8 CASE STUDY – ASSET MANAGEMENT FULFILMENT IN THE SUGAR INDUSTRY USING THE INDIRECT SUPPLY CHAIN MODEL

8.1 INTRODUCTION

The case study that follows played an important role in the life of the author, DNA EAM and Maintenance Systems Technology (MST). This was the first encounter with integrating asset management with the supply chain. The challenges set by the client stimulated creative thought and interaction. At the time, no one knew that this was to be the beginning of a new approach to asset management. Although individual integration techniques (single pieces to the puzzle) were known to all, it took a further 2 years to arrive at the EAM SC model, define it using asset management and supply chain terminology and understand how everything fits together.

Although it is not a comprehensive application of the EAM SC model it serves to demonstrate the principles and opens the possibility of what is truly possible with complete EAM SC integration.

8.2 CASE STUDY BACKGROUND

Client X is a major sugar producer in South Africa, Swaziland, Malawi, Mozambique, Tanzania, and Zambia. It is an asset intensive organisation with a reputation for solid asset management practices.

The sugar industry has its unique asset management challenges. The industry is seasonal due to the fluctuation in cane sucrose levels. Figure 29 [DNA EAM] shows the varied sucrose recovery for a year. The highest sucrose recovery takes place in August and September. The lowest recovery is during December and January. Due to the low sucrose levels it is not economically viable to crush and produce sugar during these months. This presents a window of opportunity to do a thorough overhaul of a sugar mill. This period is referred to as Offcrop and takes place due to:

- Low sucrose recovery levels
- The abrasive nature of sugar cane and sand that causes extensive wear and tear on equipment requiring a complete overhaul of the mill

During Offcrop, substantial money is spent on two cost centres, namely labour hire and M&R materials. The crushing season runs from January / February to November / December or for 40 to 48 weeks depending on the estimated crop and weather conditions. During the crushing season a maintenance week starts on Monday mornings and ends on Sunday evenings. The majority of maintenance can only take place when the plant is down (not running). Production is paramount to the industry due to the low profit margins. For this reason production and maintenance work closely together and have an

arrangement to stop the plant on a designated time and day and for a predetermined duration. This duration is usually in the order of 6 to 8 hours depending on the production schedule and production figures achieved up to date. This maintenance period is referred to as a Stopday.

Figure 29: Cane Sucrose Levels – Seasonal Variance

The industry has its own measurement of downtime or production lost. It is called Loss Time Available (LTA) and is expressed as a percentage. LTA measures the lost time or plant unavailability for production due to two internal factors:

- Equipment failures or breakdown.
- Operational impact due to operational errors.

LTA excludes all planned maintenance downtime such as the Stopdays and plant stoppages due to external factors outside the control of the sugar mill e.g. no cane, strikes, bad weather, etc. The major contributor to LTA is plant failures.

LTA is a measure of how successful the assets of a sugar mill is managed. The lower the LTA the better a mill is operated. Sugar mills, big or small, use LTA to compare performances and compete on an equal footing with one another. The reason why it is called Lost Time Available is because Head Office makes provision for downtime to forecast the coming year's sugar production figures. The LTA percentage is what a sugar mill is allowed for plant downtime. LTA as set by Head Office fluctuates between 7% and 5%.

8.3 PROBLEM DEFINITION

The sugar industry has been depressed for the last decade due to a surplus of sugar on the international market. That and spiralling maintenance costs (M&R material, labour and tools), industry average asset availability, and reliability meant that margins were under pressure. Client X has a reputation for good asset management practices. Investigations showed that asset management practices were averaged out across the 14 mills. A few mills excelled at asset management, the majority were average and the remainder were poor at it. It was further concluded that a direct correlation between production output and asset management practices existed. Good asset practices meant good production figures / output and visa versa. A second finding was that asset management practices at mills were developed in isolation. The reasons for this:

- Rivalry between mills created a "closed shop" culture.
- Location of mills and distances between mills made cross-pollination difficult.
- Different technologies and mill configurations made asset management standardisation difficult, although not impossible.
- Different CMMS software products or versions limited information sharing.

