond the following times

- 12 months ☐
- 18 months ☐
- 24 months ☐
- 36 months ☐
- other, please specify _____

21. Was your implementation time-table achieved

Yes ☐ (go to Q23)
No ☐ (go to Q22)

22. If your answer to Question 21 was no, briefly describe your problems

_____

_____

_____

_____

PEOPLE

23. Did the person driving your installation have a function background from:

(tick appropriate box/es)

- Engineering: ☐
- Production Management ☐
- Computing ☐
- Finance ☐
- Sales ☐
- Production Systems ☐

24. Did the person chairing your installation steering committee have skills in:

(tick appropriate box/es)

- Computing ☐
- Production Systems ☐
- Production Management ☐
- Finance ☐
- Engineering ☐
- Sales ☐
- MRP Systems ☐

25. Did the person directly responsible for your computer systems *(M.I.S.) have skills in the following areas prior to implementing your system:

(tick appropriate box/es)

*(M.I.S. Manager Information System)

- MRP System ☐
- Computer Systems ☐
- Manufacturing Systems ☐
- Production Management ☐
- Financial Computer Systems ☐
- Accounting ☐
- Sales ☐

26. What level of experience does your current M.I.S. Manager have of MRP Systems

- 1 year ☐
- 2 years ☐
- 3 years ☐
- 4 years ☐
- 5 years ☐
- > 5 years ☐

27. What level of knowledge does your current Production Manager have of your MRP System

(where 1 is low and 5 is high)

1	2	3	4	5
☐	☐	☐	☐	☐

28. What level of knowledge does your current Production Control System Manager/Supervisor have of your MRP System

(where 1 is low and 5 is high)

1	2	3	4	5
☐	☐	☐	☐	☐

TRAINING

29. Was your company's implementation training adequate for MRP.

(1 not adequate to 5 totally adequate) 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

30. Is your company's ongoing training adequate for MRP usage .

(1 not adequate to 5 totally adequate) 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

31. Is your company's training for new employees adequate for MRP usage .

(1 not adequate to 5 totally adequate) 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

32. Is your training documented adequately for MRP usage .

(1 not adequate to 5 totally adequate) 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

33. Have any of your company's in-house training been videoed for MRP usage Yes ☐ No ☐

34. During installation phase were you supported by a consultant Yes ☐ No ☐

35. Was adequate training of your company's personnel arranged or carried out by your consultant

(1 not adequate to 5 totally adequate) 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

36. Has your company experienced resistance to training needs of MRP users by

	1	2	3	4	5
Management	☐	☐	☐	☐	☐
M.I.S. People	☐	☐	☐	☐	☐
Shop Floor Users	☐	☐	☐	☐	☐

(1 high level of resistance to 5 low level of resistance)

SCHEDULING

37. Which function of your business has responsibility for scheduling your MRP System

- Sales/Marketing ☐
- Production Management ☐
- Production Control ☐
- M.I.S. ☐
- Some combination of the above ☐

38. Do you enter customers orders/schedules directly, or use a master production schedular (MPS) to massage

- Directly ☐
- M.P.S. ☐

39. How frequently do you run a full MRP generation?

- Daily ☐
- 3 times/week ☐
- Weekly ☐
- Fortnightly ☐
- Monthly ☐

40. Do you run a "What if" generation

Yes ☐ No ☐

41. Do you ever run a net change generation

Yes ☐ No ☐

42. Do you have a master production scheduling committee

No ☐ (go to Q 45)

Yes ☐ (go to Q 43)

43. What functions are represented at your MPS Committee

- Sales/Marketing ☐
- Accounting ☐
- Production ☐
- Production Control ☐
- Plant/General Manager ☐

44. How often does your MPS Committee meet

- Weekly ☐
- Fortnightly ☐
- Monthly ☐
- Quarterly ☐
- Ad hoc ☐

45. What percentage (%) of your orders are accepted within your **normal** manufacturing lead times

10	20	30	40	50	>50
☐	☐	☐	☐	☐	☐

46. Achievement to schedules, what % of your orders are delivered on time

<30	40	50	60	70	80	90	>90
☐	☐	☐	☐	☐	☐	☐	☐

If you ticked >90 what actual % are you achieving

90	91	92	93	94	95	96	97	98	99	100
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

47. How has your delivery performance improved in the last 5 years for what ever reasons (MRP, JIT, TQM, NEW BOSS)

0 - 5 %	5 - 10%	11 - 20%	21- 30%
	31 - 40%	> 40%	

FORECASTING

48. For your long lead time items or your seasonality of your business cycles, or marketing promotional activity, do you use any forecasting techniques.

