5 OPTIMISATION OF THE EAM SC MODEL

5.1 THE M&R DEMAND SIGNAL – THE KEY TO OPTIMISATION OF THE EAM SC MODEL

It has been established that the MRO demand signal is the connector or the golden thread between asset and supply chain management. This is what activates the supply chain in order to fulfil the material requirements within asset management. It has also been stated that asset intensive organisations have little use for operating materials. For this reason the remainder of the study will exclude the O within MRO and focus on Maintenance and Repair materials and its demand signal. In EAM this is called the M&R demand signal.

To achieve more profitable supply chain operations, companies must move towards integrated supply and demand planning. The better the planning, the better the quality of a demand signal that is passed on to the supply chain. The quality of a demand signal is related to:

- The rate of fulfilment of M&R materials as required by assets.
- Timely forecasting to give the supply chain a chance to provide a service to asset management.

In short, a good or quality demand signal gets the right M&R material at the right place at the right time in a required condition. The opposite is a poor demand signal that originates from an emergency or unexpected incident that places the supply chain under pressure. The result is a stressed supply chain with all possible benefits lost.

The M&R demand signal is the key to optimise the EAM SC model. A company has the choice of maintaining the current status quo of a poor M&R demand signal and lose all benefits that the integrated business model provides or they can opt to improve the M&R demand signal quality. The performance measure of a good demand signal has been set as:

- the correct maintenance and repair materials
- at the right place
- at the right time
- in a specified condition.

Chapter 5 will investigate ways of improving the M&R demand signal by gaining better visibility, increased forecasting, optimisation, and quantification of the M&R demand signal.

5.2 CHANGING FROM UNPLANNED TO PLANNED MAINTENANCE

Managing the M&R demand signal has its fair share of challenges. For one, assets do not communicate or advertise their requirements for M&R materials in a conventional way. They exhibit their needs through a partial or full degeneration (failure) of their intended function usually at the most inappropriate time. The only way to restore an asset to it original function (performance) is through maintenance. Maintenance is a combination of all technical and associated administrative actions with the intent to retain an asset in, or restore it to, a state in which it can perform its required function [Kelly, 1989]. To perform maintenance requires:

- Skilled resources (engineers, artisans etc.).
- Maintenance and repair materials.
- Tools (general and special tools).

An organisation can follow two approaches with maintenance. They are:

- Unplanned maintenance or
- Planned maintenance

Unplanned maintenance is maintenance carried out to no predetermined plan as a result of an asset that has failed [Kelly, 1989]. It also goes by the name of reactive maintenance. Planned maintenance is maintenance organised and carried out with forethought, control and the use of records to a predetermined plan [Kelly, 1989]. Planned maintenance is also known as proactive maintenance since such maintenance is based on the condition of an asset and usually takes place before the asset fails.

Both maintenance approaches have several maintenance categories to differentiate between subtle execution strategies. Within unplanned maintenance we have (but not limited to):

- Emergency Maintenance (EM)
- Corrective Maintenance (CM)

Emergency maintenance is the immediate performance of unplanned (i.e. unexpected) maintenance tasks to restore the functional capabilities of failed assets that resulted in a production loss or unsafe conditions. Corrective maintenance is the performance of unplanned (i.e. unexpected) maintenance tasks to restore the functional capabilities of failed or malfunctioning assets that has no safety or production impact. Corrective maintenance has no immediate priority.

Within planned maintenance we get (but not limited to):

- Preventive Maintenance (PM)
- Condition Based Maintenance (CBM)

Preventive maintenance is the repeated performance of inspections and or servicing tasks that have been pre-planned (i.e. scheduled frequency, resources, materials, tools) for accomplishment at specific points in time to retain the functional capabilities of assets. Condition based maintenance is repair maintenance performed on assets based on condition observations as provided by Non Destructive Testing (NDT), trending and objective analysis.

Having said all of this it makes sense for an organisation to move from unplanned to planned maintenance. The benefits from an asset management perspective are obvious due to:

- Increased asset availability and reliability.
- Increased production.
- Better management of the maintenance cost centre.

The benefits of planned maintenance for the integrated EAM SC are less visible but it is a major contributor towards improving the quality of the M&R demand signal. Planned maintenance places an emphasis on maintenance and repair material forecasting. It takes the form of identifying the correct materials to be used with a predetermined maintenance schedule. Creating order in the M&R demand signal means the full benefits of the supply chain now becomes available to asset management.