If that was not enough asset management at each mill operated in a state of limited integration with procurement, inventory management, and logistics for five reasons:

- A best of breed approach to software solutions meant that the inventory management, financial, Human Resources (HR), CMMS and Time and Attendance software packages were purchased and operated separately and integrated only if required. In 1999 the inventory management and financial system were the only integrated softwares for obvious reasons.
- Because mills operated autonomously they chose their own hardware, operating systems and software solutions. Several CMMS solutions and versions were to be found in use within the group.
- Different technology platforms and operating systems made integration of software solutions very difficult.
- CMMS software installations operated as stand alones. If a mill was progressive in its thinking it ran on a network but limited to the planning office only.
- Mills lacked the necessary, up-to-date hardware, Local Area Networks (LAN) and Wide Area Networks (WAN) to run the latest software solutions.

Efforts were made to improve profits and reduce expenses in all operational areas but the "optimise the silo thinking" met with limited success. To the credit of the client, the interdependency between asset management and procurement, inventory management, logistics and production optimisation was

established and the constraints due to a poor or throttled demand signal was realised. To continue optimising procurement, inventory management, and logistics, asset management had to be integrated into the supply chain function. We now know it as the EAM SC model or indirect supply chain.

The year 2000 presented it's own headaches. The majority of CMMS systems in use were not Y2K compliant and new technology platforms (hardware, software, operating systems) kept on making older CMMS packages obsolete.

The pending Y2K threat eventually broke the camel's back. Although asset management practises were average, losing all ability to manage and schedule maintenance would be a disaster to the group.

8.4 THE OPPORTUNITY

Client X saw the Y2K treat as an opportunity to resolve a number of problems at mill level and within the group. The point of departure for asset management would be the CMMS software solutions but the solution could not be done in isolation. A complete solution would have to incorporate various aspects given under the following headings:

Hardware Technology:- The first step taken by Client X was to centralise the IT function, IT support and decision making at Head Office. The second step was to outsource the IT infrastructure and support of the group (mills and Head Office) to an IT outsource specialist. The outsource deal included all IT hardware, LAN, WAN, and the implementation and support of a state of the art operating system. In this case the choice of operating systems fell on Windows Terminal Server (WTS), Citrix Metaframe, Microsoft suite of products and Oracle as the database platform. This in effect created a shared services infrastructure for the group and solved several problems:

- It was now possible to replace near obsolete fileservers, PC, and networks.
- It withdrew the Client from the continuous and ever shortening hardware replacement cycle due to technology redundancy.
- The outsourced deal would introduce technology that was Y2K compliant, thereby reducing the business risk during the millennium switch over.
- The outsourced deal would introduce a standardised (generic) technology platform at each mill and across the group.
- It provided a cost effective solution for hardware and software support, upgrades, etc.
- It made the instantaneous sharing of information between mills possible.

Software Solutions:- With the centralisation of the IT function at Head Office the decision was made to standardise all software solutions within the group. Mills would have input into what they wanted but

the final decision lay at the Steering Committee tasked with selecting the most appropriate software solution for the group. Asset management software solutions became a high priority, as most CMMS would not function after 1999. With the hardware technology, operating systems and database platform defined, and a best of breed approach to software solutions, the question remained, which CMMS solution to use given a tight monetary constraint.

EAM Solution instead of CMMS Solution:- DNA EAM and Maintenance Systems Technology (MST) - a strategic partner - presented the idea of an EAM solution instead of a CMMS solution. Selecting a CMMS solution meant keeping the maintenance function in isolation with limited integration options available (refer to chapter 5.4). An EAM solution that included a procurement, inventory management, HR and time and attendance solution meant that full integration with the supply chain was now possible.

