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# IMPLEMENTING MATERIAL REQUIREMENTS PLANNING IN A DISTRIBUTION ENVIRONMENT TO MANAGE AND CONTROL THE MATERIAL MORE EFFECTIVELY

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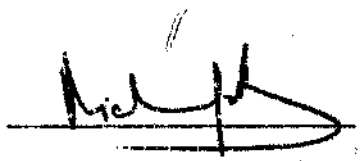
## Declaration

I delcare that this report is my own, unaided work. It is being submitted for the degree of Masters Of Science in Engineering (Ind) Conv 50%/50% Pt to the University of the Witwatersrand, Johanessburg. It has not been submitted before for any degree or examination in any other university.



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**ABSTRACT**

Pretoria Distributor, one of Eskom's five main distributors, was experiencing several problems with the management and planning of their electrification projects. These problems occurred as a result of inadequate systems, processes and training. The rapid increase in the volume of material that had to be managed necessitated them to investigate the possibility of implementing Materials Requirements Planning. The investigation highlighted the fact that it would be very difficult to handle the volume of projects on the current systems, (i.e. base systems) and while the environment at the Distributor is not ideally suited to MRP, they should still enjoy many of the benefits of implementing MRP. In preparing for the implementation, several action plans had to be put in place to address the problems of poor planning.

By the time the Distributor was "live" on MRP many of the earlier problems relating to planning and design standards, had been addressed. The post implementation evaluation revealed that although the electrification projects was not an ideal environment in which to run MRP, they were enjoying several benefits from the implementation.

**CONTENTS PAGE**

CONTENTS

## LIST OF FIGURES

# 1. INTRODUCTION

The stock that any company carries is a valuable asset to that company, and as such should be managed and controlled accordingly. Eskom is no exception. They have millions and millions of rands tied up in stock. Good stores practices and sound materials management principles, coupled with accurate planning should theoretically ensure the effective management and control of that material. However, in practise this is not always the case.

Several different tools and philosophies exist which can help a company to effectively manage their materials. These tools include:-

MRP - Materials Requirements Planning, DRP - Distribution Requirements Planning, JIT - Just In Time, Zero Inventory, and many others.

## 1.1 Background to the Project

Eskom is South Africa's largest electricity supply utility. The supply of electricity is broken down into three main areas, viz, Generation, Transmission and Distribution. The Generation Group within Eskom is responsible for the generation of electricity, while the Transmission Group is responsible for the transmission of electricity from the point of generation, the power stations, to the power grid, and then on to the users. The Distribution Group is responsible for ensuring that whoever requires electricity gets connected to the power grid. They are also responsible for the maintenance of these connections.

The Distribution Group is represented throughout the country by the five distributors, namely;-

Johannesburg Distributor
Pretoria Distributor
Free State Distributor
Natal Distributor
Cape Distributor

Each Distributor is a separate business unit operating independently from the others, while still working towards Eskom's goals. The Commercial department within the Distributor is responsible for the materials management function.
The Logistics Support section of the Corporate Commercial Department offers support to the Generation, Transmission and Distribution groups on a consulting basis. The Logistics section was approached by the Commercial Manager from the Pretoria Distributor, to implement Materials Requirements Planning (MRP) at the Distributor. Materials requirements planning was identified as a tool which would assist them with the planning and control of their stock material.

This request was made as a result of several problems that were being experienced at the Distributor, with the management of their materials. (These problems are listed in section 1.2.)

## 1.2 Statement of the Problem

Eskom's commitment to electrify South Africa has resulted in added pressure being placed on it's five Distributors. As was mentioned in section 1.1, it is the Distributors who are responsible for connecting customers with electricity. Eskom has undertaken to connect a vast number of customers in a relatively short period of time. This has resulted in large increases in stock levels at the Distributor, as a result of the Electrification stock. (see Appendix 1) However, it is not only the increased stock levels that were a concern. With the added pressure of Marketing promising the customers unrealistic delivery dates, the number of "receipts" and "issues" of materials into and out of stock had also increased. This surge in activity has exposed several problems relating to the management of material at the Pretoria Distributor.

These problems include the following;

- high stockholding figures
- poor key performance indicators (KPI's) - *
- shortages of materials resulting in stockouts, and surpluses on certain materials
- lack of discipline in performing certain stores practices such as issuing, receiving and cycle counting
- lack of training on the materials management side

- very poor, and in some cases, non-existent planning on the demand side
- lack of adherence to the standard policies regarding the management of materials

- The main KPI's against which Materials management are measured are stocklevel, stock turn ratio, days worth of stock and customer service.

The combined effect of all of these problems was that the contractors out in the field, who were doing the actual connections, were suffering because they were not receiving all the required material by the due date.
The overall impression was that there was very little control of the material, from the time that it was purchased to the time that it was issued from the store.

The second area of concern was that of material planning by the project managers. There was generally very little detailed long term planning being done. The majority of the material was being ordered on bulk orders. With the increased emphasis being placed on customer service it is essential that the project managers ensure that they plan in advance for their material to ensure that it is in the store by the due date. Both Eskom workers and outside contractors are used for construction of lines and connections. The outside contractors charge penalties for standing time if they cannot continue with a job because they are waiting for material. Planning is a vital factor in the ongoing debate between stock levels and customer service. Do you sacrifice the one to attain the other?

### 1.3 Scope of the Project

There are three main areas to this project:

- Investigate the current situation regarding the planning, ordering, receiving and issuing of material, highlighting all the problems.
- Devise the theoretical MRP implementation plan adapt it for the Eskom environment.

- Highlight any deviations during the actual implementation from the theoretical implementation plan and explain why the deviations occurred.

It is important to note that the main emphasis of the implementation will be to sort out the planning function as well as the way in which the material is controlled. The implementation will only be carried out on Electrification material as this is the major problem area at present.

## 1.4 Objectives

The objectives of this study are as follows:

- To analyse the problems with materials management prior to the MRP implementation.
- To investigate the problems surrounding the planning function.
- To develop a theoretical MRP implementation plan which can be adapted for the implementation at the Distributor.
- To see how the theoretical implementation plan differs from the actual implementation.
- To put forward any recommendations that will help them to control their material better and improve their planning of their projects.

## 2. MATERIALS REQUIREMENTS PLANNING - LITERATURE SURVEY

"Reduced lead time ..... faster responses to constantly changing custo er demands ..... flexibility to quickly adapt to dynamic market conditions ..... instantaneous, accurate communication with customers and suppliers ..... these competitive advantages have become increasingly vital to manufacturing enterprises with the onset of aggressive global competition and decreased customer loyalties. To gain such strategic advantages, many manufacturers in the past turned to manufacturing resource planning (MRPII) and have fully exploited the potential of that technology." Ref 2.1

Since around the 1960's, when computer based MRP systems were first pioneered and developed, time-phased material requirements planning has come a long way.

### 2.1 The Evolution of Materials Requirements Planning (MRP)

Prior to the development of computer based MRP systems, the conventional mainstays of inventory management came under much scrutiny. These mainstays were:

- the concept of stock replenishment
- all techniques built around reorder points
- the square-root approach to the economic order quantity
- the analysis and categorisation of inventory by function
- the conventional notion of aggregate inventory management
- the ABC inventory classification

*a. Stock Replenishment*

The term "replenishment" means restoration to an original (full) state. The stock replenishment systems are based on the principle that you will have inventory items in stock at all times. This will ensure that they will be made available whenever they are needed.

b. *Reorder Point Techniques*

The techniques in their various forms, represent the implementation of the stock replenishment concept. Systems that are based on re-order point techniques, suffer from several false assumptions concerning the demand environment.
These false assumptions include the following:- the tendency to misinterpret observed demand behaviour and the inability to determine the specific timing of future demands

These shortcomings result in a number of unsatisfactory performance characteristics, chief of them being high inventory levels, inventory imbalance and stockouts or shortages caused by the system itself.

c. *The Economic Order Quantity (EOQ)*

This turns out to be a poor ordering technique in the typical manufacturing demand environment. The main reason for the shortcomings of this ordering quantity formula, is that it was derived solely on the basic assumption of uniform demand in small increments of the replenishment quantity.

d. *Inventory analysis & categorisation by function*

This is designed to account for a given total inventory with respect to certain functions of its constituent inventory groupings; i.e. -

- order sizing
- fluctuation
- stabilisation
- anticipation
- transportation

e. *Aggregate Inventory Management*

This is a concept and set of techniques which is used for manipulating and controlling inventory in total.

*f. ABC Inventory Classification*

This is a popular inventory control technique which is an adaptation of Pareto's 80-20 principle. This principle holds for most inventories, where it can be shown that 20% of the items account for 80% of the total cost. In the typical ABC classification, A-items represent the 20% which account for 70% of the cost. The B- and C-items represent the middle 30% of items that account for 15% of the cost, and the bottom 50% of items that represent 5% of the cost, respectively.

The techniques and concepts which are covered in a-f above, were developed and pioneered during a time when there was very limited information available concerning the precise pattern of future item demand and neither could the status of every inventory item be updated and re-evaluated with sufficient frequency. Computer based materials requirements planning ensured that the approach embodied in the above mentioned techniques lost their usefulness and relevancy.

In the late 1960's as a result of the growing availability of computers, the concept of exploding manufacturing bills of materials in order to generate the order lists of parts needed, developed into material requirements planning or MRP.

The difference between the old approach, the concepts of which were mentioned above, and MRP, was that MRP allows the demand for a particular part to be derived from more than one end item. This means that you can have ten different products, each of which has one common component, and the demand for this component can be handled by MRP. MRP allows for inventory ordering to be time phased.

"Time phasing means adding the dimension of time to inventory status data, by recording and storing the information on either specific dates or planning period with which respective quantities are associated." Ref 2.2

The early 1970's (more specifically 1971), saw the emergence of the "MRP Crusade". This was a national program of publicity and education sponsored by the American Production and Inventory Control Society (APICS), in order to promote the concept as good manufacturing control practices.

As was mentioned earlier, the development and availability of computers paid a big part in the emergence of MRP. Computers are essential for the operation of MRP since there are thousands of calculations which have to be performed. Constant changes in the data necessary to run MRP, make it necessary for computers to perform recalculations in order to keep the outputs valid.

It was soon realised that a Master Production Schedule (MPS) was needed to drive MRP. Basically, a master production schedule is to an MRP system, what a program is to a computer.

"A given master production schedule is the determinant of future load, inventory investment, production and delivery service. It is the cause of certain inevitable consequences in the areas just mentioned, and it may contain the seed of future problems and failures." Ref 2.3

To allow MPS/MRP to perform a scheduling function, at the detailed level, a further module, Capacity Requirements Planning was added. The entire process is no longer known as Material Requirements Planning (MRP), but rather as Manufacturing Resource Planning (MRPII). The whole concept can be seen in figure 2.1, below.

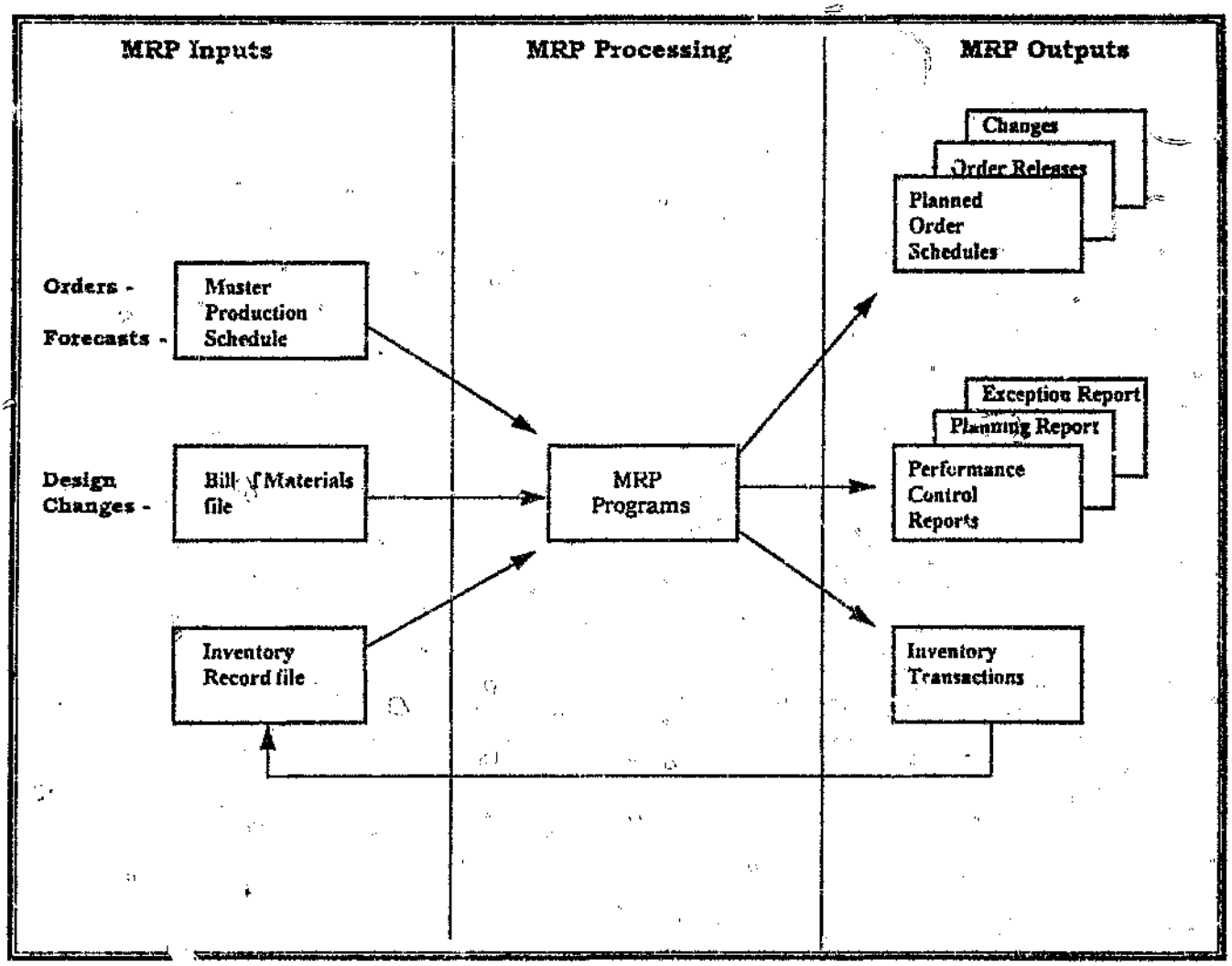


**Figure 2.1: Manufacturing Resource Planning**

Manufacturing Resource Planning is still relatively new in South Africa, compared to the rest of the world.

"In mid 1983, there were approximately one hundred and thirty installations in the country, most of which were less than 4 years old" Ref 2.4

With the progress made with personal computers and mini computer-based MRP packages, the number of MRP installations can only grow. Another factor which will contribute to MRP growth will be the recognition of it's success. A number of people still have their reservations as to the benefits that MRP can offer.

## 3.2 What is MRP?

"Materials requirements planning (MRP) and distribution requirements planning (DRP) have been two of the most significant developments in production control and materials management for the past several decades." Ref 2.5

Basically, MRP is a formal, computer based information system that integrates t scheduling and control of materials. It ensures that you have exactly what you need, when you need it. By using a set of logically related records, procedures and rules for making decisions, MRP translates a master production schedule (MPS) into time phased net requirements for each inventory item needed to meet the schedule. The MRP system specifies what materials have to be procured and determines what actions need to be taken. The master production schedule is basically a schedule of the quantity of all the products or end items that are planned for production, for a certain planning horizon. MRP schedules the materials required to meet production goals for each time period in the planning horizon.

In short, MRP, when working with a given production schedule determines the quantity of raw materials, parts, sub-assemblies and assemblies needed in each time period to produce the quantity of products or end items needed.

## 2.3 The Purpose of MRP

"Materials requirements planning has the primary purpose of taking a period-by-period (time phased) set of master production schedule requirements and producing a resultant time-phased set of component/raw material components." Ref 2.6

The material requirements planning system has a central role in materials management. (By materials management we mean material planning and control) It is used to control the inventory levels, priorities and capacity of the system. It provides the necessary information for developing capacity plans. Capacity planning means proper scheduling for a maximum load with adequate time to view future loads.

Thus MRP ensures that the correct materials are present (supplied) at the right time, and that the materials that are required by the production schedule are in place, but only when they are needed. Not before or after. By supplying the materials before they are required puts a restrictions on the company's finances, and it uses up extra space. Also having too much material laying about can disrupt production.

## 2.4 Objectives of an MRP System

The main purpose of an MRP system is to control the inventory levels, priorities and capacity of the system. However, MRP does have other broad materials management objectives. These broad objectives consist of the following:

1. Optimising of systems

   This means that effective materials management, through MRP, aims to solve all problems related to the flow of materials from the point of view of the materials supply systems.