For an organisation to change from unplanned to planned maintenance is a strategic decision taken by management. To achieve this an organisation must provide a maintenance planning and administration function [Harrold, 1999]. The maintenance planning and administration group responsibilities should include:

- Coordination of maintenance activities with production to obtain the least impact on availability.
- Maintenance work planning, including procedures, tools, materials, inspection, and calibrations.
- Coordination of minor housekeeping activities performed by operators.
- Work order and cost tracking.
- Establishment and updating of equipment history files.
- Coordination of preventive and condition based maintenance.
- Evaluation of life cycle trends for possible equipment improvements or equipment replacement.

- Spare parts management.

Even if an organisation has moved from unplanned to planned maintenance there is no escaping the unexpected failures of assets. The success of transition is expressed by the PM to CM ratio of assets. Experience has shown that a company that has successfully moved to a proactive maintenance management methodology maintains a PM:CM ratio in the order of 80:20. A ratio of 90:10 is exceptional.

5.3 Scientific Maintenance Optimisation Techniques

The first step in improving the M&R demand signal is the decision to change from unplanned to planned maintenance. Developing a planned maintenance strategy is not a simple task but help can be obtained from scientific maintenance optimisation techniques. They serve two purposes. The first is to facilitate the transformation from unplanned to planned maintenance and secondly to continuously improve and optimise maintenance in favour of a good PM CM ratio. The strengths of these methods are the scientific and systematic approach used to develop preventive maintenance schedules. The scientific database documents all decisions for future reference and optimisation. One such a technique is called Reliability Centred Maintenance (RCM). RCM is a process used to determine the maintenance requirements of any asset in its operating location. This methodology is summarised in figure 14 [DNA EAM]. As RCM is a very specialised discipline this study will provide a brief overview of each step.

RCM is founded on four principles. They are:

- Preserve the function of an asset / equipment.
- Prioritise the function requirements.
- Identify failure modes that can affect functions.
- Select only applicable and effective tasks.

The first step in the RCM process is to construct a Hardware Breakdown Structure (HBS) of the system or plant to be analysed. An HBS is nothing but a plant, property and equipment (PPE) register structured in a preferred way to suit the RCM process. The HBS is based on a functional breakdown structure indicating the functional relationships between assets (hardware) and locations (plant positions), and the system it functions within. Following are some of the more important functions fulfilled by the HBS:

- Identifies all the assets in a system to be analysed.
- Creates a structure to reference all subsequent information against.
- Groups assets into functional groups.
- Identifies and defines systems boundaries.

- Identifies system / system interfaces: inside–out and outside–in.
- Helps create an understanding of the operations of the system.
- Provides a required structure for budgeting, cost control and benchmarking.