Asset Management instead of Maintenance Management:- With an EAM solution asset management becomes a reality. With integration into procurement, inventory management, HR, Time and Attendance the Maintenance Department can take on the responsibility of effectively and efficiently managing assets. They are enabled to improve the ROI and ROA of the assets they manage.

8.5 THE VALUE PROPOSITION AND PRICING MODEL

Many organisations lack the resources to implement EAM solutions and integrate them with their supply chains. For this reason companies choose to seek help from consultants and advisors before making mistakes with their asset management endeavours. Nor does an EAM solution come cheap. Implementing an EAM option costs between one and three times the value of the software cost. This presents a problem when there is a severe budget constraint.

To motivate the cost of an EAM software solution and implementation, DNA EAM / MST presented a return on investment (ROI) based on the benefits of improved asset management practices and integration with the supply chain. Such a ROI would be impossible for a CMMS implementation. The ROI was related to three savings areas:

- Sucrose related savings due to the reduction in LTA (production).
- Reduction in labour cost due to increased productivity (productivity).
- Savings due to better inventory control (inventory management).

Sucrose related savings due to the reduction in LTA:- In the sugar industry the sucrose recovery is dependent on the sucrose level in the sugar cane. Figure 29 [DNA EAM] is an example of the estimated and actual sucrose content during the 1999-crushing season at a sugar mill in KwaZulu Natal.

There are two ways that increased asset availability and reliability (implies reduced LTA) can influence sucrose recovery and sugar production. Mills are set target tonnages to crush each year as per the crop estimates. By having higher asset availability, mills can shorten the time normally used to crush the target tonnages. Because target tonnages are disposed of earlier, mills have extra time to crush additional crops (see figure 30 [DNA EAM]). Although a good idea, the emphasis is to shorten the crushing season and not increase it, as sucrose levels at the end of a season are low compared with peak levels during August and September. Higher plant availability and reliability means a mill is able to recover extra sucrose during the season when the sucrose levels in the sugar cane are high and the LTA is less. This concept is illustrated in figure 31 [DNA EAM].

The ROI study concluded that a 1% LTA reduction increased the profit of a mill on average by R296, 500 per year (1999 rates). The ROI study calculated an average saving per mill of R420, 000 per mill per year due to increased production or stated in LTA figures, a decrease from 7% to 5.5%. The 1.5% reduction in LTA would be set as a Key Performance Indicator (KPI) against which the success of the EAM implementations would be measured. To reduce the LTA by 1.5% on average meant that DNA EAM / MST had to plan to improve the asset management practices at the mills.