No	☐	(go to Q51)
Yes	☐	(go to Q49)

49. Is your forecasting manually compiled or computer assisted.

Manually	☐	(go to Q51)
Computer	☐	(go to Q50)

50. Do you forecast using modules in your MRP software or use other software that can interface with your MRP system.

MRP Module	☐
Other software	☐

Please name other software used for forecasting _____

51. When you manually forecast do you use any checking methodology or accuracy?

Mean average deviation	Yes	☐	No	☐
Basic chart of Forecast vs Actual	Yes	☐	No	☐
Other, please specify below	Yes	☐	No	☐

_____

BILLS OF MATERIAL

52. When you started your MRP installation did you have your B.O.M. in a status that was satisfactory for transfer to your data base with little or no massaging.

Yes ☐ (go to Q54)
No ☐ (go to Q53)

53. How much time elapsed before you were satisfied B.O.M. were detailed and accurate enough to use in generating your MRP.

<3 months ☐
4-6 months ☐
7-9 months ☐
10-12 months ☐
13-18 months ☐
19-24 months ☐
>25 months ☐

54. How many BOM do you have in your database.

Quantity_____

55. How many of your BOM are active

Quantity_____

56. Accuracy of your BOM are critical to running MRP effectively, the following question relates to your BOM accuracy

- What % accuracy did you have before starting entering your BOM into MRP format

☐ %

- What % accuracy did you achieve at start up of your MRP ☐ %
- At what % accuracy are your BOM running ☐ %
- What is your goal for accuracy of your BOM ☐ %

57. What types of BOM do you use

Single level	Yes	☐	No	☐
Indented	Yes	☐	No	☐
Ghosts	Yes	☐	No	☐
Dummies	Yes	☐	No	☐
Family	Yes	☐	No	☐

58. When (and if) you are using Capacity Planning (CP) modules did you find your original configuration of your BOM was:

Satisfactory for CP Yes ☐ No ☐

If you answered **no** to this question, briefly describe why your original BOM configuration was unsatisfactory for CP.

VIEWPOINT

PART NUMBERING SYSTEMS USED IN BOM AND THROUGHOUT YOUR DATA BASE CAN BE USED EXTENSIVELY FOR MANAGING INFORMATION. THE FOLLOWING QUESTIONS RELATE TO YOUR PART NUMBERING SYSTEM.

59. Was your original part numbering system converted into your MRP system

Yes ☐ No ☐

60.Do you use: Tick box

An alpha-numeric system	☐
Numeric only	☐
Alpha only	☐

61. Please list the significance of your part numbering system

eg 1,2,3 4,5,6,7 8,9,10

Nos 1,2,3 are department numbers
Nos 4 and 5 are model numbers
Nos 6 and 7 are special category numbers (eg hardware, packaging, pressings)
Nos 8,9,10 are identifying part numbers

List your details here

PART NUMBER

DETAILS

62. Are you active in cancelling your obsolete BOM

No activity — Highly active

1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐

63. Have you a program of auditing your BOM accuracy

Yes ☐ (go to Q64)

No ☐ (go to Q65)

64. Who carries out the BOM audit

Production People ☐

Production Control ☐

MIS ☐

Special Audit Group ☐

Others ☐

Specify _____

65. What would be the maximum number of "levels" you have in your BOM

quantity ☐

66. What would be the number of levels in your BOM that you would call typical (average) of your products.

quantity ☐

67. Have you a problem for reducing the levels in your BOM

Yes ☐ No ☐

68. Please estimate your resources required for getting your BOM up and running in your system.

people hours ☐

INVENTORY

VIEWPOINT

INVENTORY ACCURACY AND CONTROL IS ESSENTIAL FOR RUNNING A BUSINESS IN AN MRP ENVIRONMENT. THE FOLLOWING QUESTIONS RELATE TO YOUR INVENTORY STATUS.