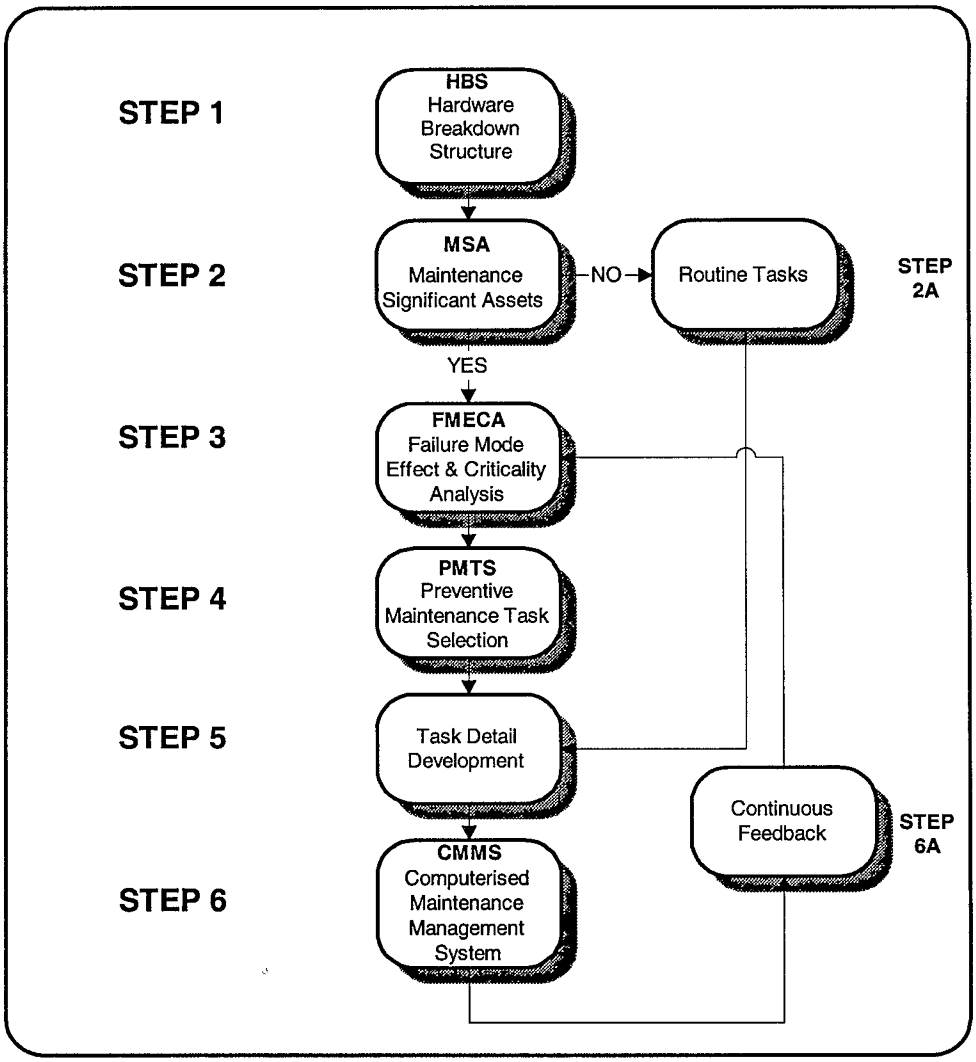

Figure 14: The RCM Flow Process

The second step is the Maintenance Significant Asset (MSA) identification process. Through a set of predetermined questions, assets are classified as MSA or non-MSA. An example of a questionnaire is presented in figure 15 [DNA EAM]. If an asset is considered to be MSA it will be subject to further analysis as it has been identified for preventive maintenance. A non-MSA is an asset that has been identified for corrective maintenance. The worst-case scenario for a non-MSA is an asset that is "run to failure" and is replaced only when it has failed. However, non-MSA are considered for applicable and effective routine maintenance tasks such as operator checks, lubrication, visual inspection, etc. The idea behind a routine maintenance task - step 2A - is that it is relatively cheap for a company but can significantly extend the life expectancy of a non-MSA asset. Experience has shown that 20% or less of all