2. Control of the level of service

Constant control over the service level is a high priority objective. Service level is one of the key performance indicators against which Materials Management staff are measured. The most important factors here are availability, reliability and the speed of service to the user. Service in Materials Management demands the highest measure of co-ordination in the long chain of supply activities (such as warehousing, procurement, distribution, etc.).

3. Limiting of inventories

The reduction of stock levels should be pursued while still keeping service level in mind. Ultimately it is a trade-off between the two. It is no good having low inventory levels if you cannot meet customer demands. The tendency world-wide, regarding inventory, is to limit inventory levels and to combat the associated risks with management techniques, such as JIT and MRP.

4. Minimum total materials cost

This objective is intended to optimise the costs of materials handling. It should be emphasised that the aim is to get a minimum level of costs related to a certain degree of service.

It is important to note that although MRP is primarily aimed at manufacturing operations, other environments such as the one at the Pretoria Distributor, can also benefit from MRP. They can:-

- increase materials handling efficiency, thus reducing delays
- reduce stockouts and material delays
- reduce rework caused by using incorrect materials

## 2.5 Importance of Planning to MRP

"The persons most directly involved with the MRP system outputs are planners." Ref 2.7

Planning is the backbone of any MRP system. If the planning is not done correctly and accurately then the full benefits of using MRP will not be realised. The planners have the responsibility for making the detailed decisions that keep the material moving. Their range of discretion is carefully limited. This means that they will still require the authorisation from the Master Scheduler before they can carry out their primary actions.

The primary actions which can be taken by the MRP planner include the following:-

- release, split and reschedule orders
- reschedule the due dates of existing open orders when desirable
- analyse and update the system planning factors such as lot sizes, lead times, and safety stocks
- reconcile errors or inconsistencies and try to eliminate root causes of these errors
- find key problem areas that require action now to prevent future crises
- use the system to solve critical material shortage problems so the actions can be captured on record for the next processing or MRP run
- indicate what, if any, further system enhancements would make the planner's job easier

The planning function will be dealt with in greater detail in sections 3 and 7.

## 2.6 The Main Components of the MRP System

There are three generally accepted main components of an MRP system. These are:-

- the Master Production Schedule (MPs)
- the Bill of Materials (BOOM)
- the Inventory Status file

### 2.6.1 The Master Production Schedule (MPS)

This is the engine of the MRP system. Basically it is a plan of WHAT products will be manufactured, and WHEN. The MPS drives the MRP system. The schedule is developed whilst taking into account the marketing plans, on the one hand, and the production capacity on the other

The master production schedule is extremely important for Materials Management since it provides, in terms of lead times, the target dates for both Purchasing and Materials Management. It also enables management to keep orders and deliveries on line with production scheduling. It should be pointed out that the MPS has to be developed and finalised before the MRP system goes into operation.

### 2.6.2 The Bill of Materials (BOM)

The Bill of Material is a list of the contents of the package or parent item, with specifications of all the components, parts and materials required for the parent item or package.

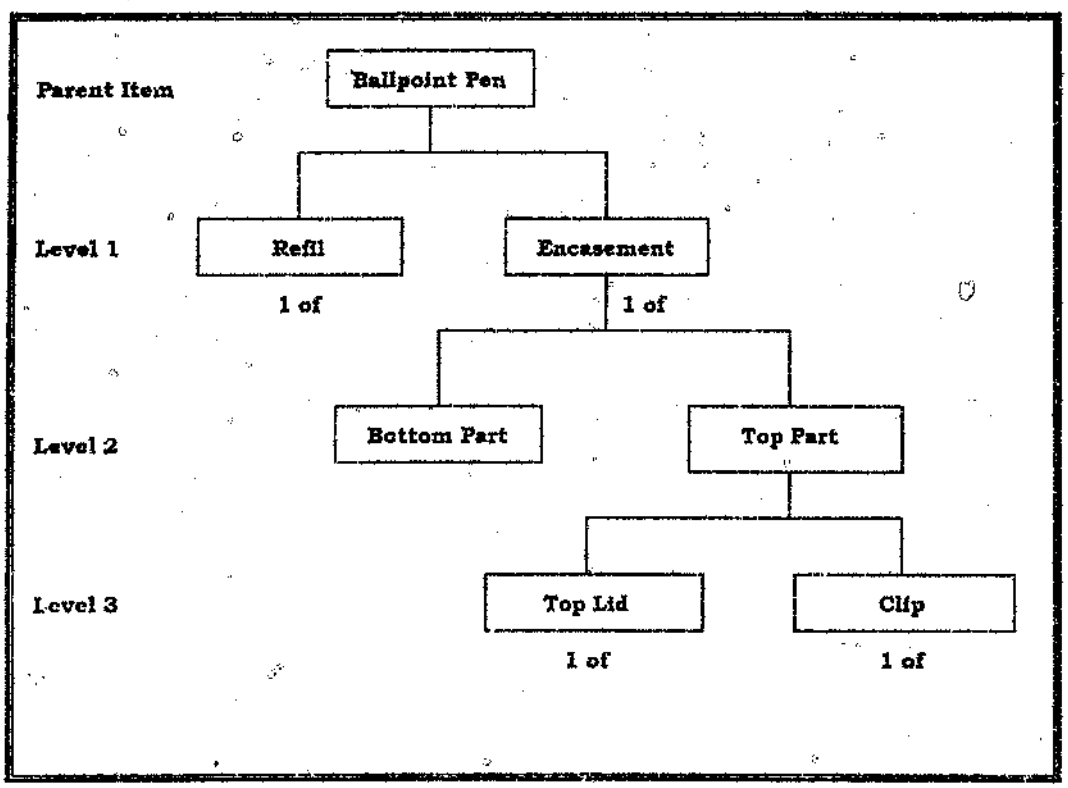


**Fig 2.2: A Standard Bill of Material**

The Bill of Material also provides the sequence in which the items are incorporated in the product, together with the quantity of each item. The basic information required by the MRP system, from the BOM, is the product structure providing the sequence and components required for the final product.

### 2.6.3 The Inventory Status File

For the system to be effective, the MRP system requires a complete record of current inventory levels for every item covered by the Master Schedule. This Inventory Status file should contain information such as:- the item identification or serial number, the quantity on hand, the quantity that is allocated, the quantity that is on order, the safety stock, as well as the lead times of every item.

The computer can then be used to calculate the material requirements for every time period, while taking into account the Production Schedule, the amounts of inventory on hand and on order, as well as the purchase and manufacture lead times of every item.

By using the MRP system as a basis for inventory planning and control, the ideal is approached, namely to have either no or very little inventory on hand, with orders being placed according to the master production schedule and lead times. The inventory is continuously checked by means of daily cycle counting.

Several advantages result from this system. These are:-

- inventory is checked and verified regularly
- problems will be identified when the actual inventory is compared to inventory records
- faulty inventory records may be revealed
- the inconvenience and time spent on the annual reconciliation of physical and theoretical inventory is reduced

To summarise, the MRP system may be described as follows;

"MRP takes a master schedule, explodes it through a bill of material, nets it against an inventory record and predicts the shortages week by week a year or more into the future." Ref 2.8

## 2.7 Advantages of the MRP System

The use of Material Requirements Planning to manage and control your materials results in several benefits. These include the following;

1. MRP is a powerful scheduling tool that ensures that your projects will
2. have the right material at the right time.
3. The number of projects that will need to be rescheduled will be reduced since MRP ensures material availability.
4. The consolidated material supply plan generated by MRP allows a degree of flexibility in balancing supply and demand.
5. MRP highlights demand for material that is impossible to meet and indicates the projects that will be affected, allowing proactive management judgement to be applied.
6. Input to MRP is derived from future projects or planned maintenance instead of historical data, resulting in inventory reductions and improved availability of materials.
7. Increased stock turn ratios, higher service levels and improved inventory accuracy will be experienced as a result of the use of MRP.
8. Budgeting is made easier and more accurate because visibility, of short and long term demand, is made possible when MRP is utilised.
9. Compilation of formal Bills of Materials required for the MRP system normally results in the creation of optimally standardised and highly accurate Bills of Material.

## 2.8 Major Requirements for a Successful MRP Implementation

1 Top Management Commitment

MRP is a system that is used to run a manufacturing business. It is not just for controlling inventory or maintaining accurate Bills of Materials. Since MRP affects everybody in the company, top management must understand it, be fully committed to it and demand results from it.

2 The appointment of a dedicated MRP Project Leader

It is important to appoint a dedicated MRP project leader who will ensure that every phase of the implementation is addressed and carried out satisfactorily.

3 Commitment to the Education and Training of all the Staff associated with the implementation

About 50% of the time and effort spent on the implementation should be directed towards education and training. Employees must learn the new philosophies and learn how to use the new tools to perform their jobs satisfactorily. At the end of the day, the cost of education and training is much less than the cost of ignorance

4 Current data integrity such as: valid lead times, accurate inventory records and formal product structures

It is of the utmost importance that the data is 100% accurate since, "garbage in, garbage out." When populating the database with all the information, the easiest way to ensure the integrity of the data, is to make someone accountable for it.

5 Set objectives and measure your performance against them

At the beginning of the implementation it is important to set objectives so that at least we know where we are going, i.t.o the implementation. If we do not measure our performance i.t.o the objectives, we will not know how far we have come. World class manufacturing requires continuous improvement and MRP without performance measurement is destined to fail.

## 2.9 What is ahead for MRP?

In the early days of materials requirements planning, it was difficult to obtain and track the correct data. In many respects the ability to do those things today is much enhanced with the current capabilities for information processing, for the sharing of data bases, for managing of data bases and the flow of information. The most important implication is the ability to maintain a single source of information that is always accurate and always available, thus improving performance throughout the company. Gains in the operating efficiency of any portion of a production environment will be multiplied by the use of MRP.

One of the main areas for growth for MRP will possibly be the incorporation of new concepts in production scheduling and control. In 1983 APICS ( American Production and Inventory Control Society) announced their new "Zero Inventory Crusade". They believed that just-in-time, zero inventory and Kanban type concepts are seen to be useful ways of making progress. MRP is a push system with released orders pushing through along the route and accumulating as work in process or buffer inventories.

The Kanban approach is radically different . It is a pull system, whereby work on a part is not started until a signal is received that it is needed further along the production process. Work in process inventories are therefore minimised. This implies continuous development of the production process to minimise bottleneck operations.

It is likely that a marriage between MRP and Zero Inventory will take place in the future. MRP is powerful at long term master scheduling. Zero inventory is powerful at the detailed scheduling level. In order to combine MRP and Zero Inventory, thought needs to be given to Group Technology type concepts. Group Technology seeks to identify families of products with similar manufacturing sequences or requirements. After this, a "cell" is created, which is in effect a flowline factory within a factory. The Group Technology factory within a factory concept may be found to fit well with the development of small or personal computer based MRP systems.

It seems likely that attention will be given to decentralised or networked MRP systems. Whilst also fitting in well with Zero Inventory concepts, such small systems

may help with the MRP implementation process, which has been the failing of many large MRP installations thus far.

Distribution is another challenging area of development. The concept of Distribution Requirements Planning, which is MRP applied to Distribution environments, has yet to make an impact in South Africa.

## 3. PLANNING - LITERATURE SURVEY

"Planning is the first step in management; it consists of selecting measurable objectives and deciding how to achieve these objectives." Ref 3.1

In management, planning is a prerequisite for meaningful execution and control. The relationship between these three functions is illustrated in the figure below.

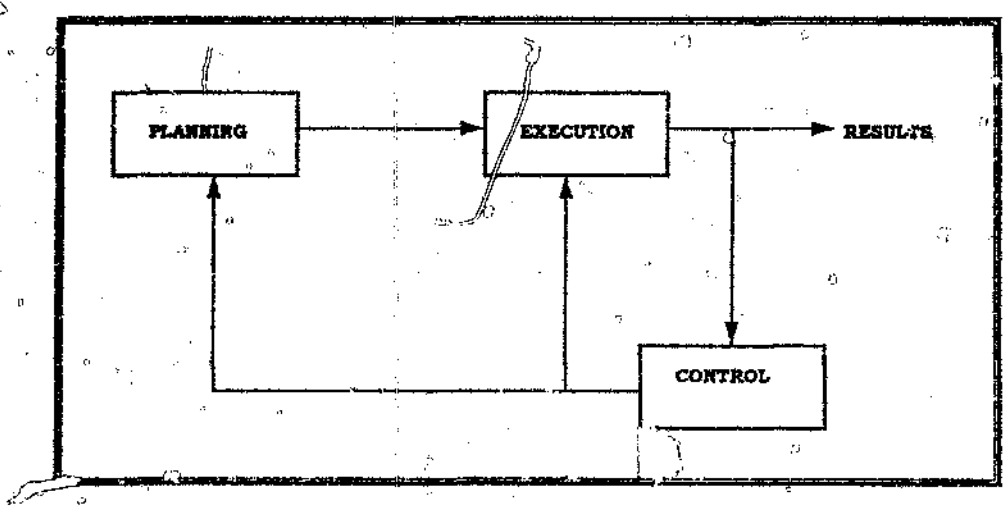


**Fig 3.1 Schematic Relationship of Management Functions**

Execution is the carrying out of the plans, whereas the control is the comparing of the actual results with the desired results and deciding whether objectives or methods of execution should be revised. Without planning there is no basis for action and as such, no basis for evaluating the results achieved.

"Planning not only provides the path for action, it also enables management to evaluate the probability of successfully completing the journey." Ref 3.2

Diligent planning often reveals the pitfalls and shortcomings of decisions which appear to the casual observer as the natural course to follow.

## 3.1 Classification of Planning Activities

Planning activities are frequently classified on the basis of the two related dimensions; viz, the length of the planning horizon and the strategic - tactical dimension.

### 3.1.1 The planning horizon

Plans can fall into one of three categories, depending on the length of time from planning to final execution. These three categories are:

- long range
- medium range
- short range

There is no set time span for each of these categories since the time span depends on the operational environment of a given organisation. The period covered by the long range plan should be equal to or greater than the composite lead time, to bring about the required changes. In some cases these changes will constitute a change in the direction of the business. Medium range planning usually covers a period beginning one to two months into the future and ending anything from twelve to eighteen months thereafter. There is no fixed number of days or weeks prior to production at which short range planning begins. It is important to note that planning is an ongoing activity which requires constant refinement and adjustment.

## 3.2 Strategic - Tactical Planning

Strategic planning is the process of establishing corporate goals and objectives along with the plans to accomplish them, while tactical planning is the process of selecting the methods of achieving these organisational objectives.

Production inventory management personnel participate in long range and strategic planning by specifying the capacity requirements for proposed plans. However, they devote most of their time and effort to tactical decisions in the medium and short range.

Figure 3.2 below shows the production inventory management activities classified by the time horizon.

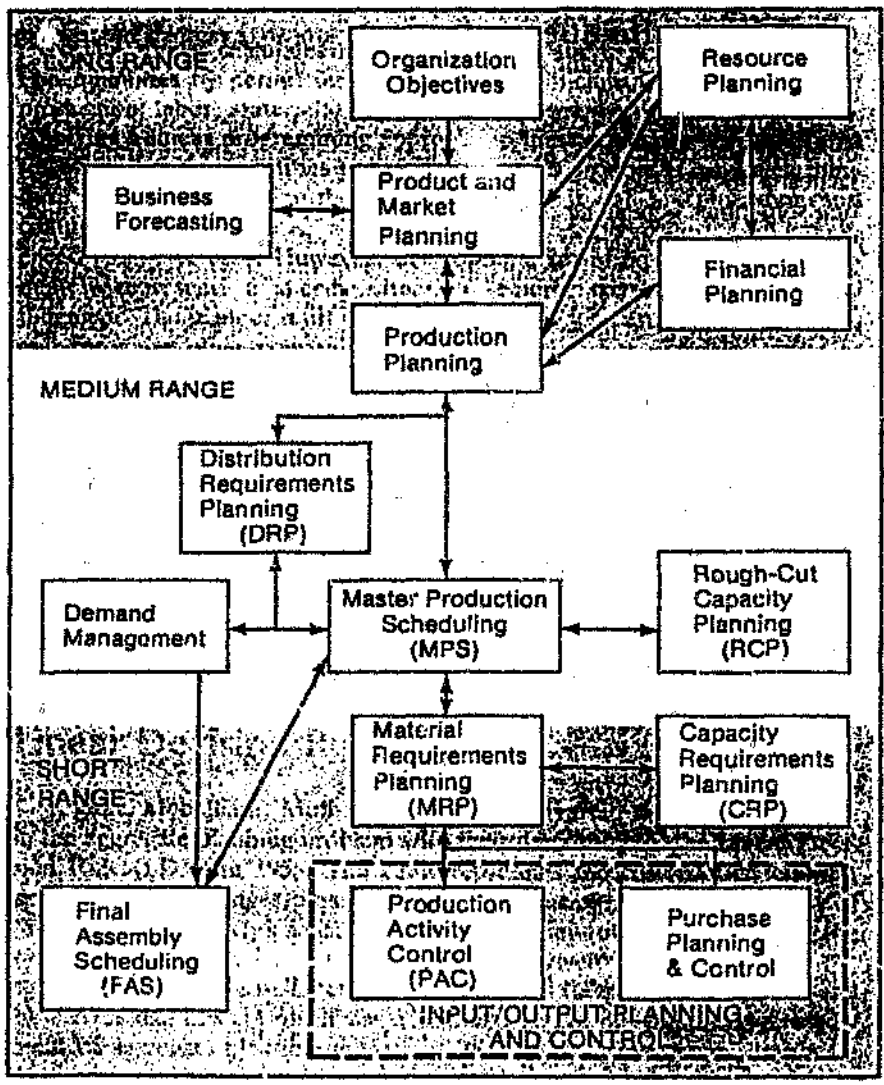


**Fig 3.2 Schematic of Planning Activities**

As can be seen from fig 3.2 all the material planning is done in the medium to short range. It is important to note that these activities frequently take place in more than one time frame. For this reason we will concentrate on the medium to short range plans.