69. How do you check the accuracy of your inventory quantities and location

	Tick Box
Counting monthly	☐
Counting quarterly	☐
Counting ½ yearly	☐
Counting yearly	☐
Counting on a cyclical basis	☐
Counting on a cyclical basis and ABC coding	☐
Ad hoc counting checks only	☐

70. What levels of accuracy of quantity counts do you maintain

Raw materials	= < 79%	☐
	80-90 %	☐
	91-95%	☐
	96-97%	☐
	= > 98%	☐
WIP	< 79%	☐
	80-90%	☐
	91-95%	☐
	96-97%	☐
	= > 98%	☐
FG	90-95%	☐
	96-98%	☐
	= >99 %	☐

71. Do you stop production for inventory status checks eg annual inventory

Yes ☐ No ☐

If yes, how long is production stopped ☐ Working Hours

72. For reporting levels of inventory status, do you use stock turns for a measure.

Yes ☐ (go to Q73)
No ☐ (go to Q74)

73. What levels of stock turns are you achieving in the following:

Raw	☐	turns
WIP	☐	turns
FG	☐	turns
Total Inventory Holdings	☐	turns

74. After running MRP for one year, did you achieve your planned increase in stock turns.

Yes ☐ (go to Q75)
No ☐ (go to Q76)

75. What % of reduction of value in inventory have you achieved after one year of MRP.

☐ %

76. Do you believe MRP will give you savings in inventory reduction that you originally planned

Yes ☐ No ☐

Briefly explain your views:

77. Do you use your inventory data together with other MRP modules to list and manage slow moving stock.

Yes ☐ No ☐

78. If you have integrated your MRP system, with Kanban system for shop floor control, have you subsequently improved your stock turns.

Yes ☐ No ☐

If you answered **yes** to this question, what % improvement have you achieved.

☐ %

LEAD TIME

In this section of the questionnaire, I am interested in the amount of control you have on your Lead Times, (LT), how the LT controls have impacted on your customer reactions, if you found MRP generated job tickets too slow for your business and have switched to Kanban for shop floor controls.

79. Do you acknowledge that LT control is an integral part of your business.

Yes ☐ (go to Q80)
No ☐ (go to Q87)

80. Have you a program of reduction of manufacturing LT that includes any of the following

	Tick box if applicable
Set up reduction	☐
Making small batch sizes	☐
Speeding up paperwork of manufacturing system	☐
Installing Kanban on shop floor	☐
Reducing wasted time between operations	☐
eg: changes in layouts	☐
grouping M/Cs together (cells)	☐
Reduction of material handling	☐
Management of queue times	☐
Other	☐

Please nominate_____

_____

_____

_____

81. Have you a program of reducing your vendors LT

Yes ☐ No ☐

82. If you answered yes to Q81, how do you measure your improvements. Please briefly describe

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

83. When you run your MRP do you have time fences

For procurement LT	Yes	☐	No	☐
For manufacturing LT	Yes	☐	No	☐
for planning LT	Yes	☐	No	☐

84. Does your MRP system have restrictions in your "buckets" of time?

Does your system have monthly buckets	Yes	☐	No	☐
Does your system have weekly buckets	Yes	☐	No	☐
Does your system have daily buckets	Yes	☐	No	☐
Is your system bucketless	Yes	☐	No	☐

85. Has your MRP system been changed or modified so that you can change the length of your "time bucket".

Yes ☐ No ☐

If yes, what have you changed.

86. Managing LT reduction is a complex task. How have you reported your overall LT reductions.

Describe briefly.

ROUTES

In this section of the questionnaire, I am interested in the quantities of routes in your system, their accuracy, how they are audited and their use in estimating.

87. When you commenced using MRP were you satisfied with your quality, accuracy of your routes.

		Tick appropriate box
Were they	100% useable	☐
	90% useable	☐
	80% useable	☐
	70% useable	☐
	60% useable	☐
	50% useable	☐
	40% useable	☐
	< 40% useable	☐

88. Most routes include a pathway of a manufacturing process, a set-up time and operation times.

Were your set-up times accurate for your MRP system?