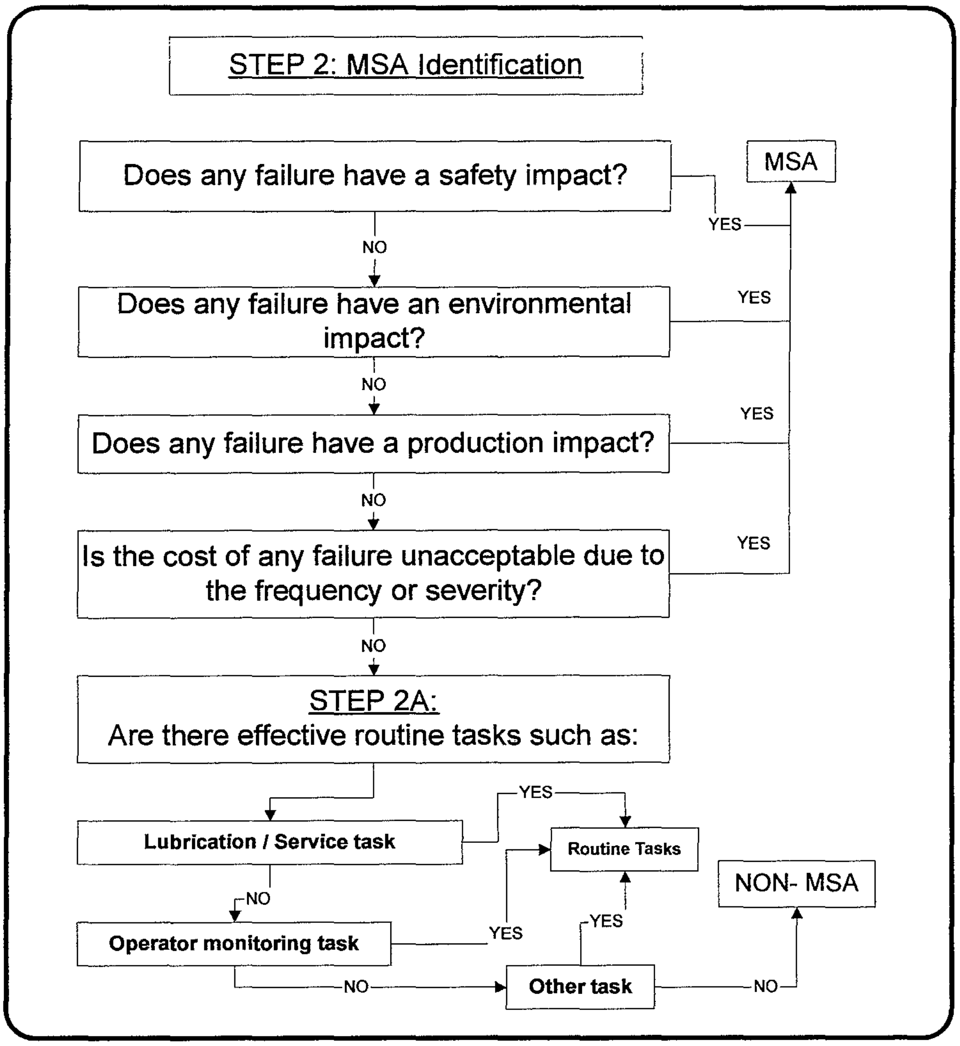

Figure 15: The Maintenance Significant Asset (MSA) Identification Process

assets are MSA and will require further analysis with the RCM process - steps 3 to 5. This shows how valuable the MSA identification process is.

Step 3 is the FMECA process and is the abbreviation for Failure Mode Effect and Criticality Analysis. The purpose of the FMECA study is to determine ways in which assets can fail and the effect of such failures on other assets or systems. The following are some of the FMECA indicators:

- Failure modes – Identify critical failures of maintenance significant assets.
- Failure mode frequencies – The frequency of the specified failure.
- Failure mode effects – What effect does the failure have on the system?
- Failure cause – What can the possible cause of the failure be?
- Location MTBF – The Mean Time Between Failures for a location.
- Location MTTR – The Mean Time To Repair a failure of that location.

- Location criticality – This defines the criticality of a location that should have preference to other locations for repairs.

The purpose of step 4, the Preventive Maintenance Task Selection (PMTS) is to derive at an applicable and effective maintenance task that will prevent or reduce the frequency of occurrence of asset failures. The PM task recommendations are identified by means of the RCM algorithm. The RCM algorithm asks a set of questions regarding each asset failure mode, as was identified and documented during the FMECA process. The RCM algorithm's questions are based upon parameters such as:

- hidden and evident failures
- operating safety
- cost consequences
- predictive monitoring
- inspections
- services
- overhaul
- replace
- discard

These questions guide you in a structured way through various types of potential preventive maintenance tasks. The end result of the RCM process is a set of maintenance task recommendations. The most appropriate one(s) are selected and expanded into plant specific preventive maintenance tasks during the next step; the Task Detail Development step.

Step 5 is the Task Detail Development step and is the final step of the maintenance identification or optimisation process. The aim of this step is to supply the asset management team with sufficient technical detail, to enable them to compile service job plans and / or update maintenance procedures. The PM task recommendations as provided by the RCM algorithm are critical. Recommendations could be a detailed maintenance inspection, discard, lubrication servicing, operational check, temperature monitoring, etc. During the task detail development the PM tasks recommendations are "translated" into plant maintenance detailing the following:

- Task Type – a descriptive name for the maintenance task type to be executed.
- Interval of Services – the number of time units to elapse before the re-occurrence of the next maintenance task.
- Discipline – the primary maintenance discipline responsible for executing the task.
- Priority – identify the importance of the maintenance task at hand relative to the plant, assets and other active tasks to the maintenance person.

- Subtask – the subtasks or procedure to be performed when executing the task.
- Asset Status – gives an indication of the state in which the asset should be to perform maintenance e.g. running or down.
- Plant Status – indicates the state in which the plant or higher level of equipment should be found or placed in to execute maintenance.
- Task Duration – indicates the time required to execute the task.
- Permit to Work – indicates if any special safety or isolation conditions should be adhered to or not.
- Statutory Requirements – indicates whether assets should be maintained according to rules and regulations imposed by governing bodies.
- Service Notes – indicates any extra tasks to be executed.
- Procedure Numbers – documents if there are any existing procedures or documents applicable to this task.
- M&R Materials – identifies maintenance and repair materials to be used / replaced during the task execution.
- Special Tools – identifies tools required by the artisan to execute his task not normally found in his toolbox.

The end product of the analysis provides the input to the next phase, which is the implementation phase. This is discussed is greater depth in the next paragraph. One must not underestimate the impact that RCM can have on an organisation [Harrold, 1999]. It is not limited to maintenance alone and has far reaching impacts on:

- Organisational structures.
- People's attitudes.
- Corporate culture.
- Work methods.
- Quality measures.
- Mission effectiveness.
- Performance objectives and measures (KPA's and KPI's).
- Work and document control.
- Maintenance prevention methods.
- Training plans.
- Major project scheduling and planning.
- Spare parts management.