### 3.2.1 Medium Range Planning

The medium range plan is a common intermediate step between the production plan and the master production schedule. It may be a distinct activity at a point in time six to eighteen months prior to production or it may be a refinement in the production plan that takes place gradually over a number of months. Whereas long range planning involves decisions which take a long time to implement or undo, medium range planning involves decisions usually concerning such things as employment levels, overtime budget, production rates, inventory levels and subcontracting out.

A major task faces inventory management in the medium range. Planning aggregate inventory and production levels to attain a desired level of customer service and to have the costs of carrying inventory, approach a minimum. This is called the aggregate planning problem.

### 3.2.2 The aggregate planning problem

Not only does the demand for snow blowers and lawn mowers follow a seasonal trend, but so does the demand trend for many items. Variations in the demand for consumer goods generate varying demand for the raw materials, components and supplies used in their manufacture. Coping with these variations in demand is one of the most challenging problems confronting manufacturing and inventory management. The economic consequences of planning aggregate production and inventory levels can be substantial.

Different approaches are available for obtaining solutions to the aggregate planning problem. These approaches include:

1. Trial and error methods
2. Linear programming cost minimisation
3. Linear decision rules
4. Search decision rules
5. Hierarchical planning and disaggregation
6. Goal programming

While trial and error probably is still the most commonly used method, methods 2 and 6 are gaining greater acceptance as the situations in which each works well are pinpointed.

The aggregate planning problem is complex and aggregate planning decisions have a major impact on the success of the firm. The objectives of aggregate planning support overall organisation objectives such as profit, return on investment and growth.

Aggregate planning objectives usually include the following:

- Achieving a customer service at or above a specified level
- Maintaining the inventory investment below a specified level. (This specified level will be the maximum inventory level)
- Maximising production efficiency within the constraints of customer service and inventory cost objectives
- Minimising total inventory decision related costs while achieving the desired production efficiency and customer service objectives.

## 3.3 Forecasting

Forecasting has a major role to play in planning.

"Forecasting demand is a lot like forecasting the weather. In both instances there is no such thing as a sure bet; predictions usually turn out to be in the ballpark, but occasionally they miss the mark completely. Moreover in both cases the forecasts serve as a basis for planning." **Ref 3.3**

In business, forecasts are the basis for capacity planning, budgeting, sales planning, production and inventory planning, purchasing planning and many more. Forecasts play such an important role in the whole planning process because they enable managers to anticipate the future and thereby plan accordingly. It is important to note that business forecasting consists of more than simply predicting demand.

Forecasts are also used to predict profits, costs, productivity, availability of resources and raw materials. However for the sake of this study the focus will be on forecasting demand.

Even with the aid of computers and advanced mathematical models, forecasting is not an exact science. A successful forecast requires the skilful blending of art and science. Experience, judgement and technical expertise all play a role in developing accurate forecasts. Forecasts are major inputs for many operation decisions and thus it is essential that those people preparing forecasts know exactly what kind of forecasting techniques are available. There are a wide variety of forecasting techniques available, each one being used in different situations or under different conditions. However, there are certain qualities which are common to all techniques and it is important to recognise them.

These are as follows:

- Forecasting techniques generally assume that the same underlying system that existed in the past will continue to exist in the future.
- Forecasts are rarely perfect. Actual results will usually differ from predicted values and as such allowances should be made for inaccuracies.
- Forecasts for groups of items tend to be more accurate than forecasts for individual items because forecasting errors amongst individual items tend to cancel each other out. Opportunities for grouping could arise if items or raw materials are used in more than one product.
- Forecast accuracy decreases as the time period covered by the forecast increases. The reason for this is that short term forecasts have to contend with fewer uncertainties than longer range forecasts.

There are five basic steps which should be followed in order to achieve accurate forecasts. These are:

- Determine the purpose of the forecast and when it will be needed. This will enable you to determine the level of detail required in the forecast.
- Establish the time period that the forecast must cover. Always keep in mind that accuracy decreases with time.
- Select a forecasting technique.
- Gather and analyse the appropriate data and then prepare the forecast.

- Monitor the forecast to see if it is performing in a satisfactory manner. If not revise the forecast.

There are two general approaches to forecasting. There is the qualitative and the quantitative approach. The qualitative approach consists mainly of subjective inputs which often defy precise numerical description. Qualitative techniques permit the inclusion of soft data, such as human factors, personal opinions , hunches, etc. Quantitative methods involve either the extension of historical data or the development of associative models to make a forecast. Quantitative techniques consist mainly of analysing objective or hard data. They usually avoid the personal biases that sometimes contaminate the qualitative methods.

### 3.4 Forecasting Techniques

There are numerous techniques that can be used for forecasting. We will examine three of the more commonly used techniques.

1. The naive approach
2. Moving averages
3. Exponential smoothing

1. The Naive Approach

This approach to forecasting is wonderfully simplistic. The last observation in a time period or sequence is used as the forecast for the next period. For example, if January's demand is for ten bicycles then February's forecast will be for ten bicycles. What they are basically saying here is that the immediate future is expected to be pretty much the same as the recent past.

While the naive approach may appear to be too simplistic it does have it's merits. It is very easy to understand and use, and there is little or no cost involved in preparing the forecast. The catch with the naive approach is that it only works if there is little variation in actual values from period to period.

There will be many cases where the naive approach will not work very well, however in these cases it can serve a useful purpose in providing a standard against which the alternative techniques can be measured.

2. Moving Averages

Next to the naive approach this is the simplest of all forecasting techniques. When using historical data for forecasting there is a certain amount of random variation which tends to obscure systematic movements in the data. Ideally it would be desirable to be able to completely remove any randomness from the data. Moving averages are usually used to remove most of this randomness. This will ensure that the nonrandom variations remain intact.

Averaging techniques smooth out these random fluctuations because the individual highs and lows in the data offset each other when they are combined into an average. Moving averages are continually updated by replacing the oldest values in the series by the most recent values. There are two types of moving averages; the simple moving average and the weighted moving average.

With the simple moving average the average of three periods of actual data can be calculated and this can be used as the forecast for the next period's data.

The weighted moving average differs from the simple moving average in that a simple moving average assigns an equal weight to each observation while the weighted average generally weighs the more recent observations heavier than the older ones. For a four period observation the simple moving average would assign an weigh of 0.25 to each period. The weighted moving average would weight it as follows: 0.1, 0.2, 0.3 & 0.4 with 0.4 going to the most recent observation. (note: the sum of the weights must always be equal to 1). The advantage of weighted averages over simple averages is that more emphasis is placed on the recent observations.

It is important to note that averaging techniques have two fundamental characteristics. One is that they smooth variations in the data and the other is that they do not react immediately to changing trends in the data.

3. Exponential Smoothing

This is probably the most popular method used for forecasting. Basically exponential smoothing is a form of weighted moving averages. However, it is far superior to the methods discussed in the previous section. Exponential smoothing's superiority comes from the fact that the weighting patterns can easily be altered to meet the needs of a particular situation. The fact that it has minimal data storage requirements makes exponential smoothing attractive for computerisation, especially when there are many items which you want to forecast. In contrast, for a large number of items the data storage requirements for moving average techniques can be enormous.

The name exponential smoothing is derived from the way weights are assigned to historical. The most recent values receive most of the weight and the weights fall off exponentially as the age of the data increases. Exponential smoothing is ideal for data that varies around an average.

The principles behind exponential smoothing are relatively easy to use and understand. Each new forecast will be based on the previous forecast plus a percentage of the forecasting error. The forecasting error is the difference between the forecast value and the actual value of the series at that point.

New forecast = Old forecast + K(Actual - Old forecast)

where K - smoothing constant

### 3.4.1 Choosing a Forecasting Technique

There are many different kinds of forecasting techniques available and no one technique works best in every situation. In selecting a technique for a given situation the manager or analyst must take a number of factors into consideration. The two most important factors are cost and accuracy. Generally speaking the more accurate the forecast, the higher the cost, so it

is important to weigh cost-accuracy trade offs very carefully. The best forecast is not necessarily the most accurate or least costly, but rather some combination of the two.

Other factors to take into consideration include the availability of historical data, the availability of computers, the time needed to gather the data, analyse it and prepare the forecast, as well as any prior experience with a particular technique. The forecast horizon is also important because some techniques are more suited to long range forecasts while others work best for the short range.

In some instances it may be decided to use more than one forecasting technique in order to obtain independent forecasts. If the different methods produced approximately the same predictions, that would boost the confidence in the results.

Forecasting is an integral part of planning and many companies brush it off as a waste of time and money.

## 4. PROBLEMS AT THE DISTRIBUTOR PRIOR TO IMPLEMENTATION

As was mentioned in the introduction, the Distributor was experiencing several problems in the area of Materials Management and it was as a direct result of these problems that it was decided to implement MRP and to address the lack of adequate planning.

The problems that occurred at the Distributor prior to implementation can be split into two categories:

1. general materials management problems
2. MRP associated problems

### 4.1 General Materials Management Problems

These were problems that were identified at the Distributor and which occurred as a result of poor materials management practices. These problems, if not resolved, would have an adverse effect on the MRP implementation.

There were two ways by which these problems were identified. These were:

- by doing audits and conducting interviews
- by monitoring the Distributor's key performance indicators (KPI's)

Eskom's KPI's are used to measure performance as well as the direction and trends of activities. By doing this they enable top management to see at a glance whether overall performance is focused towards Eskom's goals. The KPI's that we monitor for the MRP implementation are:

- total stockholding
- day's worth of stock
- customer service level
- stock turn ratio

**Total Stockholding**

The stock on hand is measured as it represents the magnitude of capital that is tied up in stock. The optimum amount of stock should be kept so as to keep operations running smoothly without excess inventory costs. The inventory value is presented as a bar graph showing total stock for each of the previous 12 months.

**Day's worth of Stock**

This ratio allows a comparison of materials management performance over time, as well as between Business units. The usage value for a year (value of the previous 12 months' issues) is divided by 365 to calculate the value of a day's worth of stock. This is divided into the stock value (ideally the average over the past 12 months) to determine how many days worth of stock are held.

**Customer Service Level**

Customer service level reflects the success rate achieved in delivering an item to a customer by the promised time (which is ideally the need date). The achieved service level depends, to a large extent on the investment in inventory. The higher the inventory, the better the potential service, given that the inventory mix is correct. The lower the inventory, the greater the risk of stock outs.

**Stock Turn Ratio**

This ratio basically tells you how often you turn over your stock during a year. This ratio allows you to see if any of your stock is not moving at all.

The audits were carried out at both the regional offices and at the stores. These audits and interviews were conducted to determine what problems, if any, existed in the Distributor. The KPI's would only highlight (indicate) that there are problems, but the interviews and audits would help to pinpoint the exact problems.

Problems that were identified included:

- high stockholding figures
- low stock turn ratios

- mediocre customer service
- insufficiently educated materials management staff
- stock outs on some items & surpluses on others
- lack of discipline with stores practices, such as issuing, receiving and cycle counting
- lack of adherence to materials management procedures
- no accountability at the stores for high stock levels
- LITTLE OR NO PLANNING BY THE PROJECT MANAGERS

These problems have to be addressed and sorted out before the MRP implementation is complete.

The key performance indicators will be used to benchmark the Distributor at the start of the implementation. They will be monitored on a monthly basis throughout the duration of the implementation, thus monitoring the progress.

### 4.1.1 How the problems were addressed

- High stockholding figures, low stock turn ratios and mediocre customer service levels: - these result from the lack of discipline in issuing, receiving and cycle counting. Addressing this problem will ensure that the KPI's improve. The only way of addressing this problem is through education. Another factor that could result in poor KPI's is bad planning. If the planning is not accurate, then MRP is going to reflect this. When planning is based on forecasts, it is essential that those forecasts are as accurate as possible. Inaccurate forecasts will result in bad planning which will ultimately lead to the abovementioned problems.
- Insufficiently educated materials management staff: - the only way in which this can be addressed is through education and training. The first step was to determine what the skills shortages were for each of the functions at the Distributor. The next step was to develop and schedule the training courses. One of the biggest activities with an MRP implementation (approximately 60% of the time), is education and training. The importance of this cannot be emphasised enough.
- Stock outs on some items and surpluses on others: - this can be attributed to two things; bad planning and bad materials management. Good, accurate planning is essential to the success of MRP. Thankfully the Distributor recognised the problem and made a stern effort to resolve the problem. They looked at retraining the staff as well as starting an

awareness campaign as to the importance of planning. Since a lot of the planning is based on forecasts from the Forecast & Planning system, it was essential that the users knew how to work the system properly. Once again retraining was needed. A large number of stock outs were directly attributed to poor materials management practices. It is essential to ensure that your stock levels are always up to date and accurate (95% accuracy). By doing this a great many of the stock outs could have been avoided.

- Lack of discipline with stores practices, such as issuing, receiving and cycle counting: - Stores practices and procedures are in place to ensure that the stores will be run effectively. Audits were carried out at all of the stores to ascertain where the problem areas were. Once highlighted, each problem area was addressed individually by the appropriate manager. Enforcing accountability onto the relevant people, coupled with the authority and responsibility to do the job, the performance in these areas should improve,

- The planning issue is the most urgent issue to address, since there is ongoing pressure from management to reduce stocks and increase service levels. This issue will be addressed in section 6 of this report.

By addressing each of the abovementioned problems and finding solutions to them, the chance of a successful implementation was greatly increased.

### 4.2 MRP Associated Problems

These were problems that were identified as arising due to a resistance to, or lack of understanding of materials requirements planning.

Problems that were identified included:-

- a general lack of understanding or knowledge of MRP
- a general resistance to MRP
- a lack of belief in the benefits of MRP

- a general resistance to change
- a lack of support for ASI

One of the major MRP related problems that arose even before the implementation began, was the resistance and lack of support for MRP. This resistance was encountered mainly at grass roots level, with the operational staff. However, resistance was also experienced, to a lesser extent, with middle management. A lot of the resistance and lack of support could be directly attributed to a lack of understanding of materials requirements planning. One of the things that was evident was that many of the people who were involved in the MRP project, from the Distributor's side, had little or no knowledge of MRP. This meant that we had to embark on an extensive training program even before the implementation began.

An extensive training program was developed from the project team which would provide them with the necessary training and exposure needed in order to work on the implementation. Over a one month period the whole project team underwent extensive training in MRP, as well as the Eskom ASI system. Once this was done, our attention was focused to the people who would be using this MRP system. Before any training was attempted it was felt that it was more important to try and overcome this resistance to the system, because there is no way that a system is going to be successful if the people using it do not believe in it. A series of roadshows were developed in order to inform the future users, as to what exactly was happening with the MRP project. The main aim of these roadshows was to create awareness and understanding of the project.

It was important that the roadshows were held at all the regions and districts in order to ensure that sufficient awareness was created throughout the Distributor. The effect was almost instantaneous. As soon as the people became aware of what the project entailed, and especially what the benefits would be to them, they voiced support and accepted that the implementation would be of benefit to everyone. However, there will still some "hardline" cases of people who refused to alter their standpoint on MRP.

Another of the problems was the lack of support for the ASI (American Software Incorporated) system. This is the mainframe system that Eskom presently uses to manage it's materials. This is also the system that will be running MRP.