Yes ☐ No ☐

Were your operating time sufficient for your MRP system?

Yes ☐ No ☐

How long after commencement of using your MRP system were you satisfied with accuracy of your routing data?

	Tick box
6 months	☐
7-9 months	☐
10-12 months	☐
13-18 months	☐
19-24 months	☐
> 24 months	☐

89. How many routes do you have in your data base. ☐ quantity

90. Who plans your routes?

(a) Production planner ☐
(b) Shop floor people ☐
(c) Combination of a & b ☐
(d) Engineering department ☐
(e) Others ☐
please describe_____

91. Do you use your current routes and BOM within your MRP system to help estimate new work, ie does your system let you manipulate your existing information and come up with a new process/BOM/route with new costs?

Yes ☐ No ☐

92. Do you have in place an audit system of checking the accuracy of your routes.

Yes ☐ No ☐

If you answered yes to Q92, who does the auditing

Shop floor people ☐
Production/planners/controllers ☐
Estimators ☐
Supervision ☐
Design ☐
Others ☐
Please name functions_____

CAPACITY PLANNING

In this section of the questionnaire, I am interested in your methodologies of planning your capacity requirements, to what depth you use your MRP system and if you consider your capacity planning successful.

NOTE: C.P. Capacity Planning
R.C.C.P. Rough Cut Capacity Planning

93. At what level do you use capacity planning.

	tick appropriate box	
Not Used	☐	(go to Q102)
RCCP	☐	
CP	☐	

NB: it is claimed that 95% of companies using capacity planning only use RCCP.

94. What time horizons do you use for your capacity planning

	Tick appropriate box	
	RCCP	CP
0 → 3 months	☐	☐
> 3 → 6 months	☐	☐
> 6 → 12 months	☐	☐
> 12 months	☐	☐

95. It is often quoted that using RCCP, that 80% of your work occurs in 20% of your finished goods parts and therefore you can apply your RCCP of that proportion to your situation.
Have you found this to be applicable to your situation?

Yes ☐ No ☐

96. When using RCCP did you select special BOM of "typical" products and if so were they initiated in the original planning process of setting up your MRP system or were the RCCP bills added later as you gained experience with the system.

	We use special BOM for RCCP	Yes ☐	No	☐
	Initiated at set up of MRP	Yes ☐	No	☐
*	RCCP bills added later	Yes ☐	No	☐

* If you answered yes to this question, how much later were they added

Please tick appropriate box

< 1 year	☐
1 year	☐
1½ years	☐
2 years	☐
2½ years	☐
3 years	☐
> 3 years	☐

97. Using full CP you can have your capacity calculated for all your work centres or for only your bottleneck work centres, what do your do?

All work centres	☐
Only bottleneck work centres	☐

98. If your work centres are overloaded what action do you take to bring load back into balance.

Short term (say up to 6 months)

(a)	Work Overtime	☐
(b)	Rearrange work schedules	☐
(c)	Unexpedite orders	☐
(d)	Ask customers for extended delivery dates	☐
(e)	Contract work out	☐
(f)	Put on extra shifts (if possible)	☐
(g)	All of the above	☐

If you ticked box (g), which of the load massaging techniques do you use:

most frequently	☐
least frequently	☐

Please place the selected identifying letter in the box, eg ☐

99. What parameters can you adjust in your available capacity and which ones do you use.

	Tick appropriate box	
	Parameter available	parameter in use
Hours per shift	☐	☐
Shifts per day	☐	☐
Efficiency of work centre	☐	☐
Adjustment for maintenance	☐	☐
Machine up-time	☐	☐

100. Do you use capacity planning for both labour and machine capacity.

Labour	Yes	☐	No	☐
Machine	Yes	☐	No	☐

101. Time for using the information generated by RCCP and CP is critical. How successful (gut feeling will do), do you think your company has been in using your information.

	RCCP	CP
< 50%	☐	☐
> 50 → 75%	☐	☐
> 75 → 90%	☐	☐
> 90%	☐	☐

Thank you for completing this section on MRP.

WORK TEAMS

I am interested in how companies are using or proposing to use Self Managed Work Teams (SMWT) in their organisation.