The establishment of a maintenance planning and administration group is the first step to move from reactive to proactive management of assets. To achieve world-class levels an organisation requires continuous improvement through the establishment of a reliability improvement group [Harrold, 1999]. Responsibilities would include:

- Operate a self-directed maintenance team integrating all predictive maintenance technologies.
- Provide timely equipment condition evaluation to maintenance planning with the goal of eliminating unplanned downtime.
- Perform ongoing system and equipment reliability prioritisation analysis.
- Implement proactive maintenance technologies and methods, including identification of recurring problems.
- Track performance measures, e.g. savings from single event analysis, uptime / downtime, maintenance costs, quality, etc.
- Identify and eliminate unnecessary preventive maintenance activities.
- Improve reliability by identifying equipment design changes required.
- Manage a Computerised Maintenance Management System (CMMS).
- Analysis to determine and eliminate root cause failures (root cause analysis).
- Implement predictive technologies.

Membership in the reliability group can include fitters, electricians, etc. chosen for their experience, abilities and willingness to learn techniques and tools. Initially the group includes several experts such as RCM consultants, and technicians skilled in the fields of infrared thermograph, vibration and lubrication analysis. As the group matures additional experts in precision alignment, balancing, and root cause failure analysis are added.

The importance of RCM with regards asset management has been established. It serves two purposes for asset management. The first is to facilitate with the transformation from unplanned to planned maintenance and the second is to continuously improve and optimise maintenance in favour of a good PM CM ratio, all to the benefit of improving the M&R demand signal. From an integrated EAM SC model RCM is an accurate M&R forecasting and optimisation tool.

5.4 THE USE OF A COMPUTERISED MAINTENANCE MANAGEMENT / EAM SYSTEM

Technology has greatly assisted companies wanting to make the change from unplanned to planned maintenance using scientific maintenance techniques. The condition based and preventive maintenance disciplines have seen the introduction of predictive technologies such as oil and vibration analysis and preventive and proactive maintenance tools such as thermographs and infrared cameras. Changing from an unplanned to planned maintenance strategy requires a higher degree of administration and scheduling capabilities. Before the advent of computers, companies used a manual maintenance management system or the so-called "cardex" system to schedule and collate maintenance information against plant assets. Computers can greatly assist with the administration function and have automated the scheduling function. The manual maintenance management system now became known as the Computerised Maintenance Management System (CMMS). The industry describes a CMMS as a computer based management application that assists a user in tracking and managing maintenance work. A CMMS is a plant-engineering tool that provides excellent support for maintenance activities, but usually doesn't look beyond the boundaries of the Maintenance Department [Singer, 2000]. More recently, the trend has been towards the use of enterprise asset management (EAM) programs [Vasey, 2000]. EAM systems have grown from single maintenance applications to include procurement and inventory management solutions through applications. EAM systems are often described as CMMS "on steroids". Their importance is growing because EAM systems are including new technologies such as wireless, web and e-commerce functions. The change towards EAM systems is more complex than the description in this assessment. Asset management is becoming more and more important because the value proposition is far greater than managing maintenance costs only. Its no longer enough to simply maintain assets (although it remains a critical and core function of EAM) but it is equally important to determine the effect capital assets have on a company's profit line. EAM software is elevating the more traditional CMMS software to greater corporate prominence. EAM / CMMS solutions are being recognised as effective and efficient ways to increase ROI and lower the cost of the ownership of assets [Harrold, 1999].

EAM systems start the process of integrating the business processes down the supply chain [Vasey, 2000]. This type of supply chain integration can reduce costs, increase business efficiency and business flexibility. Under the integrated supply and demand planning process model, technology is needed to support the "demand" planning component of the process [Lapide, 1998]. Integration is taking place through the materials requirement for each specialised maintenance process and its replenishment process. As an example, work orders with a materials replacement schedule are linked against asset bill of materials, inventories in multiple stores and procurement and replenishment procedures. Once again it is the M&R demand signal that ties in all the different supply chain functions with asset management.

The EAM / CMMS software market is a very competitive environment. EAM / CMMS software is not a new technology and the software market is saturated with entry level to high-end software solutions. Comprehensive EAM / CMMS software is available from companies such as Indus International (INDUS), MRO (MAXIMO), Datastream Systems (MP2, MP7), Mincom (Mincom) to name but a few. The market dynamics and increasing competition from Enterprise Resource Planning (ERP) providers challenge EAM / CMMS vendors to continuously incorporate new functionalities, scalability, and platform choices to meet specific customer requirements. Software platforms used for EAM / CMMS software include Access, SQL Base, SQL Server, Oracle, etc. What distinguishes these companies from the rest of the pack has little to do with the quality and functionalities of the EAM / CMMS software but with the value added services. They include:

- Tailor-made business solutions.
- Successful implementations of their software (track record).
- Education and training (scientific maintenance management principles and software).
- Customer support and after sales services.
- EAM / CMMS Research and Development (R&D).
- Software customisation.
- Software interfacing due to a best of breed approach used by a client.