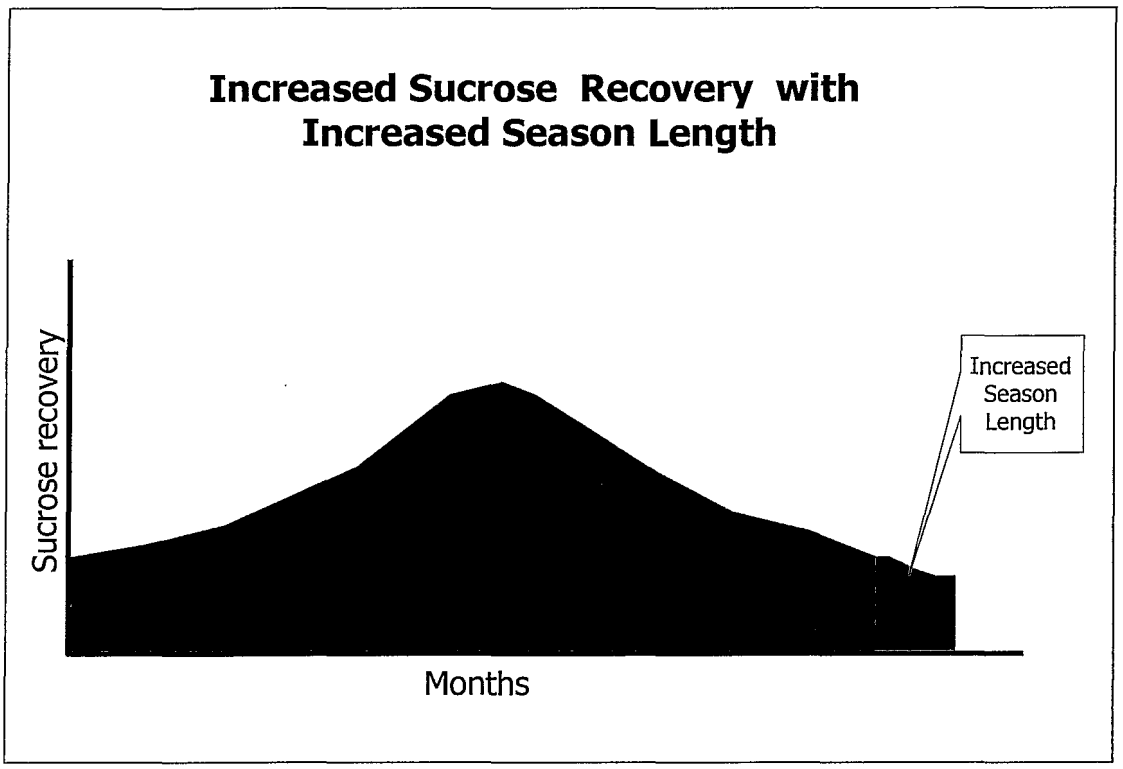

Figure 30: Increased Sucrose Recovery with Increased Season Length

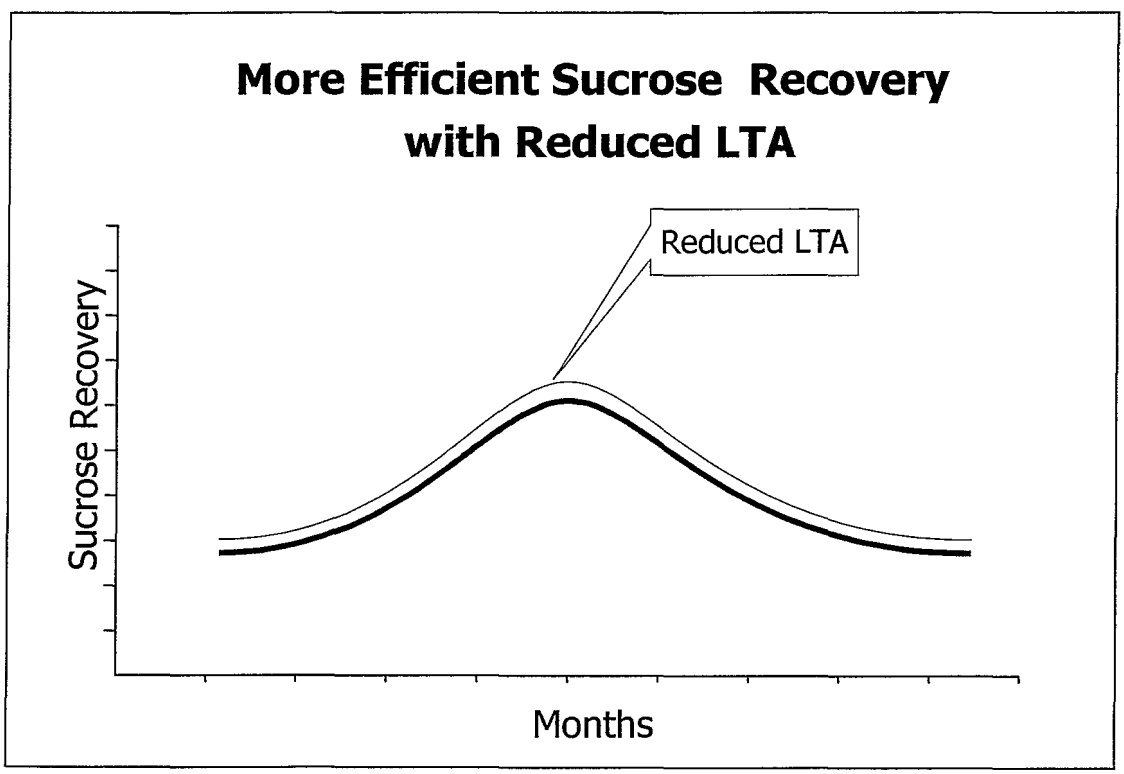

Figure 31: More Efficient Sucrose Recovery with Reduced LTA

Several benefits associated with a reduction in LTA were not included in the ROI calculations. They were as follows:

- During a LTA incident, it is possible for the maintenance teams, with their advanced scheduling techniques, to do opportunity maintenance. This maintenance can result in the reduction of Offcrop maintenance work.
- With less LTA incidences, and better asset management practices, the life cycle of assets are increased.
- During a breakdown, certain hidden costs are incurred e.g. start up costs, primary energy costs, etc. With fewer breakdowns, these costs are minimised.

This shows how complex ROI calculations can become and how difficult it is to establish the true costs of improved asset availability.

Reduction in labour cost due to increased productivity:- There are three areas where labour has a direct impact on maintenance costs. They are normal time, overtime and contract labour. The ROI study concluded that savings were achievable in all three the areas. For normal time a reduction in LTA results in a reduction in season length, which in turn results in a reduction in maintenance operating shifts. Saving on season normal time labour was estimated at 1% of total normal time. Higher plant availability means less time spent on overtime such as call outs, etc. The ROI study estimated a savings of 5% on season maintenance overtime labour due to a lower LTA. This estimate was conservative as industry norms indicated potential savings of up to 12%. With a reduction in the crushing season mills are able to increase the Offcrop period. This means that employed labour has more time to finish the Offcrop and this means a reduction in contract labour.

The ROI study concluded that a reduction in labour costs due to increased plant availability and reliability was in the order of R238, 000 per mill after the implementation of an EAM solution.