Definition:
For this project I consider a Self Managed Work Team to be a team of employees, who have been empowered to make decisions that would normally have been taken by management.
eg: teams may be engaged on duties such as:

Recording attendance
Allocating work in teams
Responsibility for quality
Problem solving
Safety
Training
Scheduling

102. Have you started using SMWT.

Yes ☐
No ☐ (go to Q106)

103. (a) How many teams have you at present. ☐ (no of teams)

(b) What % of organisation staff does this require. ☐ %

104. When did you start your first SMWT.

Month_____ Year_____

105. It has been claimed that once SMWT become experienced that the structure of the organisation is able to be changed, particularly reducing management involvement. If you consider you have over 50% of your staff in SMWT that are experienced, have you been able to reduce the number of management or change their roles.?

Reduce the number in management	Yes	☐	No	☐
Planning to reduce the number in management	Yes	☐	No	☐
Planning to change the role of management	Yes	☐	No	☐
Have already changed managements role	Yes	☐	No	☐

Go to Q108

106. (a) Are you planning to start SMWT. Yes ☐ No ☐
(b) If yes, When

Date._____ month ☐ year ☐

107. Training people for working in teams is claimed to be essential, what training if any, are you planning.?

NAME OF COURSE (OR TOPICS)	DURATION (HOURS)

eg Your answer may be something like this.

Training for team members	10
Training for team leaders	20
Training for management about teams	16

Go to question 109

108. Refer Q107.
(a) For those companies already using SMWT, what training was undertaken before commencement of SMWT.

NAME OF COURSE	HOURS

(b) What other training has been undertaken by SMWT since their formation.

NAME OF COURSE	DURATION (HOURS)

109. Have you had or do you have, another form of SMWT in your organisation that have previously been set up to help in productivity and quality improvements.

Yes ☐ No ☐

If yes, what are they/were they called.
eg: PIT: Productivity Improvement Teams
WIG:Work Improvement Groups
QC: Quality Circle

Name_____

Thank you for completing this section on work teams

ACTIVITY BASED COSTING

This section briefly enquires if your organisation is using or considering using and ACTIVITY BASED COSTING SYSTEMS for allocation of overhead costs against a product or process. Traditional manufacturing accounting practice has been to allocate overhead and indirect costs against the prime hours (direct hours) earned. As direct labour hours has reduced as a percentage of total costs due to technological innovation, smarter work practices and improved quality, there has evolved a different method of allocating costs. That is, allocating activities associated with the cost of the product or process; this is known as Activity Based Costing.

110. Is your organisation using full activity based costing (ABC) for its accounting procedures.

Yes ☐ No ☐

111. Is your organisation using partial ABC for its accounting procedures.

Yes ☐ No ☐

112. (a) If you answered "no" to both question 110 and 111, do you intend using ABC.

Yes ☐ No ☐

(b) If you answered "yes" to section (a) when do you intend using ABC.

Month_____ Year_____

113. If you answered "no" to question 112(a), have you been made aware of possible benefits of ABC.

Yes ☐ No ☐

114. If you answered "yes" to Q113 and "no" to Q112, do you consider the cost and complication of changing your current accounting procedures too difficult.

Not enough benefit	Yes	☐	No	☐
Too costly	Yes	☐	No	☐
Too complicated	Yes	☐	No	☐

115. Do you think Cost Accounting Courses cover ABC sufficiently.

Yes ☐ No ☐

116. If your direct labour input per product or process has reduced in the last 5 years, by how much has it reduced.

	tick box
< 5%	☐
>5 →10%	☐
>10 → 20%	☐
>20 → 30%	☐
>30%	☐

117. If your direct labour costs have decreased on average by more than 10%, have you changed your method of allocating indirect costs.

Yes ☐ No ☐

118. Please comment on any change to costing structures you have made.

THANKS FOR COMPLETING THIS SECTION ON ABC.

Please accept my thanks for completing this questionnaire. Your reply by the requested date is fully appreciated.

Don't forget all information is strictly confidential, any information will only be used in summary form, no identifiable comments will be allocated to any business.

If you wish to receive a copy of the summary of the survey, don;t forget to tick the box on the front page.

Thanks

Rick Castle