Due to several support problems with the system, ASI's users have been losing patience with the system and as a result there was some doubt as to whether an ASI based MRP system would work. The first step to rebuild the users' confidence in ASI was to sort out the system support side of things. Better people were assigned to system support and measures were introduced so that customer complaints and enhancements could be handled swiftly and effectively. This proved to be very effective since users were no longer having to wait for a lengthy period of time to see results. The other measure was to train the users better. Many of the faults that were being registered on the system were as a direct result of incorrect user entries. The same applied to enhancements. Users were submitting enhancements in order to change the system to do things that it could already do, just the users did not know about it. Therefore the user trainer campaign was a very important part of the implementation.

These were not all the problems that were encountered during the implementation, however they were the ones that if not attended to, could result in the failure of the implementation.

Following is a list of some of the other problems that were encountered during the implementation:

- inconsistent design standards
- contractors not sticking to design standards
- hoarding of materials in the field
- Marketing overpromising
- databases full of corrupted information
- staff shortages
- use of several systems which do not talk to each other
- poor system support on the ASI side

These problems will all be covered during the course of this study.

## 5. MRP IMPLEMENTATION PLAN

Before any work could be carried out on the implementation, a detailed action plan, or implementation plan had to be developed and agreed upon between all the concerned parties, viz, Operational Support, who are the MRP specialists, and the Pretoria Distributor, who are the customers.

### 5.1 Development of MRP Implementation Plan

There are several theoretical approaches which can be followed when implementing MRP, however, there are certain areas of the implementation that are common to all the different approaches. The problem is that it is impossible to simply follow an implementation plan that is laid out in a text book and hope that the implementation will be successful in your particular environment. It is important to develop an implementation plan that will best meet the objectives of the customer. The different types of information that should appear on the action plan are as follows;

- the different activities
- the responsible people for the activities
- the start and due dates of the activities

The vital activities that have to be included in any MRP implementation plan are as follows;

- training
- integrity of data
- system set-up

The purpose of the action plan is to lay down all the activities that have to be completed to ensure that the implementation is a success. The project manager should ensure that each activity is met by the due date. It is important that once the implementation plan has been drawn up, responsible people have been assigned to the various tasks and target dates have been decided upon, all the relevant parties must agree to this plan and accept it. In this case the relevant parties were the Engineering Manager, the Materials Manager and the consultant (myself).

Once everyone was happy with the implementation plan, the implementation could begin.

(See Appendix 2 for implementation plan)

### 5.2 The Detailed Implementation Plan

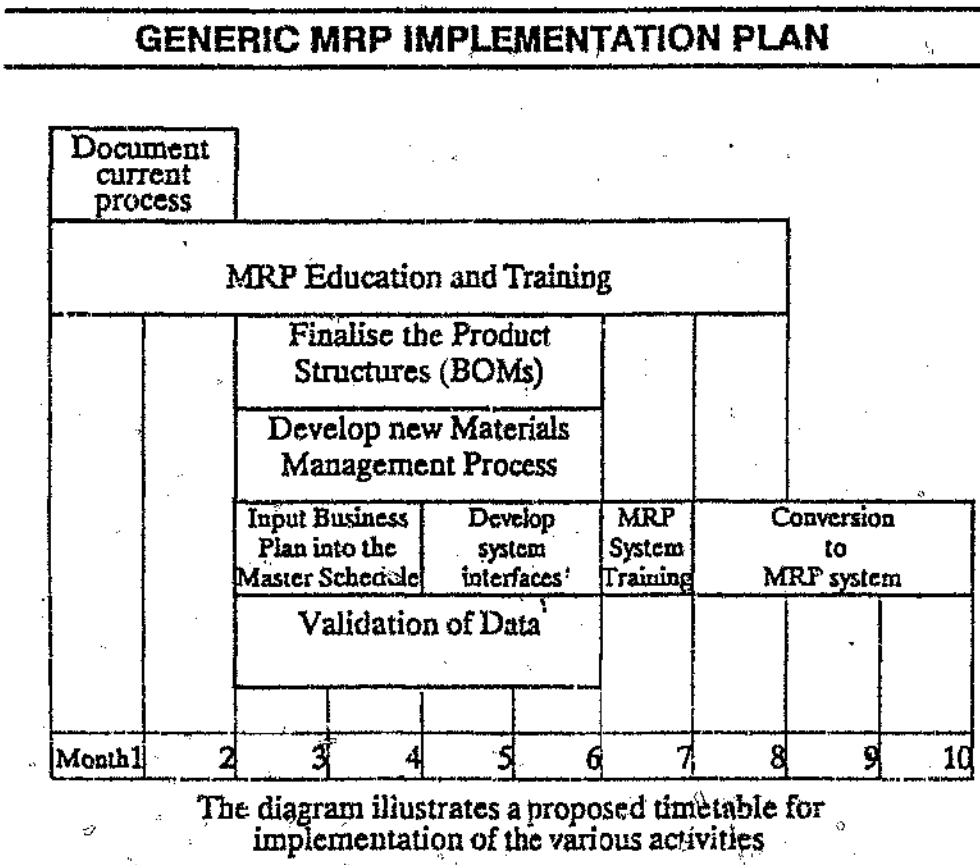


**Fig 5.1 Theoretical Implementation Plan**

## 1 Formation of a Project Team

While it is the function of the consultant to advise and monitor during the implementation, it is vital that the Distributor staff, who will be using MRP, are actively involved in the implementation. A project team should be formed consisting of high-level representatives from all the relevant line functions. These line functions include - Commercial, Engineering, Design, Marketing, Construction, Project Services as well as the consultant.

The role of the project team will be to ensure that every aspect of the implementation is addressed and completed successfully. The project team should sit every week or second week depending on necessity.

## 2 Initial Work

There is a lot of initial preparatory work that has to be done at the onset of the implementation. This consists of the following;

- audits on BOM's, buying and stores
- documentation of the current planning process
- sell presentations to design, districts and commercial

### *a. Audits on BOMs, buying and stores*

Before we can start the implementation it is important to determine the current status of the business. See how the business is operating without MRP. MRP will only be successful if the bills of material (BOMs) are 100% accurate. Inaccurate BOMs will ultimately lead to inaccurate material requests. An audit of all the electrification BOMs had to be done to ensure that product structures, lead times and usage rates are accurate. The engineering department are responsible for maintenance of the BOMs and they have a design standard specifying the Eskom specified design standards for the BOMs. All projects have to be designed according to these design standards. All the bills of material in the design standards must be audited. It is important to include the contractors and project engineers in this audit since they are the people who are using the material to build the lines, therefore they will know if the current BOMs are up to scratch or if they need to be amended.

The buying process is an integral part of the MRP process. The placing of purchase orders and expediting according to the Master Schedule are key functions in

ensuring the success of MRP. As with the BOM audit, the current buying and expediting processes should be audited and documented.

The stores play an integral role in MRP and as such the stores audit should be done thoroughly. The computer system used at the Distributor to manage their materials, prior to MRP, reflects certain information about the stock items in the store. It is important to do a store audit to determine the accuracy of this stores data, since 100 % data integrity is essential for MRP success.
The following information is captured for each stock item;

- the NSN - national stock number
- inventory on hand
- location in the store
- UMC - unit of measure
- purchase lead time

Theory dictates that this information should be 95% accurate for MRP to be a success. The findings of the audit must be documented and if this 95% accuracy is not achieved, action plans must be put in place to achieved the desired accuracy.

With both the BOMs accuracy and the stores accuracy it is important to set target dates by which these accuracy's have to be achieved, or else the implementation will be halted until such time that they are achieved. (in our case these target dates were one month prior to the "go live" date) Setting these target dates is important since they force the project team to achieve and maintain these data accuracy's.

*b. Document the Current Planning Process*

As was mentioned in the literature survey, accurate planning up front can be the difference between a success story or a failure as far as MRP is concerned. All the other requirements can be in place but if there is no planning up front, MRP will fail. The current planning process should be documented as it is almost certain that it will have to be altered to accommodate MRP.

*c. Sell presentations to design, districts and commercial*

Many of the people doing the design, construction, planning and commercial functions for Electrification are unaware of what MRP is, what impact it will have on the business and what is required to make it work. A presentation should be put together to convey this information to the above mentioned people. Once the presentation is compiled, everyone who will be affected by MRP should be present. It is vital to include everyone who will be working with MRP, in the implementation from the start. A MRP implementation should not be handled as a Turnkey project. It is the users system and they should be involved.

## 3 Education and Training

As was mentioned in the literature survey, 50% of the time and money spent on the implementation should be spent on education and training. Two types of training are needed. These consist of theoretical MRP training and system based training. The MRP project team and user group should undergo this training early on in the implementation. The user group should consist of the most important users' of the system, such as the master scheduler, the demand scheduler, inventory optimisers and stores processors.

*a. Theoretical MRP Training*

Most of the users of this system are unfamiliar with the principles of MRP. It is important that these basic principles be conveyed to all the people who will be working with MRP. The project team and user group should be trained early on in the implementation so that they can become familiar with the philosophies of MRP as well as become familiar with the system. The other users can go through this training just prior to going live. It is important that all the various functions involved in running MRP attend the same initial training. The reason for this is that these different functions will be working together to make MRP a success once it is implemented therefore if they all attend the training they can highlight and discuss any potential problems.

*b. MRP System Training*

MRP is a computer based system and it is important that everyone using this system knows how it works. Two types of system training are suggested; a system overview and detailed system training.

A general MRP system overview will be given to the project team and user group quite early in the implementation. This will give the users insight into how the MRP system will integrate with the current systems being used.

A more detailed training session will be held just prior to going live. Each user will be given detailed training in his/her specific function. This is done late in the implementation to ensure that it is still clear in their minds when they switch over to MRP. a training data base will be made available to the users so that they can "play" on the system while they train. This is a good way to get to know the system. A refresher training session will be given a week prior to going live for anyone who needs it.

User manuals are provided by ASI (ASI is the system that Eskom uses to manage its inventory.)

**4 Finalise Organogram, Project Management Process & MRP Process**

Implementing MRP does not simply involve taking the current processes and applying some software to them. It involves reviewing the current processes for planning, scheduling and issuing material. The MRP process for these functions must be finalised, documented and distributed to the relevant parties. This distribution of the processes will take place via a roadshow. Each of the different functions will be shown how MRP will affect them and what changes will be necessary to make MRP work.

It is important to decide on how many people are needed to run MRP successfully and what their functions should be. This must be drawn up by the consultant in conjunction with the Materials Manager, the Engineering Manager and the Commercial Manager. If new people are needed they should be appointed as soon as possible. Job descriptions should be drawn up for every person who is working with MRP.

## 5 Decide on Plant Material Types and Implement

In Eskom there are different types of material that are used for different categories of work, i.e. reticulation material, construction material, maintenance material, etc. A material type has to be decided on for all electrification projects that are going to be run through MRP. Only MRP material will be assigned this material type. It is important to decide on this material type fairly on in the implementation since all the material that is currently being used for electrification will have to be transferred from it's current material type to the new one. This will be done during the material type conversion. Eskom Corporate Commercial decides on the material types that should be used throughout Eskom. It was decided that all MRP material will be assigned a material type of MF. Prior to MRP all electrification material was assigned a material type of SS.

## 6 Collect Security Information for BUC

The Business Unit Controller (BUC) is responsible for loading people onto the network and assigning them profiles. In order to restrict the number of people that have access onto the system, each user will be assigned profiles that are linked to the function he/she is performing. Each function will have a separate profile. It is important to identify what profiles each person should have and to supply this information to the BUC, who will then load them with their relevant profiles. Audit reports can be run to determine who has what profile.

## 7 Compilation & Distribution of new Policies & Procedures

The existing policies and procedures for the handling of electrification material did not make provision for MRP. These policies and procedures basically dictate how the electrification projects should be handled from the planning phase, right through to the issuing of the material. These policies and procedures have to be revised to accommodate MRP. It is the responsibility of the project team to compile these new procedures in accordance with the Business Unit's objectives.

Once the new policies and procedures have been compiled they must be distributed to all the users, so that they can see how MRP is going to impact on the way things are currently being done.

## 8 Implement Manual Planning Process

As has been mentioned before, planning is the key to a successful implementation. The planning process that was being used prior to MRP was considered not to be a success from the Inventory Management point of view. One of the action plans was to investigate the current planning process and revise it so that the up front planning was accurate. The planning process has to ensure that the material requirements for all the projects are known to the inventory department at least 6 weeks prior to the need date. We work on 6 weeks since this is the average purchase lead time for the stock items. This manual planning process must be implemented at least 2 months prior to going live so that the project managers can become familiar with it by the time they switch over to MRP.

A detailed investigation into the planning process can be found in section 7.

## 9 Implement Engineering Change (ECN) Process

As was mentioned earlier, 100% data integrity is essential to MRP success. One of the areas that can effect this data accuracy is engineering changes. An engineering change will occur when a stock number for a stock item changes, or a bill of material changes. It is important to have strict control over these changes. Normally it is the design engineers that request the changes to be made. They will inform the inventory people who will in turn inform the project managers and contractors. However, if this is not enforced then it will not happen. The easiest way of enforcing this is through the formation of an Engineering Change Committee, consisting of representatives from all the areas affected by an engineering change (viz, design, inventory, project management and construction). The current engineering change procedures must be revised to accommodate the Engineering Change Committee. All engineering changes must be submitted to the Engineering Change Committee for approval before they can be implemented. This will help to maintain 100% data integrity.

## 10 Identify Planning Parameters

Certain planning parameters such as safety stock, order quantities and lead times have to be decided upon for every item.

The chances are good that all this information already exists for all the stock items, however it must be revised at regular intervals. The buyers and the master scheduler are responsible for revising this information.

### 11 Instruct IT (information technology) to set up Data Base

The Information Technology department is responsible for setting up the MRP data base on the mainframe. They need approximately one month to set up the software and test it before going live.

### 12 Check BMS/ASI interface is in place

One of the main problems that is experienced in Eskom regarding systems, is that there are a number of systems being operated that do not talk to each other. The Project managers input their requirements for MRP onto the Business Management System. (BMS) This information must then be downloaded into the MRP system which is loaded on the ASI system. (Section 6 gives a detailed look at the systems used to run MRP) A major problem was discovered. The BMS system could not talk to the ASI system, therefore all the requirements would have to be loaded manually. This was unacceptable therefore the Information Technology department was commissioned to design an interface between BMS and ASI to facilitate the downloading of demand. A requirement for "going live" is that the interface must be tested and in production by the "go live" date, or else the switch over would be postponed.

### 13 Conversion and Test

During this phase of the implementation the database has to be populated with data. All the stock items and parent items have to be loaded together with the Bills of Material and planning parameters. The consultant should advise the users on how to populate the database, but it is the users themselves that should do the actual population. Since data integrity is essential to MRP success a check should be done after the population is complete to ensure that the data has been loaded correctly.

Once this has been done, the projects can be loaded onto the system and they can convert from their manual system to MRP.

### 14 Sign Off (final audit)

Once the system is live the consultant will have to spend a couple of days at the business unit to help sort out any teething problems. When both parties are satisfied that the objectives of the implementation have been achieved and that the system is working well, the project can be signed off.

The above implementation plan is specifically designed for the implementation of MRP in Eskom's Pretoria distributor and is by no means a generic MRP implementation plan. Only by following the theoretical framework while doing the actual implementation will we be able to highlight any deviations or problem areas that are not catered for in the implementation plan.

## 6. THE ACTUAL IMPLEMENTATION (PRACTICAL)

The theoretical implementation plan is very thorough and detailed. However, there is a good chance that the practical implementation may not go according to plan. By this we mean that there will always be deviations from the action plan due to some unforeseen circumstances. For this reason it is important to document the progress at every stage of the practical implementation. It is important to highlight those areas that deviated from the theoretical plan and to explain why they deviated. This will enable the consultant to revise the action plan accordingly for the implementation at the next site.

### 6.1 Overview of Systems used to Manage Projects and Inventory

Each company has their own unique computer systems which they use to help them run their business. These may be big mainframe systems or smaller PC based systems. Eskom are using a mainframe system called ASI (American Software Incorporated). ASI does have an MRP module which Eskom purchased a few years ago when they purchased ASI. In any implementation software selection plays an important role, however in our case the software to be used has been predetermined. Eskom does not use ASI on it's own, they also have a mainframe based system called BMS (Business Management System), which they use for the costing and scheduling of projects. This was one of the big problem areas of the implementation.

To allow the two systems to be able to communicate with each other the project team specified an interface which the Information Technology department had to have in place by "go live" date. This interface would allow for the download of data from BMS to ASI.