Inventory related savings:- Inventory related savings were based on the principle of integrating asset management with inventory management through a M&R demand signal, materials related information i.e. bill of materials, asset tracking, "where used" principle, and a closer (improved) working relationship.

Inventory savings are achievable in two areas. Firstly, it was estimated that there was very slow moving stock at each mill to the value of R1, 000, 000 (represents in the order of 25% of the stock) that can be eliminated over a five-year period. This will result in an annual reduction of R200, 000 that impacts the cash flow. Assuming that this conversion of capital to cash is invested at a rate of 16%, an initial return of R32, 000, stepping up to R160, 000 per year over the five-year period, can be attained. Industry

norms indicate typical savings of between 5 and 10% on the total stock value through the optimisation of slow moving stock.

Secondary savings on the yearly turnover of material purchases can be achieved through improved material control, controlled issuing of materials, and the direct allocation of spares and material usage to specific work orders. The linking of spares (Bill Of Materials) to equipment facilitates validation of material issues to work orders. If it is assumed that a 0.5% saving can be achieved it represents a saving of R80, 000 per year on a yearly materials budget of R16, 000, 000 (1999 figures).

The ROI study concluded that savings due to better inventory control came to R112, 000 per mill after the implementation of an EAM solution.

The ROI study only used "low hanging fruits" to motivate the implementation of an EAM solution instead of resolving a CMMS software crises. During the investigation it became apparent that it is difficult to calculate a ROI for asset management due to:

- A lack of financial information needed to calculate the "true" cost to company of a savings area and opportunity.
- The sheer number of possible inputs or beneficiaries of an integrated or optimised function. One needs to ask how far you want to take the influence or benefit of a savings opportunity.
- The immense number of permutations for a savings opportunity.