Good EAM / CMMS software packages don't come cheap. Selecting the right software for your business requirement is half the battle won. Experience has shown that a company can buy the best software but if it is not implemented correctly, has no support from top management and buy-in from the end-user it is destined for failure.

Implementing EAM software is not for the faint-hearted. EAM software vendors have become the leaders in the latest asset management techniques and innovative solutions. They spend in the order of 10% to 15% of revenue on research and development and pass on new asset management concepts to their clients through their EAM software solutions. It is inevitable that an organisation will be challenged in the way it does business when implementing an EAM solution. This, in turn, usually results in resentment, as it is human nature to resist change. Strong management support and a people change-management process are essential. EAM software solutions keep abreast with the latest software, hardware technology, and methodologies. This means that they rely on companies to provide the necessary technology platforms to run on. It is difficult for a company to implement software that they know little about and lack the resources, including skilled employees, to integrate asset management with their supply chain.

It has become common practice for companies to use consultants to implement EAM software. It is a grudge purchase as the costs keep on escalating. A "cheap" EAM implementation is in the order of one times the software cost, on average it is double, and can become as high as three times the software purchase cost. This does not include the cost for a new hardware platform. The stakes are high when a ten-user licence for an EAM software package is in the order of R500, 000 to R750, 000 and implementation costs are double or triple the software cost. The success of asset management and the integration with the supply chain is dependent on the implementation process. Appendix B is a recommended and comprehensive project plan / Work Breakdown Structure (WBS) used by DNA EAM to implement asset management solutions. Table 3 is a summary of the main steps used for discussion purposes.

PHASE	EAM WORK BREAKDOWN STRUCTURE
Phase 1	Project Initiation
Phase 2	Solution Definition and Development
Phase 2A	Process Finalisation and Specification for the Maintenance Function
Phase 2B	Process Finalisation and Specification for the Inventory Function
Phase 2C	Process Finalisation and Specification for the Purchasing Function
Phase 2D	Process Finalisation, Specification and Development of EAM Interfaces
Phase 2E	Client Training Material Development
Phase 2F	Process Finalisation and Specification for the Scheduler Function
Phase 2G	Reliability Centred Maintenance (RCM) Analysis
Phase 3	EAM Development and Testing
Phase 4	EAM Database Population
Phase 5	Site Start-Up
Phase 6	EAM Roll-Out
Phase 7	Audit and Support
PM	External Functions

Table 3: EAM High Level Implementation Project Plan

Phase 1 starts the project and addresses project resources, infrastructure, training, and project governance. A detailed study of the current network, servers, workstations, software and operating systems is performed to determine the impact / constraints of the client's environment on the performance of the new EAM software. This may mean that the client needs to invest in a new technology platform before installing the EAM software.

Phase 2 is the heart of an EAM implementation and integration with the supply chain. Remembering that EAM software provides a framework for a business solution, phases 2A, 2B, and 2C integrates the maintenance, inventory and purchasing function. Each phase uses a systematic approach to qualify and quantify the client's discipline's business solution while taking into consideration the other disciplines, their business objectives, inputs, outputs and requirement. Each phase starts at the strategic level and reviews or creates a philosophy, a strategy, business concepts, Key Performance Areas (KPA), and Key Performance Indicators (KPI). A strategy needs process mapping to translate intent into a business solution. A process is documented in two ways; a process flow chart and process description. Process mapping helps determine how the new EAM software is configured (database configuration and screen customisation).

The purpose of phase 2D is to extend integration and provide the opportunity to integrate with an ERP, production, time and attendance, equipment monitoring, supply chain, financial systems, to name but a few. Step 2D is used when a company uses a best of breed technology approach and wants integration between all the individual business software solutions.

Phase 2E embeds a company's business solution through a training program and customised training material. Phase 2E is desirable when the EAM software undergoes considerable customisation to adapt to a client's business solution and the existing training material is inadequate.

Phase 2F takes maintenance planning and scheduling one step further and provides a solution for major outages, overhauls or CAPEX projects.

Phase 2G is an opportunity to improve on current preventive maintenance management practices or take the first step in the direction of planned maintenance.

The results from phase 2 determine the extent of EAM software customisation in support of the business objectives. Setting up the EAM software in response to the business solution takes place in phase 3. Customisation takes place on several levels within the software.

- Screen customisation changes the look and feel of application screens and adds or removes data fields.
- Database configuration defines data field attributes such as data type, field lengths, value lists, etc.
- Security settings define the level of access to applications, functionalities, data, etc. for an end-user.
- Coding of reports, including management, daily event, and work reports.