The systems used by Distribution to manage their electrification projects are as follows;

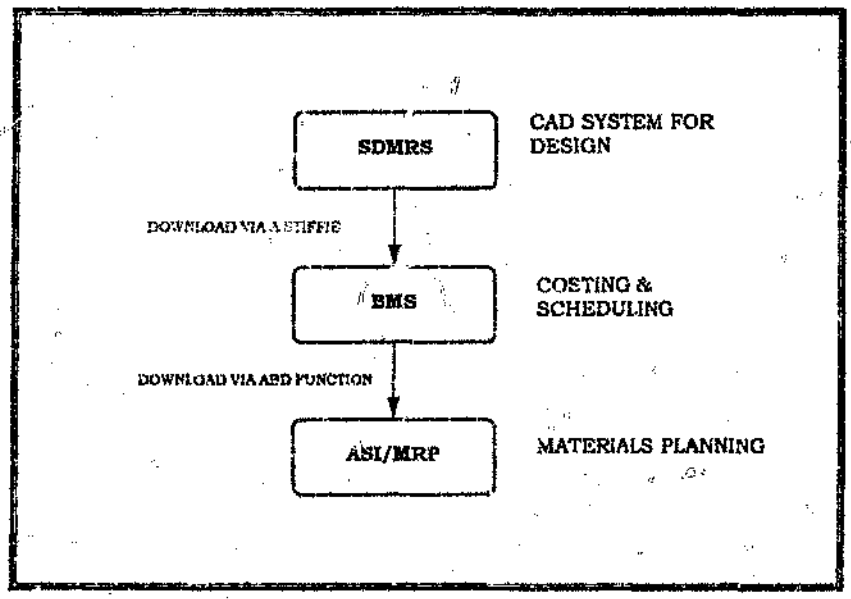


**Fig 6.1 Current Systems used in Distribution**

Each of the three systems performs a different function.

1. *SDMRS*

SDMRS stands for the Standard Design & Materials Requirements System. SDMRS is a CAD system which is used by the contractors and project engineers to do the designs for their projects.

It contains all the standard bills of materials that are used in electrification. These BOMs are the building blocks of the projects.

The project engineers receive an overhead photograph of the town or area that has to be electrified. They scan this into the computer, and then using the CAD function they apply the building blocks of the project as and when they are needed.

The system then consolidates all the requirements, in terms of BOMs, for that particular project and this is sent to a file on a stiffie.

2. *BMS (Business Management System)*

The file from SDMRS is downloaded onto BMS. The BOMs are exploded into the material requirements. The costing and scheduling of the project are done at this stage with BMS. The labour and transport requirements are added to the project in BMS. The material requirements are then downloaded, in the form of BOMs, to ASI, via the download that was written by the IT department.

3. *ASI (American Software Inc.)*

The ASI system is used by Eskom to manage their dependent and independent demand items. It is a modular system, with different modules for different functions. The Base Systems and Planning modules are used to manage the independent demand items. Prior to MRP the Base Systems were used to manage dependent demand items as well. The purchasing and stores functions can be found on the Base Systems.

The MRP module was specifically designed by ASI to manage dependent demand type items and while it is a separate module it is also fully integrated with the Base Systems, utilising some of it's functions.

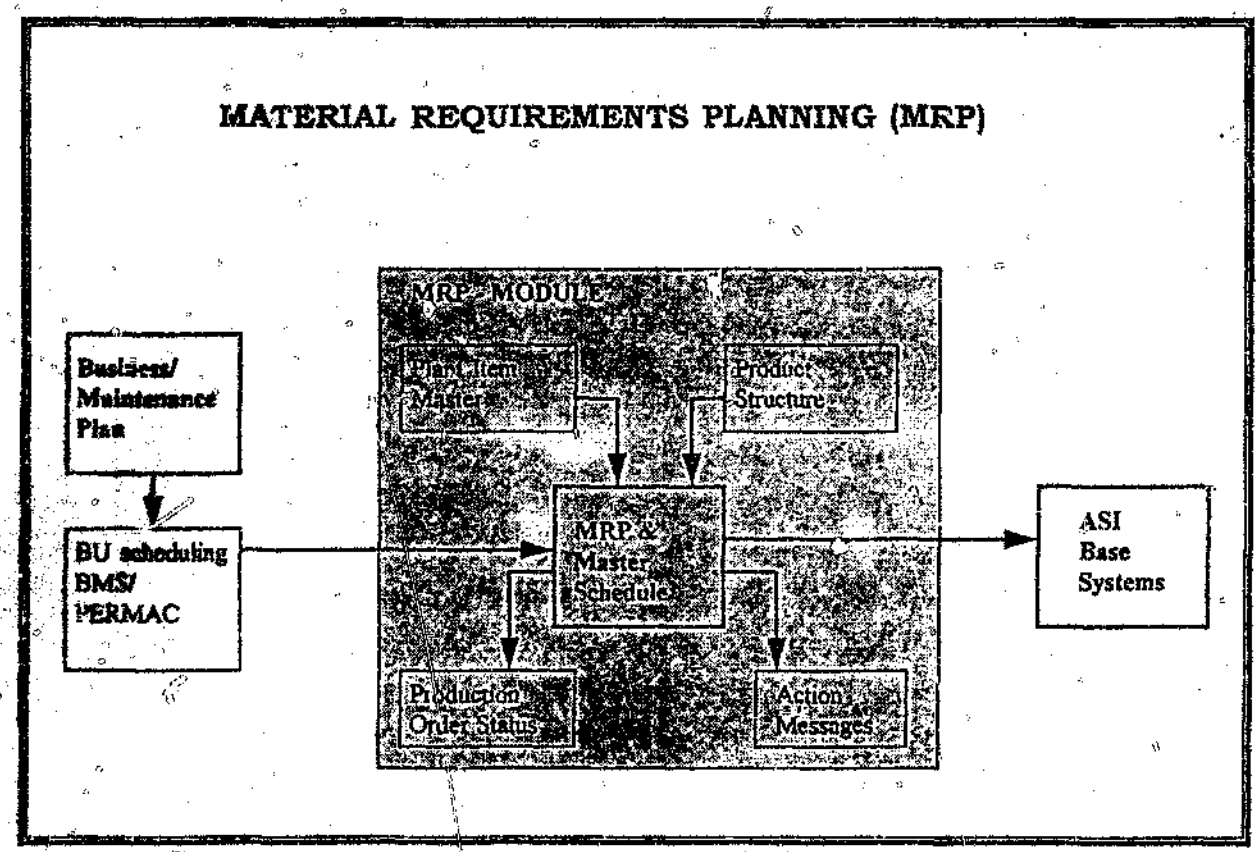


**Fig 6.2 An Overview of ASI MRP**

The main systems utilised within the MRP module are;

- Plant Item Master

  The plant item master holds all the static inventory management information (lead times, lot size techniques, item definition, scheduling methods, safety stock data, etc) required by the MRP process.

- Product Structure

  This contains the bills of materials (BOMs) for all the dependent demand items and defines the relationship between the parent items and their components items.

- Production Order Status

  The Master Scheduler will use this function to load the business/maintenance plan into the master schedule. Routine activities of issues, additions, changes and deletions of production orders are facilitated here.

- Master Schedule and Material Requirements Planning

The master schedule system drives the MRP run, ensuring that demand will be met with the supply of component items from the purchasing and stores functions in base systems.

As can be seen from the above many potential problems could arise with having three systems to manage your projects. The ideal would be to have one fully integrated system that does not need customised interfaces to communicate.

### 6.2 The Planning Process

The planning process is vital to the success of MRP. In order for the contractors to be able to make their connections they need material. The project managers have to plan for this material well in advance of the project start date because of lead times. During the planning of projects, certain approvals have to be obtained before proceeding. An example of this is the Form 150 approval. This approval has to be obtained for the project before any material can be bought. The Distributor formalised their planning process for electrification projects in order to ensure that all the planning is carried out in a similar manner. There are six project managers planning and managing electrification projects. If each was allowed to do their own thing, then chaos would reign.

### 6.2.1 Planning Process Prior to MRP

In order to determine how effective the planning was prior to MRP, the planning process had to evaluated and it had to be determined whether this process was being adhered to.

The easiest method of determining if there are any problems with the current planning process was to document it. The Project Services department made it quite clear that there was a formalised planning process in place and that the project managers were adhering to it. However upon investigation it became apparent that this formal process was nowhere to be seen.

In the absence of a planning process it was decided in order to get an accurate picture of how projects were being planned, the six project managers and their staff should be interviewed separately and the current planning process should be documented. A standard set of questions were developed as a basis from which the process could be documented. (see Appendix 3 for questionnaire) This investigation revealed that although their was no formal process in place, all the project managers were planning and managing their projects in a similar manner. Therefore it was not too difficult to document the planning process. A copy of this process can be found in Appendix 4.

The electrification project process consists of 6 phases;

- Research and evaluation phase
- Negotiation phase
- Preparation phase
- Construction phase
- Energising
- Normal business phase

The general feeling was that the planning, in whatever shape or form, was abysmal. Project managers were inflating their materials requirements and stockpiling the excess material for "emergency jobs". There was no monitoring of planning and since the Inventory Management department was ultimately responsible for the material, the project managers did not put as much effort into planning as they should.

Section 7 will provide an in depth look into the problems associated with the planning of electrification projects, and how these problems were overcome.

### 6.3 Education and Training

All the members of the project team and user group attended the theoretical and system training, which was held at the beginning of the implementation. Their one concern was that the theoretical training course was to manufacturing focused, and we are a service organisation. It was felt that the people who will be doing the work will not be able to associate with some of the aspects of the training because it is not customised to Eskom's environment. Whilst this may be true it is difficult to find any theoretical training on MRP that is tailored for the service industry. Certain areas of the training were revised to accommodate Eskom's unique scenario.

The training that was held just prior to going live for the users of the system was not as successful. Many of the people who were assigned to MRP did not turn up to the training sessions. Various excuses were forthcoming. The Distributor management was approached and it was made very clear that if the people who requested the system do not want to attend the training, there is no point in holding the training sessions or even continuing with the implementation. Needless to say everybody turned up for the next session.

The detailed system training that the main users, viz the master scheduler, demand scheduler and inventory optimisers, attended a week prior to "go live" was a success. There were fears that they would not be able to come to terms with the system in one week, however this was not the case.

All in all it was felt that the system training was more than adequate, but the theoretical training is not.

### 6.4 Audit Findings

#### 6.4.1 Initial Audits

Initial audits were carried out on the main stores in the Distributor, focusing on the following information;

- stock accuracy ;
    - quantities
    - units of measure
    - description
    - location
- housekeeping
- security

The audits were done with i... t that 95% stock accuracy is essential for MRP success, in mind. The findings of the initial audits were not encouraging. Of the three stores audited, only one of them was close to the desired level of accuracy. The other two stores had accuracy's in the sixties.

The main problems encountered at the stores during the audits were linked to stock accuracy. There were several ... pancies between the quantity of inventory indicated on the system and wh... s actually in the store. Bin locations were also a problem. All the stock items are assigned a bin location on the system. This location prints on the picking list to indicate to the picker here the item is located. Many of the locations on the system did not correspond to the location of the items in the store.

In general the security and housekeeping at the stores was acceptable.

### 6.4.2 Action Plans

Since the findings of the audits did not comply with the minimum requirements for MRP, certain action plans had to be introduced to ensure that the stores would be ready by the implementation date. These action plans included;

- Conducting a wall to wall audit on the electrification material in the two stores that had low accuracy's. In contrast to the initial audit, every item is audited during the wall to wall audit. Every discrepancy must be resolved by reconciling issues and ...ipts.

- Review the locations of the item... on the system, updating where necessary. These items that are housed in ...s with no locations, (temporary bins) must be assigned a location and this must be entered onto the system.

### 6.4.3 Follow-up Audits

Follow-up audits were conducted just prior to the "go live" date to ensure that the action measures that were introduced were effective. The results of these audits were greatly improved since the previous audits. It is important to note that none of the stores achieved the desired 95% accuracy level even though there was a great improvement. The accuracy's of the stores were in the upper eighties.

## 6.5 MRP Process

The policies and procedures were drawn up in accordance to the implementation plan. All in all, nine policies were drawn up for the handling of electrification projects, ranging from the creation of the initial BOM, in response to a customer request, up till the material is issued and the completed order is removed from the system. A flow chart was put together to illustrate the flow of work in the MRP process. It also indicates which policies govern the different areas of work. This flowchart can be found in Appendix 6.

The compiling of the policies and procedures went according to plan, however here were problems with their distribution. The key role players in MRP did not receive copies even though they were instrumental in the development. This problem was addressed.

## 6.6 The Engineering Change (ECN) Process

The Engineering Change Committee was established prior to going live. All the required representatives were present on the committee. There were a great number of problems with stock numbers that had to be addressed by the ECN committee before MRP could be switched on. The ECN committee proved to be very effective in reducing the number of stock number discrepancies that occurred with the planning and managing of the electrification projects. All design and material changes had to be submitted to the committee for approval before they could be implemented. Prior to this anyone and everyone were making changes on the system, thereby creating havoc with the design standards.

The one problem that did arise with the Engineering Change Committee was with the communication of the changes to the contractors and project engineers in the field. While each contractor and project manager should be working from the design standards, situations arise where they need extra material that is not linked to a bill of material. They normally have their own list of stock numbers, which in most cases is outdated, which they use when planning their material requirements. A suggestion was put forward that all the project managers be notified of any impending changes by the Engineering Change Committee.

The project managers then have 2 weeks to inform all the contractors before the change is made on the system. This should give the contractors ample time to update their standards before the change is introduced.

### 6.7 Conversion and Test

The testing of the system went off without too many problems. A comprehensive set of tests was developed for the testing. There were one or two reports that would not run, but apart from that, everything else ran smoothly. The Information Technology department was requested to fix those reports that would not run.

The conversion from the old system to MRP proved to be quite troublesome. The major problem areas were the stock numbers and the format of the projects that were loaded onto the system. Many of the bills of materials found in the design standards had items linked to them that were not loaded in the plant item master. The reason for this was that the Design Technology department had made design changes to the BOMs and they had not bothered to inform anyone. Both the design section and inventory management had to go through every single bill of material to determine if any changes had been made, and if so, they had to load the new items onto the plant item master and product structure on the ASI system. This was a long a painstaking task which could have been avoided if the design section had bothered to communicate their changes. This is why the formation of the Engineering Change Committee was essential.

The other problem experienced had to do with the format of the projects that were being loaded onto the system. Many of the project managers were not using the standard bills of materials when planning their projects.

They were still using the old method of sending their material requirements through in terms of component items. The demand scheduler then had to convert this demand into the bills of materials. This was causing more work so the project managers were called into the planning meeting and they had to agree to co- operate and plan accordingly, since everybody had bought in to MRP from the start. The situation improved remarkably since then.

### 6.8 Go Live

As with any system implementation, teething problems were experienced once the MRP system was live and being used to manage projects. These were mainly due to the fact that the master scheduler and his staff were still learning the system. Thankfully the "go live" date was during a quiet period of the year, so there were not too many projects that were due during the first two weeks of MRP operation after implementation. This provided a bit more time to become familiar with the system. Being the consultant on the project I had to stay on for a period of 10 days to help them to iron out the teething problems.

### 6.9 Post Implementation Evaluation

A post implementation evaluation was carried out to determine how well things were running. The main findings of the evaluation were;

- MRP is helping inventory management to manage the high volume of electrification projects currently underway in the Pretoria Distributor.

- The political instability in some of the townships designated to be electrified, is resulting in a very unstable master schedule. The master scheduler's job is becoming more and more important due to the number of projects that have to be constantly rescheduled.

- Strikes over the election period by many of the Distributor's suppliers forced them to increase their safety stocks on many items, therefore there was no marked reduction in inventory levels.

## 7. MRP PLANNING PROCESS

The one complaint that was forthcoming throughout the whole implementation was "*MRP will not work in Eskom because nobody plans.*" The investigation into the planning process prior to MRP confirmed this concern.

### 7.1 Problems associated with Planning

Several problems were identified with the planning of projects.

These include;

- There are two project managers who share a store for their electrification material. The base systems does not allow a project manager to prioritise his projects. It issues according to material availability and due date. This causes countless problems. The scenario exists where one project manager plans for his projects well in advance of the due date and he ensures that his material is in the store. The other project manager is suddenly faced with an "emergency job" and he sees on the system that there is sufficient material in the store, even though this material is meant for another job. He inputs his job with a need date just prior to the other project currently on the system. The system will allow him to issue this material since his project is due before the other. This is a big problem because the system cannot track who initially ordered the material therefore they are both accusing one another.

This problem was solved with the introduction of MRP. The system is designed to allocate material to particular projects when they are firmed up. No one else can draw that material once it has been allocated.

- The number of additional projects that were being put through the system was a concern. Even with the most accurate planning there will be occasions where extra or additional material will be needed but not on the scale that was being experienced at the Distributor. The number of additional projects were at one stage outnumbering the number of planned projects. The problem with the additional projects is that more often than not they were being submitted just prior to the need date, and therefore there was insufficient time to obtain the material for these projects.