Although only 3 savings areas were used in the ROI calculation, this by no means represents the true savings opportunity of a well thought through EAM solution. Figure 32 [DNA EAM] was an attempt to demonstrate the relationship between asset management and the rest of the mill operation and the effect that this relationship can have on the company's bottom line. A lack of financial information and a good understanding of the savings mechanism made it impossible to include these in the ROI calculation.

The purpose of the ROI study was to motivate the costs of implementing an EAM solution based on benefits and savings to the group. Although asset management was the departure point for all calculations the return on investment was realised in the disciplines of production and inventory management. The ROI targeted three savings areas and excluded all possible benefits in the logistics and procurement function. It shows that although asset management is about improving the ROI and ROA of capital-intensive assets through their effective and efficient management, it cannot take place in isolation and requires the indirect supply chain functions to achieve results and savings. Although not clearly stated the ROI shows that the main beneficiary is production and that connectivity with the remainder of the supply chain functions is through the M&R demand signal.

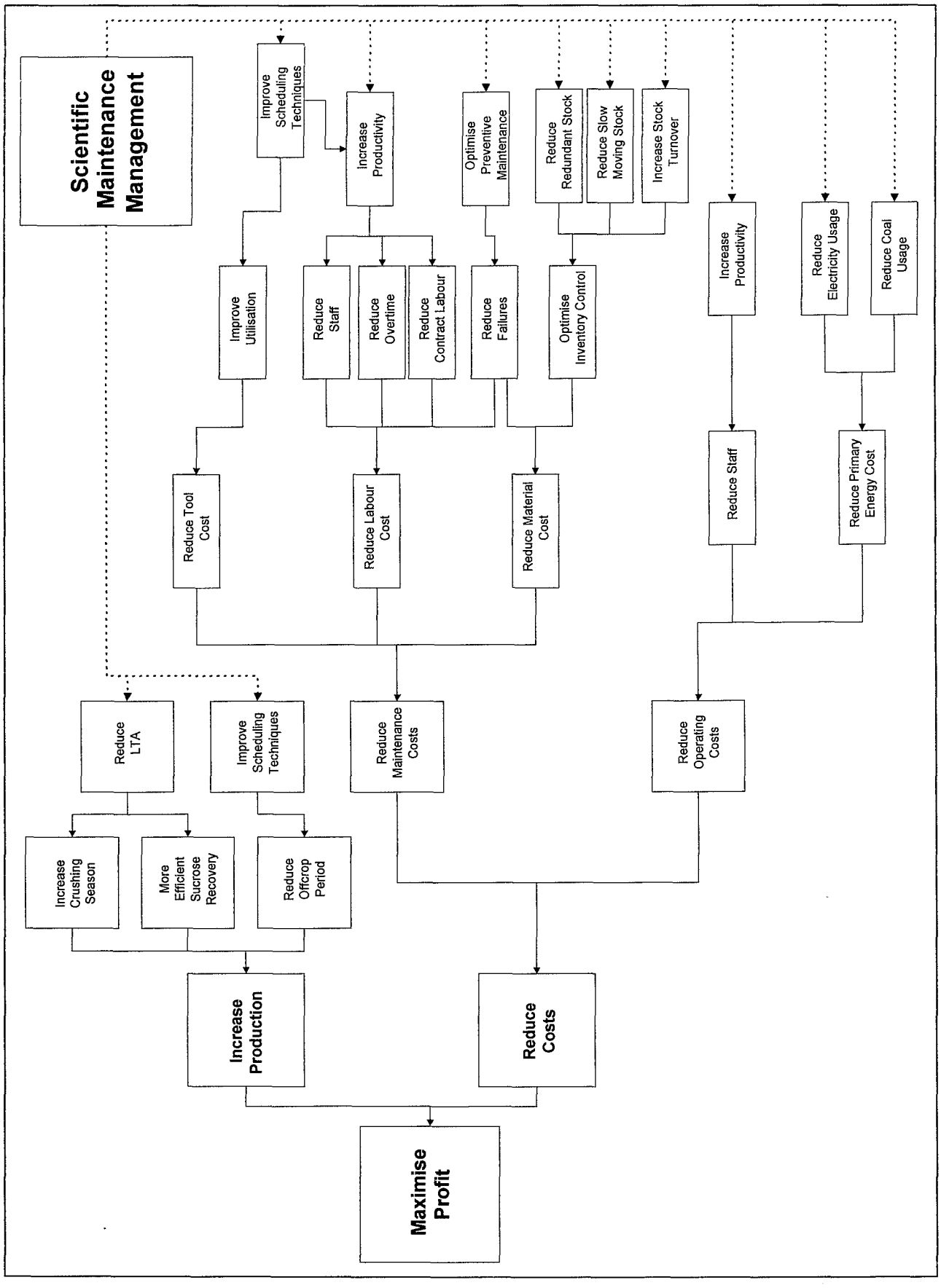

Figure 32: The Relationship of Enterprise Asset Management and a Mill's Profit

As a motivator for an EAM-instead of a CMMS software solution the ROI study concluded that at an implementation cost of R8, 000, 000 the payback period would be just over 2 years. The author believes this figure to be conservative as only three savings areas were factored in. Figure 33 [DNA EAM] is a graphical presentation of the payback profile for the implementation of the EAM solution at Client X.