Once the EAM software is set-up according to the company's business requirements the database can be populated. Data collection and population in an EAM system is in accordance with the client's business solution as defined in phase 2. It stands to reason that the correct data needs to be gathered to support decision making and reporting. Phase 5 is the "switch-on" and "going live" stage of the pilot project. It focuses on end-user training, process switch-on, commissioning, and support – in short, bedding down the solution. Phase 6 is the opportunity to roll out the stabilised and client approved EAM software solution to the rest of the plant, remaining business units or factories.

Phase 7 can be described as a compliance, support, and optimisation phase. This is where consultants are essential to audit the compliance of end-users with the business solution, gauge end-user acceptance, and use of the software. Support is in the form of debugging software problems, customer support, training of new end-users, retraining, and upgrades to the latest EAM software version. EAM software vendors have support programs that are renewed on an annual basis and are referred to as an Annual Customer Support Plan or ACSP. Optimisation deals with requests for enhancements to the software solution and can include new functions, reports, interfaces, process simplification, etc.

The last phase has to do with the management of the implementation project from inception to completion. Project management is essential to bring a project in on time and on budget. It also addresses the grey issues of people management, change management, communication, and the quality of deliverables.

In conclusion, selecting the right EAM software solution is not a simple matter and depends entirely on what the organisation wishes to achieve. An example of the current complexity is the debate between EAM and ERP software vendors with regards the suitability of ERP systems to fully address asset management requirements [MRO]. The fundamental difference between EAM and ERP systems is the way in which the materials supply chain is attuned to the maintenance process. ERP systems originated from a production environment and requirement. The demand signal process revolves around the purchase of raw material of a small to-moderate number of items in very large quantities, from a small, constrained set of vendors. EAM systems originated from the asset management environment. The demand signal revolves around the purchase of small quantities of MRO materials of a very large selection of parts, often with differing suppliers part numbers, but identical Original Equipment Manufacturers (OEM), from an equally large number of suppliers. Appendix C is a comprehensive list that describes the subtle differences between EAM and ERP systems with regards asset management.

5.5 Asset Management Parameters as Supply Chain Parameters

One way of gaining control and understanding planned maintenance is to use asset management parameters to define significance, indicate time lines or state a process requirement. The following are popular parameters used by asset intensive organisations:

- Significance parameters
    - Maintenance Significant Assets (MSA) and non-MSA.

    - Location criticality rates.
    - Work order priorities.
- Time line parameters
    - Mean Time Between Failures (MTBF).
    - Mean Time To Repair (MTTR).
    - Preventive maintenance scheduling frequencies.
    - Preventive maintenance next due dates.
    - Warranty dates.
- Process indicators
    - Maintenance or work order type.
    - Warranty conditions.
    - Frequency or meter based maintenance tasks.

Due to the diverse nature of manufacturing plants the importance and interpretation associated with asset management parameters vary. Asset management parameters present a vast amount of information for supply chain management. They provide insight as to what is important for asset management and how things fit together. With integration they lose their exclusivity and can become very useful interpreters or indicators to customise the supply chain in favour of asset management. The opposite is also true. Supply chain parameters provide useful information and can change the approach asset managers use to maintain a plant. Supply chain parameters that need consideration from asset manager are:

- Significance parameters
    - Safety Stock (SS).
    - Economic Order Quantity (EOQ).
    - Issue and order units.
    - Minimum and maximum stock levels.
    - Purchase order priority.
- Time line parameters
    - Lead times.
- Process indicators
    - Reorder points.
    - Vendor analysis.

There is no definitive way that the asset and supply chain parameters complement each other. Asset and supply chain parameters chosen by an organisation are adapted to suit the way they do business, taking into consideration numerous factors such as, location, product manufactured, technology, human resources, etc. It is the responsibility of asset and supply chain managers to share information and knowledge so that each discipline complements the other and integration becomes seamless.

Figure 16 [DNA EAM] is an example of a flow process used to determine the Location Criticality Rate of an asset. A location criticality rate reflects the importance of the location and the asset in the location according the organisation's ethics and plant operating philosophy.