Due to the increased pressure to reduce inventory levels, the safety stock levels were set to the bare minimum and they could not accommodate the increase in additional projects. In order to overcome this problem the project managers started inflating their materials requirements on their planned projects and using this excess material to supply the additional projects. All this does is increase the inventory levels and does nothing to ensure better planning.

- Another problem was the high number of projects that were planned and submitted and cancelled just prior to need date or they simply were just never built. No one was questioning why these projects were suddenly cancelled when all the material had already been bought. Nobody was checking the planned projects against the completed projects. They would have gotten a nasty shock. Since the project managers do not have to account for high inventory levels they do not care about more accurate planning.

- Nobody was doing an "as built" audit on the projects. Many of the projects that were being submitted were not designed or built according to the standards.

- The Form 150 approval was another problem area. Project services could not submit the BOM for the project to inventory management before the Form 150 was approved. This generally happened two to three weeks prior to the start date of the project. With the average lead time of materials being 6 weeks this causes a problem.

- Inventory management and project services are both chasing different KPIs (key performance indicators). Project services have to ensure that they do a certain number of connections during the year. They are not concerned with inventory levels and service levels, they just require the material to be their when they need it. Inventory management on the other hand are under constant pressure to reduce inventory levels and increase service levels. This is not easy when project services are planning badly, and the RDP ensured that their targeted number of connections has shot up.

There are a number of problems associated with the planning of electrification projects that had to be sorted out, regardless of MRP. However, if they were not sorted out, there is no way that MRP would be a success.

### 7.2 Electrification Planning Process for MRP

Several measures were introduced to ensure that the planning of projects was drastically improved.

The main issues that had to be addressed were;

- developing bills of materials per project
- Form 150 approval
- loading of firm planned orders
- monitoring of requested material vs. issued material
- revision of KPIs

Prior to MRP there was no forum where the inventory department and project services could meet and discuss projects. They were two enemies sitting on opposite sides of the wall. A MRP planning meeting was introduced just prior to going live. The Master Scheduler, project managers and stores people had to attend this meeting. The purpose of this meeting was to report on the progress of the projects that were loaded onto the system. In this environment the project managers usually had to make compromises on one project to ensure that other projects came off. This was the forum for making those compromises. The Master Scheduler would give feedback on any potential problems with material and make suggestions. Traditionally one project manager would not compromise one of his projects to help another project manager. This meeting was held once a week and after the second meeting there was a marked improvement in co-operation between the Project services and inventory management. Both parties realised that with the added pressure being place on them they had to work together to meet their targets.

The development of standard bills of materials was important to accurate planning. While standard BOMs were developed prior to MRP, they had not been distributed to the people in the field who were doing the planning. Two measures were introduced.

The design section undertook to go on a roadshow to all the planners and distribute the new standards. Every project that was entered onto the system was downloaded to ASI by the Demand Scheduler. However, before the projects were downloaded they were checked to ensure that the new standards were being used. If not they were sent back until they were planned properly according to the BOMs. At first this created an uproar, but it did enforce that everyone started to use the new standards. Another outcome of this was that there was a lot of material in the stores that was not included on the standards. This material was now redundant and could be disposed of, thus marginally reducing inventory levels.

The Form 150 approval is still a problem. A suggestion was made that Inventory management should be allowed to purchase on the initial BOM for the project, and not have to wait for the Form 150 approval. There was strong opposition to this. However the project managers have been pushing for quicker Form 150 approval and up to now they have been successful.

One of the requirements of planning a project on MRP is that a firm planned order has to be loaded onto the system for each project. Each order has a unique order number. Once the project manager is certain that the project is going to come of, the order is released (status is changed from 1 to 3). When this happens the material linked to that particular project becomes allocated to that project and no one else can take it without going through the project manager and master scheduler. This solves the problem that the project managers had with the base systems where material destined for one project was being taken by someone else.

In order to try and combat poor planning a measure was introduced whereby the demand scheduler will be responsible for monitoring the projects that are loaded onto the system against those that are issued. Where there are large discrepancies the project manager must account for why the project was cancelled or delayed. On the other hand, in those cases where the project has been planned and the material is not available on the need date, then the master scheduler will have to account as to why.

Another measure that has not yet been introduced, but which is being pursued is that of accountability for material. As long as both the inventory management and project services are being measured against different KPIs, and only one of them is responsible for inventory levels, it is felt that problems will continue to arise. By making the project managers also accountable for inventory levels, this will force them to plan properly. Management, however do not share this opinion.

The additions to the planning process can be seen in Appendix 5.

### 7.3 Planning and MRP

Many of the staff see these as drastic measures, however given the situation prior to MRP the introduction of these steps was warranted. There has been a marked improvement in the co-operation between the project services department, including the project managers, and inventory management. Fewer additional projects are being submitted and the majority of the planned projects are being planned and built according to the design standards.

There are still a few problem areas that need to be continuously addressed, however, as long as the planning continues to improve with the measures that were introduced, it should not have any negative affect on the successful operation of MRP.

The only concern is that of the weekly planning meeting. It is important that all the interested parties be present at every meeting and that they discuss MRP related projects. What has been happening is that they have used the two hours a week to moan about other matters and have not been dealing with what they should have been.

# 8. CONCLUSIONS AND RECOMMENDATIONS

## 8.1 Summary And Conclusions

Although the system appeared to be working successfully during the period of the post implementation evaluation a few areas were highlighted that could develop into problems if not monitored. These are:

- The use of non-standard materials and NSNs (national stock numbers). The engineering change committee has been very effective in stamping out the use of both non-standard material and NSNs, however if for some reason the ECN committee is dissolved or fails to continue to monitor the projects that are loaded onto the system, this problem could arise again. The contractors out in the field knows what items he wants but he does not always take the time to check for the latest or most recently updated NSN. He simply uses the first stock number he can find.

- The importance of the planning meeting cannot be emphasised enough. Indications from some of the meetings, attended by the consultant, tend to suggest that the focus of this meeting can easily be changed from a planning meeting for electrification projects, to a "free for all" session where they moan about every single problem that they are experiencing from quality to Industrial relations problems. This must not happen. The objective of this meeting is to look at all current electrification projects, to highlight possible problems and to provide solutions to them.

To summarise, the environment at the Pretoria Distributor is not ideally suited to MRP, however since it's implementation, there has been a noticeable decrease in the number of problems being encountered by materials management.

This may not be directly attributed to the MRP system, but more to the preparation work that had to be done before the implementation could be a success.

Several conclusions can be made from this study. These are;

- The problems experienced at the Distributor, concerning materials management, did not arise due to the absence of MRP, and therefore the implementation of MRP was not the only answer to the problems. A lot of preparatory work had to be done before MRP could be implemented. It was this preparatory work, which consisted of system clean ups, training and process improvements, which solved many of the problems. MRP was simply a tool which was implemented to help the Distributor in managing their electrification projects.
- The planning function is vital to the success of MRP. If the planning that is done up front is inaccurate, then according to the old saying "garbage in, garbage out", the outputs from MRP will not count for much. The planning at the Distributor at the start of the project was virtually non existent, but as the implementation progressed it slowly improved.
- The nature of the Distributor's business (electrification) is such that it is governed by many external factors, - viz political instability and unrest, the changing electricity supply industry, etc, - which make it very difficult to maintain a stable master schedule. This proved to be quite a problem since one of the requirements of MRP is a stable master schedule. The result of this was that the planning meeting became even more important.
- The increase in volume of connections that had to be completed during this year and next year, forced the Distributor to make a change, since there was no possible way that they could handle the increase in volume with the current systems. MRP was the logical answer. This point was proved once they started using it.

## 8.2 Recommendations

- The staff turnover at the Distributor can become a problem. At present they are running very lean in terms of resources due to a number of internal problems. If one of the key people leave, such as the Master Scheduler, there is no one available to replace him at present. They should look at training backup people for all the key functions in MRP, since it will take a lot a time and effort to train someone from scratch.

- MRP is not the answer to all their problems, but it is merely a tool to help them to manage and control their projects. They should keep on monitoring their planning functions and design standards to ensure that the problems do not re-occur. The easiest way to do this is to keep having the planning meetings and running the audit reports that MRP offers, to evaluate it's effectiveness.

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# APPENDICES

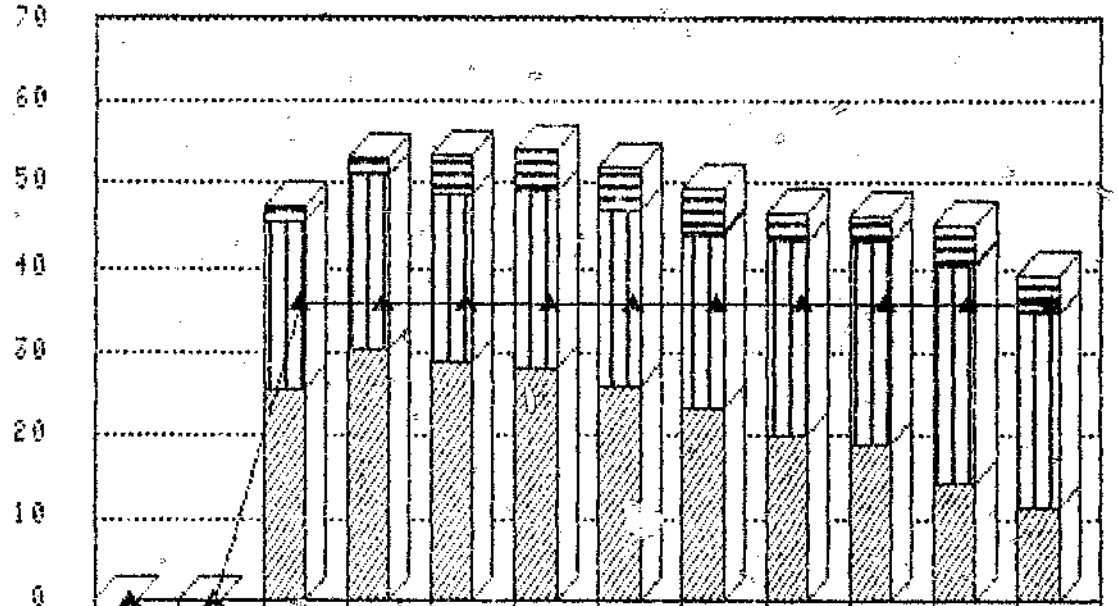
## APPENDIX 1

## KEY PERFORMANCE INDICATORS USED TO MEASURE PERFORMANCE

# MATERIALS MANAGEMENT

## TOTAL STOCK VALUE - WUC

Millions




| | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Elec | 0.0 | 0.0 | 25.0 | 30.5 | 28.9 | 28.3 | 26.2 | 23.4 | 20.2 | 19.1 | 14.3 | 11.3 | |
| Retic | 0.0 | 0.0 | 19.4 | 20.5 | 19.8 | 20.8 | 20.8 | 20.7 | 23.1 | 24.1 | 26.2 | 23.6 | TOTAL |
| Project | 0.0 | 0.0 | 2.2 | 2.1 | 4.8 | 5.0 | 5.0 | 5.2 | 3.3 | 2.8 | 4.4 | 4.4 | 39.5 |
| Target | 0.0 | 0.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | |

Comments : ☒ Elec ▥ Retic ▤ Project + Target

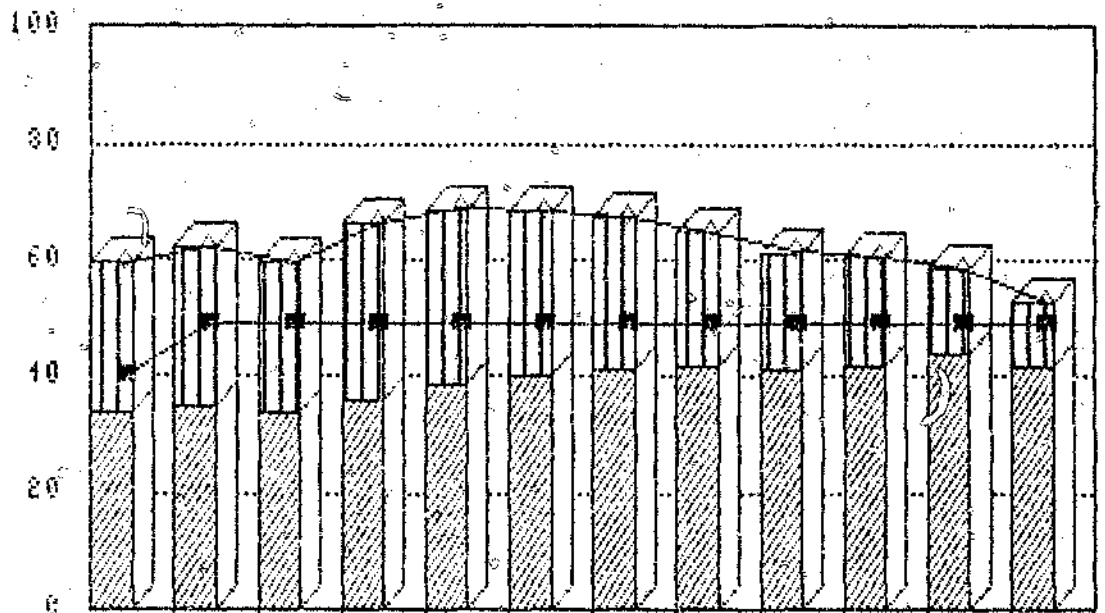
STCKWUC1.PRG

stockwuc

# MATERIALS MANAGEMENT

## TOTAL STOCK VALUE

Million




| | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| W_stock | 34.1 | 34.8 | 34.2 | 36.2 | 38.7 | 40.1 | 41.3 | 41.6 | 41.4 | 41.5 | 44.2 | 41.5 |
| Elec | 25.5 | 27.5 | 25.5 | 30.5 | 30.1 | 28.3 | 26.2 | 23.2 | 20.2 | 19.1 | 14.3 | 11.3 |
| Total | 59.6 | 62.3 | 59.4 | 66.7 | 68.8 | 68.4 | 67.5 | 64.8 | 61.6 | 60.6 | 58.5 | 52.8 |
| Target | 49.0 | 49.0 | 49.0 | 49.0 | 49.0 | 49.0 | 49.0 | 49.0 | 49.0 | 49.0 | 49.0 | 49.0 |

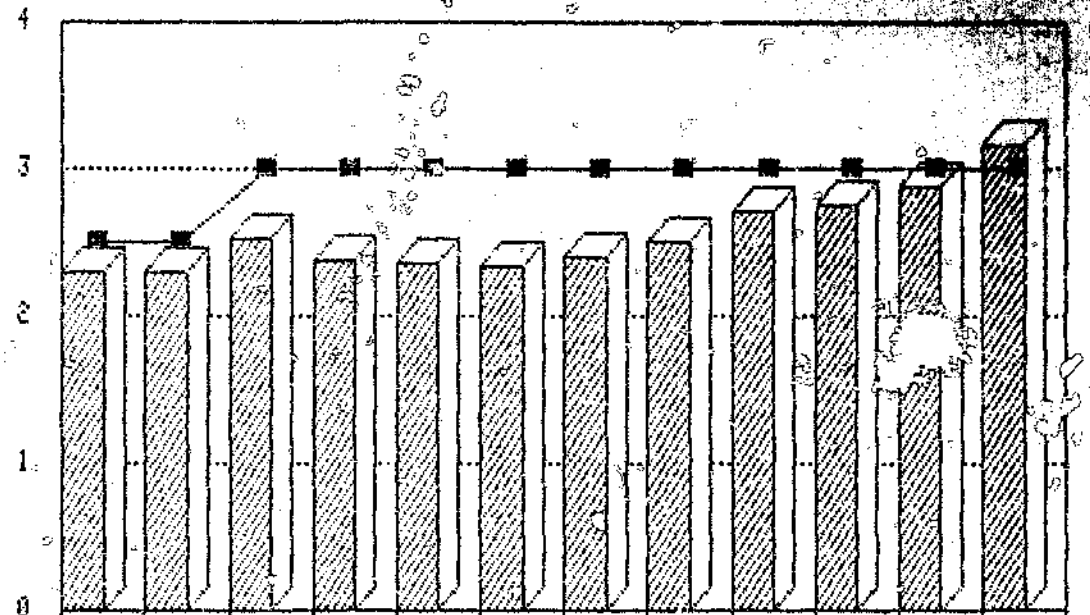
W_stock Target Elec Total

MATTOT04.PRG

mattot

# MATERIALS MANAGEMENT

## STOCK TURNOVER - TOTAL



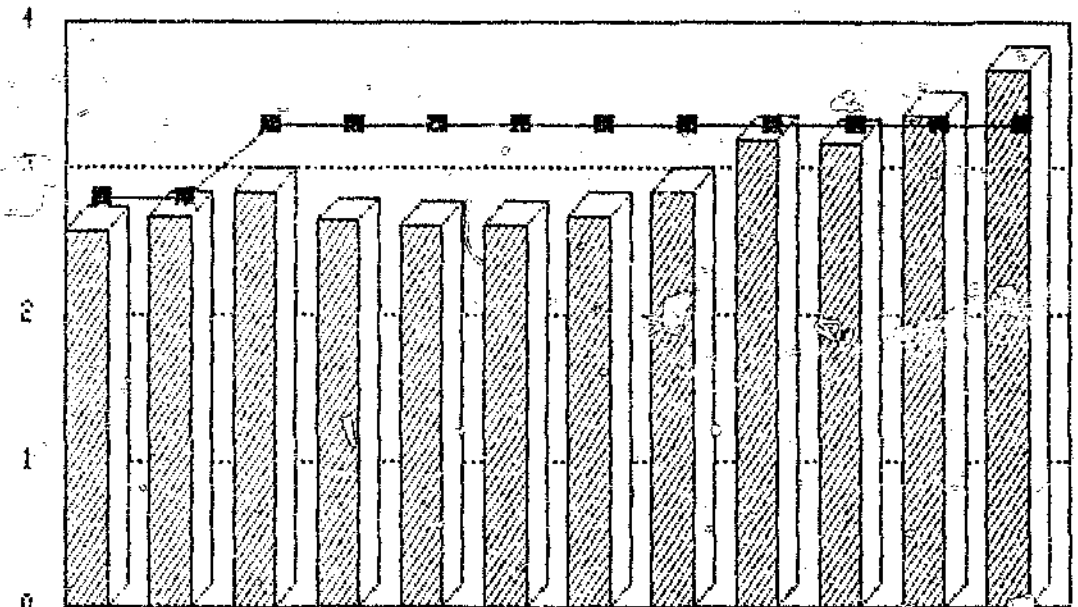

| | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Actual | 2.30 | 2.30 | 2.52 | 2.37 | 2.35 | 2.34 | 2.39 | 2.51 | 2.72 | 2.75 | 2.89 | 3.17 |
| Target | 2.50 | 2.50 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |

Actual ■ Target

STCKTAT1.PRG
stocktat

# MATERIALS MANAGEMENT

## STOCK TURNOVER - EXL STRATEGIC

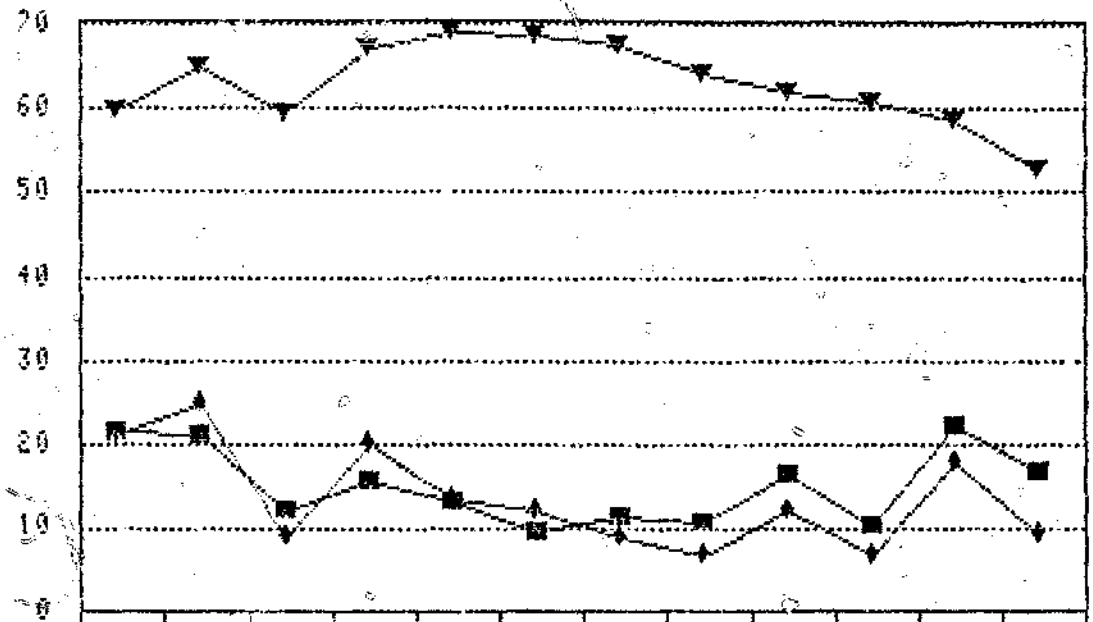



| | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Actual | 2.57 | 2.68 | 2.84 | 2.64 | 2.60 | 2.61 | 2.68 | 2.84 | 3.20 | 3.17 | 3.36 | 3.67 |
| Target | 2.80 | 2.80 | 3.30 | 3.30 | 3.30 | 3.30 | 3.30 | 3.30 | 3.30 | 3.30 | 3.30 | 3.30 |

Actual ■ Target

MATERIALS MANAGEMENT

Million ISSUES / RECEIPTS




| | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Issues | 21.6 | 21.5 | 12.2 | 15.7 | 13.3 | 9.5 | 11.3 | 10.7 | 16.5 | 10.3 | 22.3 | 16.8 |
| Receipts | 21.5 | 24.3 | 9.0 | 20.0 | 13.6 | 12.1 | 8.6 | 6.8 | 11.9 | 6.5 | 17.9 | 9.4 |
| Total | 59.6 | 64.8 | 59.4 | 66.7 | 68.8 | 68.4 | 67.5 | 64.2 | 61.6 | 62.6 | 58.5 | 52.8 |

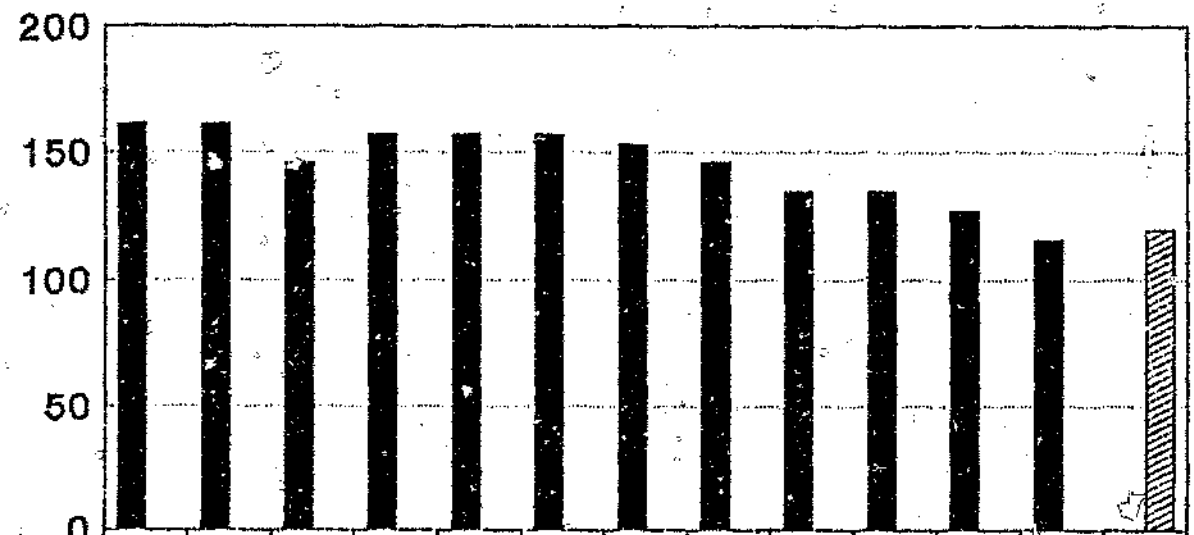
▼ Total ■ Issues ♦ Receipts

Comments :

1. Issues include transfers out external.
2. Receipts include transfers in external.
3. Returns = R1 796 503.
4. Adjustments = R238 689.
5. Transfers internal = R19 881.

# MATERIALS MANAGEMENT

## DAYS ON HAND




| | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DAYS ON HAND | 161 | 161 | 146 | 157 | 157 | 157 | 153 | 146 | 135 | 135 | 127 | 118 | |
| TARGET | | | | | | | | | | | | | 120 |

DAYS ON HAND  TARGET

# APPENDIX 2

## MRP IMPLEMENTATION PLAN FOR PRETORIA DISTRIBUTOR

MRP IMPLEMENTATION PROGRAMME FOR THE PRETORIA DISTRIBUTOR

| | | | AUG-NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | AUDIT STORE, BUYING & BOM'S (Doc. findings) | MJ | XXXX | | XX | | | | | |
| 2 | DOCUMENT CURRENT PLANNING PROCESS (Organogram) | MJ | XXXX | | | | | | | |
| 3 | SELL PRESENTATION - design,districts,comm. - ROADSHOW | MJ | XXXX | | | | | | | |
| 4 | GENERIC MRP TRAINING (Project team) | MJ | XXXX | | | | | | | |
| 5 | BEUKER TRAINING (Project team) | MJ | XXXX | | | | | | | |
| 6 | GENERIC TRAINING (User Group) | MJ | XXXX | | | | | | | |
| 7 | BEUKER TRAINING (User Group) | MJ | XXXX | | | | | | | |
| 8 | REVIEW BOM's (Std.,training,codification,sys) | JH | | XXXX | XXXX | XXXX | | | | |
| 9 | FINALIZE ORGANOGRAM | MJ | | | | XX | | | | |
| 10 | FINALIZE PROJECT MANAGEMENT PROCESS | MJ | | | XXXX | XXXX | | | | |
| 11 | FINALIZE MRP PROCESS | MJ | | | | XXXX | | | | |
| 12 | DECIDE ON PLANT MAT. TYPES & IMPLEMENT | DB | | | XX | XX | | | | |
| 13 | MAT. TYPE CONVERSION (SK to MF) | GC | | | | XXXX | XXXX | | | |
| 14 | COLLECT SECURITY INFORMATION FOR BUC | GC | | | | XXXX | | | | |
| 15 | COMPILE POLICIES AND PROCEDURES (include KPI's) | GC | | XX | | | | | | |
| 16 | ROADSHOW ON NEW PROCESS | GC | | | | | | XXXX | | |
| 17 | IMPLEMENT MANUAL PLANNING PROCESS | GC | | | | XXXX | XXXX | XXXX | | |
| 18 | IMPLEMENT ECN PROCESS | JH | | | | XXXX | XXXX | XXXX | | |
| 19 | IDENTIFY PLANNING PARAMETERS (SS, OQ & LT) | DB | | | | | XXXX | | | |
| 20 | DETAIL SYSTEM TRAINING | MJ | | | | | | | XXXX | XXXX |
| 21 | INSTRUCT I.T. TO SET UP DATA BASE | MJ | | | X | | | | | |
| 22 | CHECK BMS INTERFACE | JV | | | | | | | | XX |
| 23 | CONVERSION AND TEST | MJ/GC | | | | | | | | XXXX |
| 24 | REFRESHER TRAINING | MJ | | | | | | | XXXX | XXXX |
| 25 | SIGN OFF (Final Audit) | MJ/GC | | | | | | | | XXXX |
| 26 | BMS/ASI INTERFACE IN PLACE | MJ | | | | | | | XX | XX |

MJ - consultant
DB - Materials Manager (Eng dept)
GC - Commercial Manager

REV 2.1

# APPENDIX 3

## QUESTIONNAIRE FOR THE DOCUMENTATION OF PLANNING PROCESS

## DOCUMENTATION OF CURRENT PROCESS

The objectives of the "participartory session" are:

- to identify the inputs and outputs
- to understand & document the current process
- to identify any problem areas

**Project Services**

1. Organizational overview - who is involved, what sections,etc.

2. What is the scope of work?

3. What are all the different phases of a project -
   - incl. duration of each phase

4. What systems are used in project management?

5. How are applications from the customers handled?

6. What, and who, initiates the project management process?

7. Who calculates the estimate, and what info. is used?

8. How long is it from the time of application to the customer getting the quote?

   How often does the quote change?

9. How long prior to project initiation is the estimate calculated?

10. Does the estimate take into account:

    - a check on resource capacity
    - availability of critical material
    - estimated start and end dates

11. What KPI's are used to measure:

    - project progress
    - inventory levels
    - construction efficiency

12. Who determines:

    - the length of the route/line
    - the major equipment to be used
    - the quantity of structures

13. How long before construction is the detailed BOM calculated?

    How accurate is it?

14. When are the projects firmed up?

15. When are the material rewuirements given to Commercial?

16. When are the spanning plans drawn up?

17. How often are the BOM's adjusted?

    - does this affect the estimate?
    - is the customer notified?

18. When is the SLAC $ given to the project?

19. How is the project progress monitored?

20. Who prioritizes projects and on what basis?

21. Who may schedule projects out?

22. What, if any, standards exist - such as standard BOM packages.

    Are these standards being used?

**General**

1. What are your biggest problems?

2. Is there a project schedule?

   Who determines the schedule and how
   Does management review the priorities regularly
   Do changes occur regularly
   - how close to project construction?

3. Who orders project material?

   Is it all ordered at once
   Is it delivered all at once, or staggered delivery

4. Have we defined:

   - All support systems that are used
   - All documentation involved
   - All the parties involved
   - The various phases in each project

# APPENDIX 4

## CURRENT ELECTRIFICATION PLANNING PROCESS
(Prior to MRP)

# ELECTRIFICATION PROJECT PROCESS

## 1. RESEARCH AND EVALUATION PHASE

1.1 Preliminary Project Process Planning
1.2 Research
1.3 Preliminary evaluation (total)

## 2. NEGOTIATION PHASE

2.1 Negotiation with authorities
2.2 Community negotiations
2.3 Preliminary planning, Economic evaluation, Project motivation (with concept report)
2.4 Funding negotiations
2.5 Consolidation
2.6 Final project approval
2.7 Project registration
2.8 Target negotiations, resource planning and scheduling
2.9 Capex preparations for facilities
2.10 Annual Material Requirements
2.11 Contracts/agreements with authorities
2.12 Communication with communities

## 3. PREPARATION PHASE

3.1 Appointment of Consultants
3.2 Survey, aerial photography and mapping
3.3 Detail planning/ design
3.4 Capex approval
3.5 Bill of materials placement
3.6 Tender process
3.7 Marketing/point sales
3.8 Customer education
3.9 Site Office/Vending/Revenue Management - Validator

## 4. CONSTRUCTION PHASE

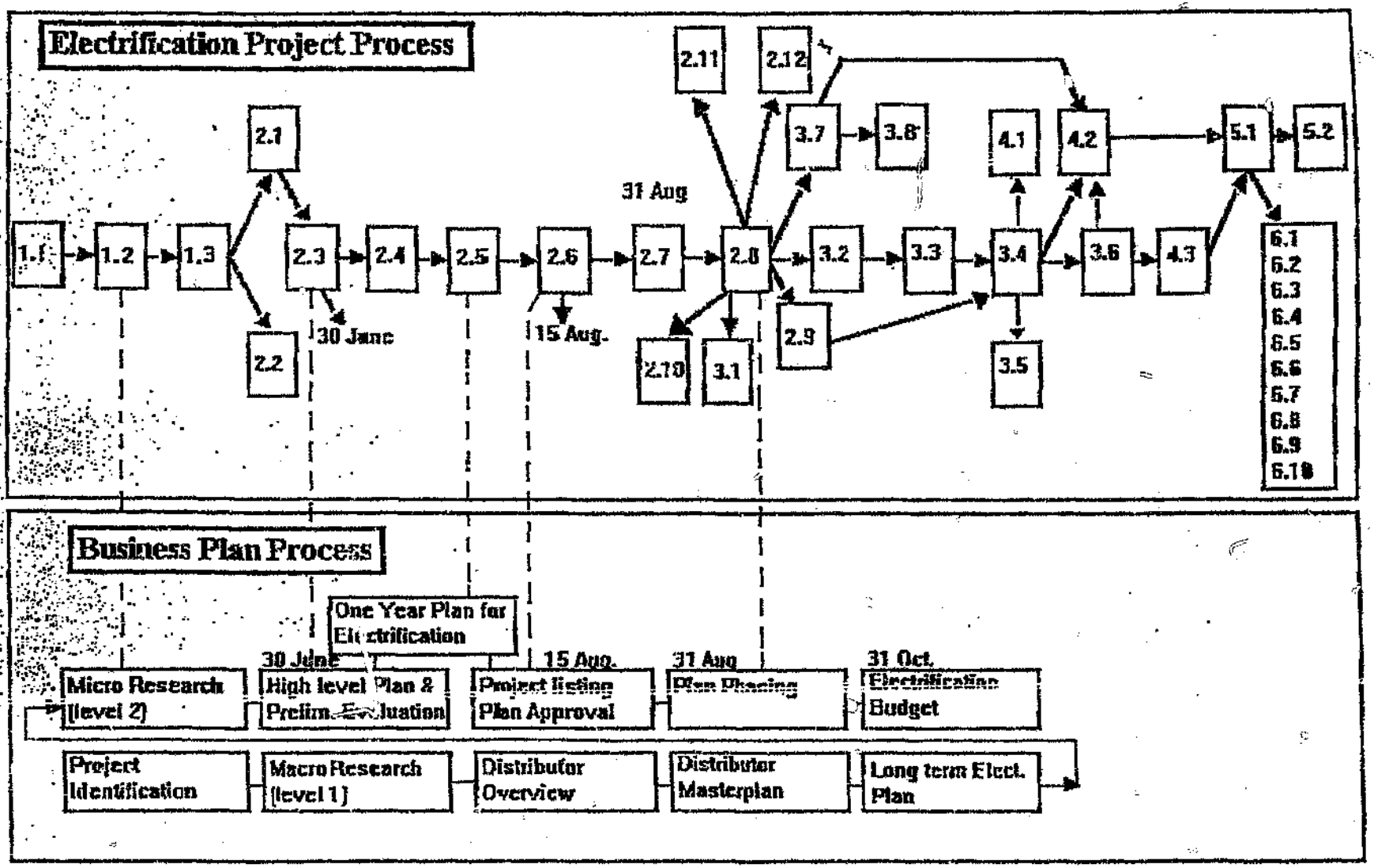
4.1 Cost Management
4.2 Construction of bulk, feeder line, infrastructure and house connections
4.3 Facilities Construction