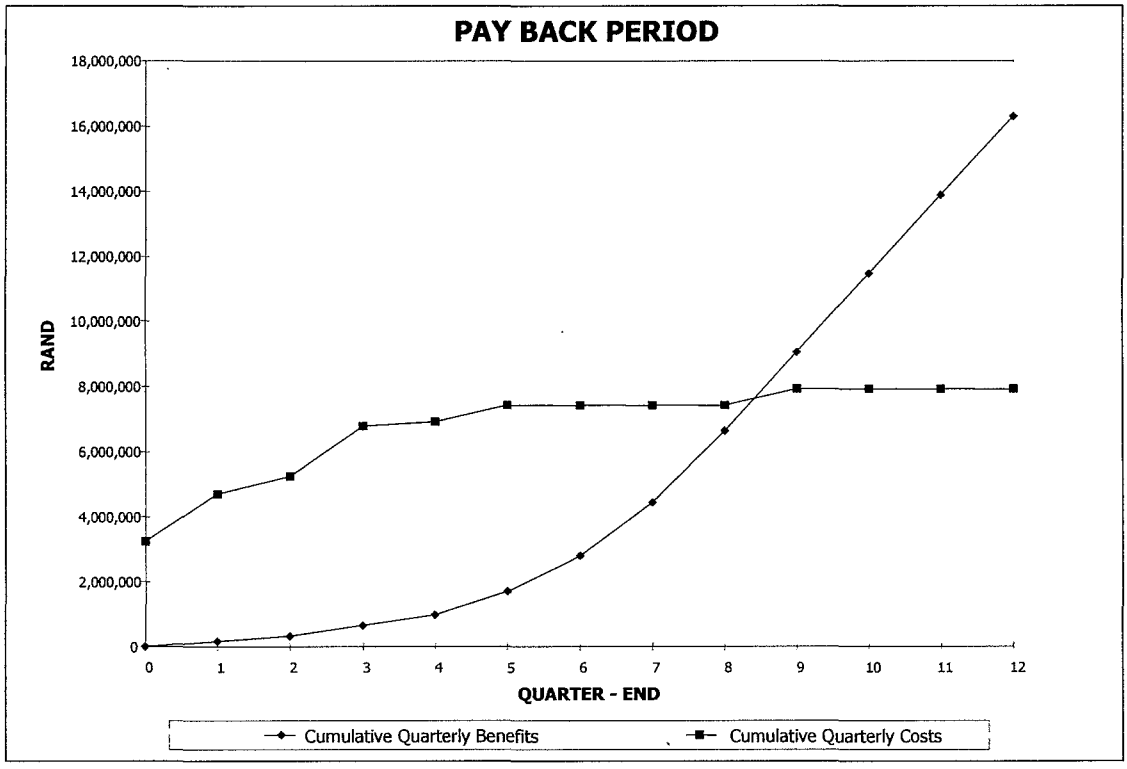

Figure 33: Pay Back Profile for the Implementation of an EAM solution

8.6 THE EAM IMPLEMENTATION

The ROI study sealed the deal for DNA EAM / MST. The author was appointed the project manager for the duration of the project. The scope required the EAM solution to be implemented at 11 mills; 8 in South Africa, 1 in Swaziland and 2 in Malawi.

The ROI document had an unexpected and bigger impact on the project than initially anticipated. The idea behind the ROI was to motivate the cost for an EAM implementation. Client X accepted it but stipulated that the reduction in LTA was to be an additional project KPI. The main drivers for the project became:

- Complete the project on time and
- within budget and
- reduce the current LTA figures per mill as stipulated in the ROI document.

This changed the way the author would usually approach an EAM solution. Instead the project plan reflected the need to optimise asset management practises at the sugar mills. The first change was to relocate the pilot project to the sugar mill with the best asset management practices. The selection criteria used was the mill that had lowest LTA (averaged) over the last three years. This, incidentally, is the group's largest sugar mill and the flagship of the company. The second change was to introduce a process of asset optimisation using RCM (Reliability Centred Maintenance). This required additional money, as this step had not been included in the initial negotiation process. To gain the best results, not only for the pilot site but the remaining mills, the RCM analysis would focus on generic assets found throughout all the sugar mills. Although not an ideal situation for a total asset management optimisation exercise the cumulative benefit across all 11 mills would pay off the small investment in no time at all. Ten generic asset types were selected for the RCM analysis:

1. Boilers
2. Bundle tables
3. Cane knives
4. Centrifugals
5. Conveyors
6. Diffusers
7. Evaporators
8. Pumps
9. Cane shredders
10. Turbo alternators