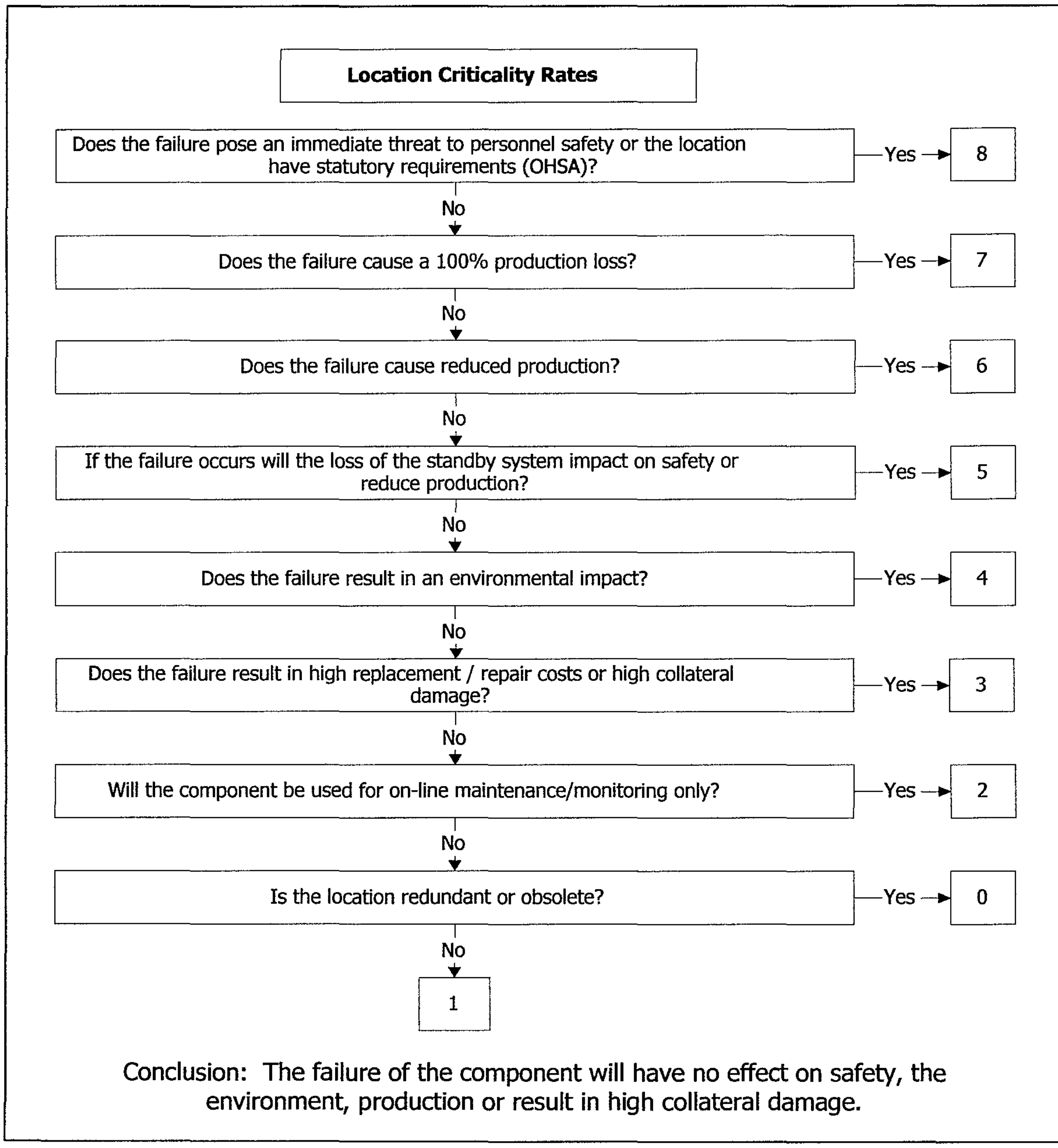

Figure 16: Asset Management Parameters

A location criticality rate is an asset management parameter. In isolation its value and interpretation remains within EAM. However, with integration it can be used to indicate the importance that an asset should receive if the supply chain is called upon to support the asset. It can assist in determining the purchase order priority, assess safety stock levels, set minimum and maximum stock levels, to name a few.

5.6 Conclusion

The M&R demand signal is the key to optimise the EAM SC model. A company has the choice of maintaining the current status quo of a poor M&R demand signal and lose all benefits that the integrated business model provides or they can opt to improve the M&R demand signal quality. A good demand get the correct maintenance and repair materials at the right place, at the right time, in the required condition.

There are several ways that the M&R demand signal can be improved. Changing from unplanned to planned maintenance means that a company has visibility into the materials that it will use and with a schedule frequency, they can accurate forecast consumption. Scientific maintenance management techniques such as RCM can facilitate with the transformation from reactive to proactive maintenance and optimise the M&R demand signal by improving on the PM to CM ratio. An Enterprise asset management software solution greatly assists with the integration process with the supply chain. It provides the platform to link all the components within the indirect supply chain and allows for information exchange and management reporting across the total supply chain solution.