## 5. ENERGIZING

5.1 Handing over / commercial operation.
5.2 ED education to customers

## 6. NORMAL BUSINESS PHASE

6.1 Operation & Maintenance
6.2 Customer service
6.3 Sales
6.4 Project Audit/Monitoring
6.5 Post completion connections
6.6 "As built" drawings
6.7 Metering
6.8 Load growth and normal expansion
6.9 Post evaluation
6.10 Revenue Audit


Electrification Project Process
1.1
1.2
1.3
2.1
2.2
2.3
30 June
2.4
2.5
2.6
15 Aug.
2.7
31 Aug
2.8
2.9
2.10
2.11
2.12
3.1
3.2
3.3
3.4
3.5
3.6
3.7
3.8
4.1
4.2
4.3
5.1
5.2
6.1
6.2
6.3
6.4
6.5
6.6
6.7
6.8
6.9
6.10
Business Plan Process
One Year Plan for Electrification
30 June
15 Aug.
31 Aug
31 Oct.
Micro Research (level 2)
High level Plan & Prelim. Evaluation
Project listing Plan Approval
Plan Phasing
Electrification Budget
Project Identification
Macro Research (level 1)
Distributor Overview
Distributor Masterplan
Long term Elect. Plan

# APPENDIX 5

## ELECTRIFICATION PLANNING PROCESS FOR MRP

# ELECTRIFICATION

# PROCESS FOR MRP

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 31 AUGUST YEAR PLAN FOR NEXT YEAR. "INCLUDES TOTAL BOM" | 4 MONTHS PRIOR TO PROJECTS START DATE | 4 MONTHS PRIOR TO START OF PROJECT. | | | | | START PROJECT |
| | DESIGN<br><br>FINAL BOM PER INDIVIDUAL PROJECT | FORM 150 APPROVAL | | | | | CONTSRUCTION PHASE BEGINS |
| DROP PROJECT FROM BMS INTO MRP (PLANNED ORDER) NOT FIRM AND NO COMMITMENT | UPDATE PROJECT BOM's | LOAD FIRM PLANNED ORDER AND MATERIAL NOW COMMITTED PER PROJECT | | | | | |

## APPENDIX 6

## MRP POLICY AND PROCEDURE FLOW DIAGRAM

# PROJECT "CUSTOMER TOUCH" POLICY AND PROCUDURE FLOW DIAGRAM

## DISTRIBUTOR WORK UNDER COSNTRUCTION PLAN

Policy 1

SMRS — GREATE BOM — Policy 9

BMS — DOWNLOAD BOM — Policy 1

BMS/INTERNET — SCHEDULE THE BOM

ASI — DOWNLOAD TO ASI — Policy 3

BMS/ASI INTERFACE

MRP — LOAD DEMAND DATA ON SYSTEM

NOTE: Auto download from BMS

(Refer "Electrification process for MRP" and Policy 2)

FIRM-UP NEXT PLANNING PERIOD

REFER TO POLICIES 4,5

REQUEST MRP RUN RUN (NETT OR REGENERATIVE) — Policy 7

REQUEST MSP REPORT

Policy 6

?

No

Yes

Action message for current planning period

MS ACTION MESSAGE FOR THE NEXT PLANNING PERIOD — Policy 6

Yes

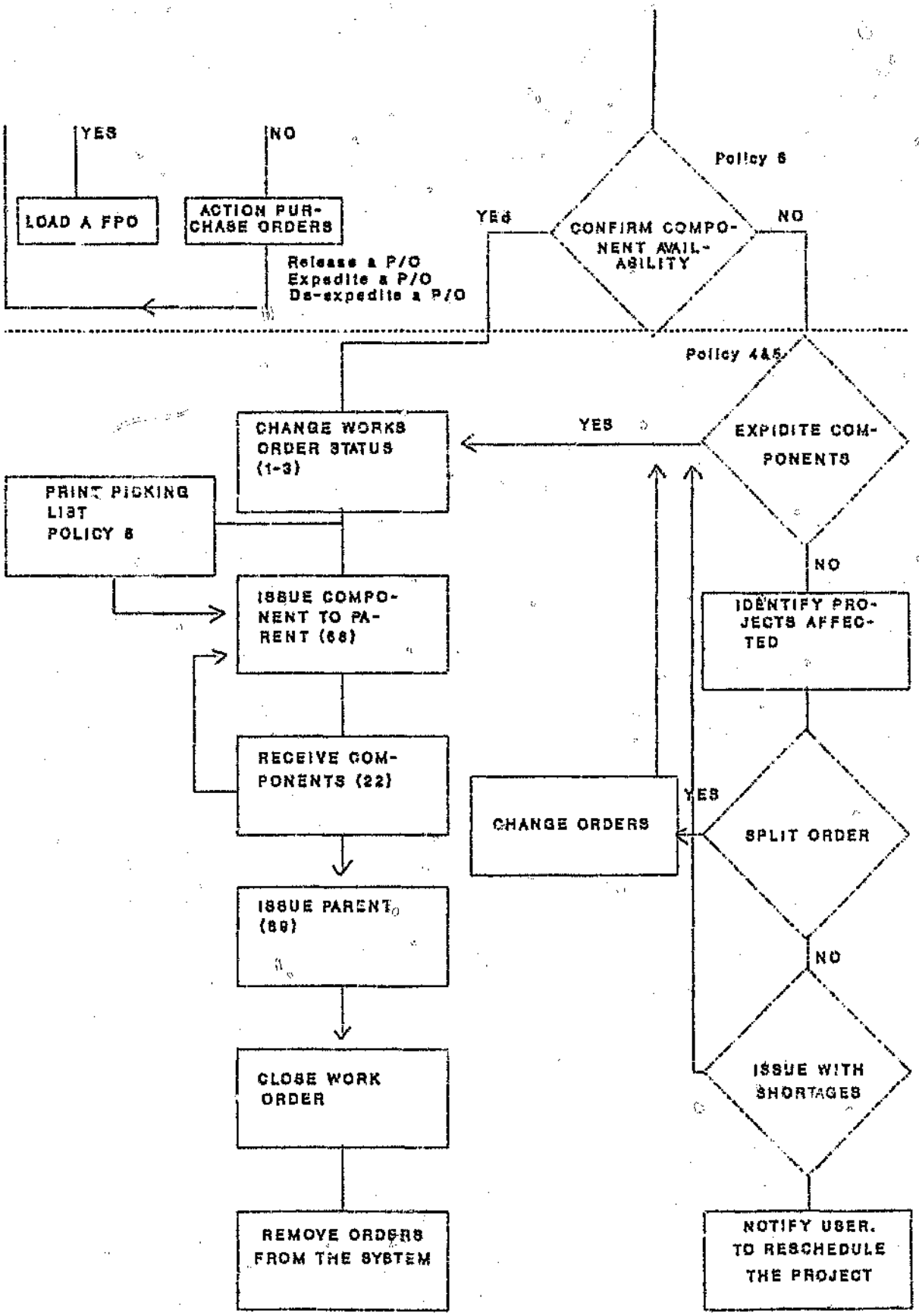
No

MS Item?

?

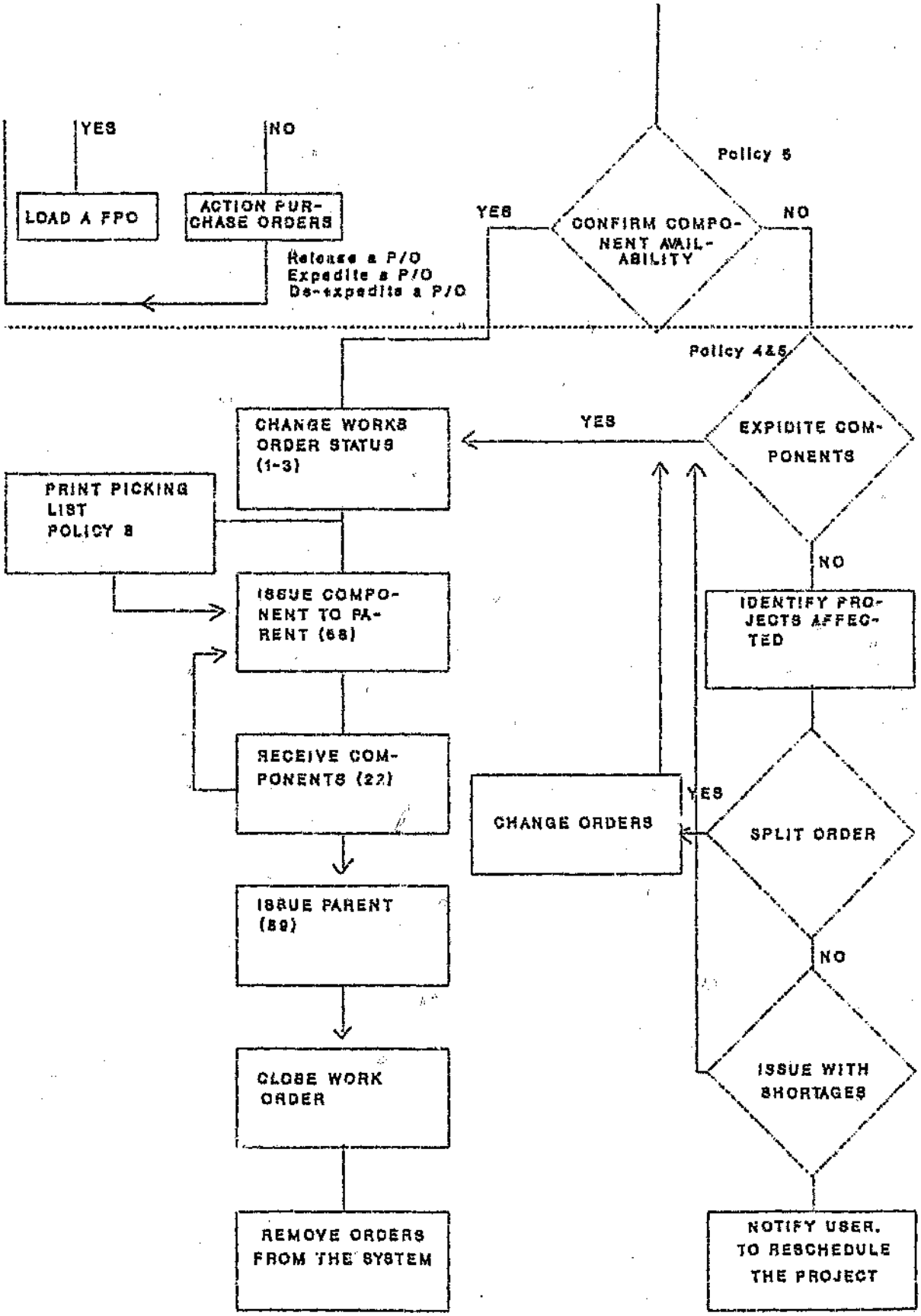
No

No




KEY:

COD = CUSTOMER ORDER DATA BASE
MS = MASTER SHEDULER
MSP = MASTER PRODUCTION SCHEDULE
FPO = FIRM PLANNED ORDER
PO = PURCHASE ORDER
89)= TRANSACTION NUMBER ON AS/

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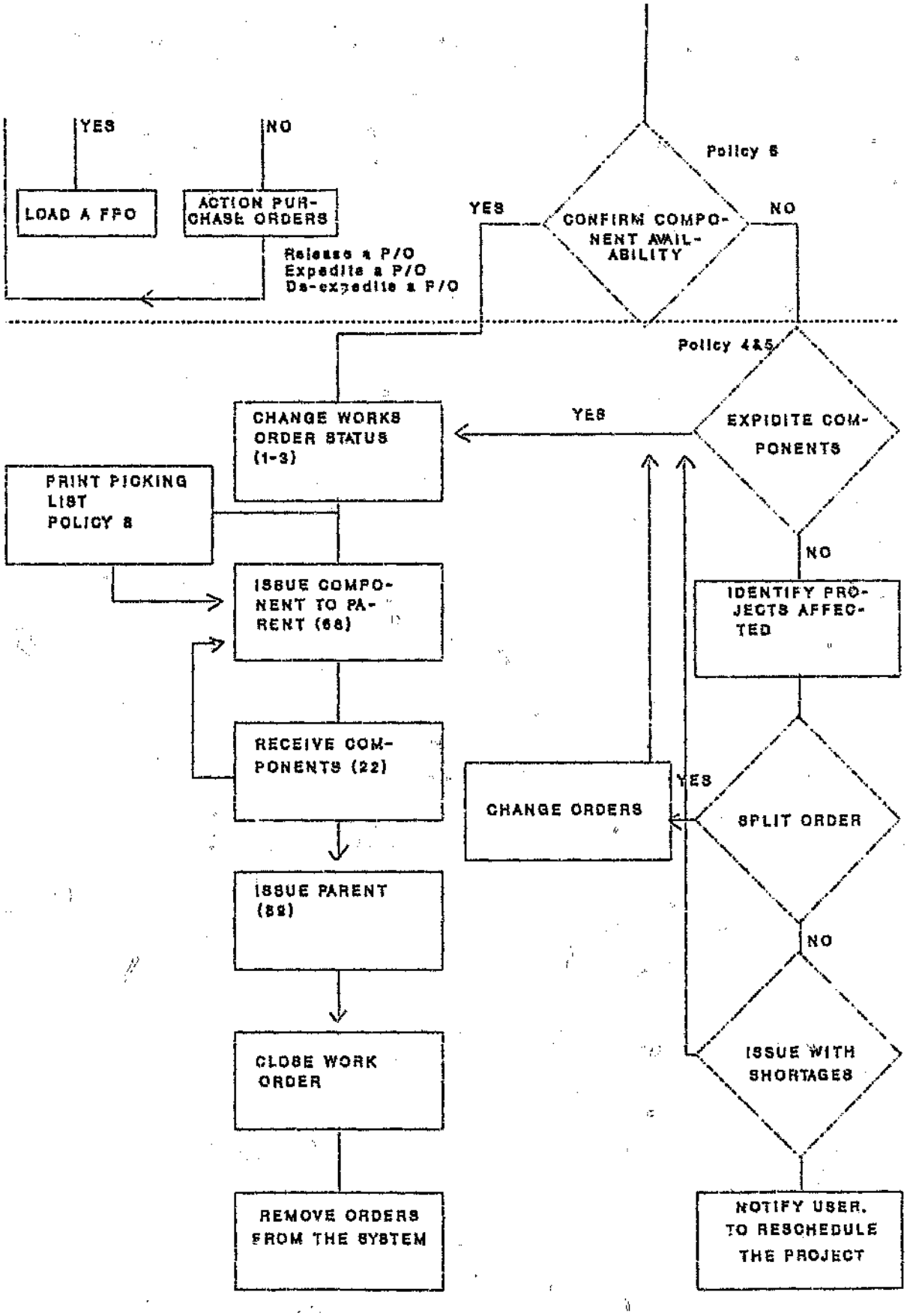


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PO = PURCHASE ORDER
89)= TRANSACTION NUMBER ON AS1