The idea was not to start an RCM analysis from scratch but use the good asset management practices of the pilot site as a baseline. The third change made was how to affect the transfer of the optimised asset management practices from the pilot plant to the remaining mills. The strategy used was:

- Standardisation of all asset management practices through processes, terminology and asset management parameters.
- Transfer all useful asset management information from the pilot site to the remaining mills so they can use it. This was made possible by the establishment of a baseline database and transferred to the new implementation site. Information transferred included job plans, maintenance schedules, etc.
- Introduce the RCM results to the mill asset managers so that they can implement it at their mills.

The fourth change instituted was intended to break down the "closed shop" culture through a set of frequent asset management workshops to discuss asset management practices, the standardised solution and receive input and feedback from the mills.

The high level project plan used is listed in table 8 [DNA EAM] below. For a breakdown to activity level per phase refer to Appendix B for more information.

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 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 8: High Level EAM Implementation Project Plan for Client X

8.7 RESULTS

Implementation at the pilot project started early in 1998. In the beginning of 1999 the proof that the EAM solution worked gave DNA EAM / MST the green light to continue with a fast track implementation schedule for the remaining mills. All the South African and Swaziland mills were successfully implemented during 1999 in time for the year 2000 deadline. As the Malawian mills had no CMMS systems in use their implementations rolled over to early 2000.

The pilot site started running with the new asset management strategy in 2000. It was agreed that the first results would be measured and compared with the 2001 season. The pilot site had averaged a LTA figure of 3.9% during the 2000 season. The 2001 season yielded a LTA figure of 2.7% - a difference of 1.2% year on year. Because LTA is not a pure reflection of the plant availability and includes operating mishaps, it was felt that the 1.2% improvement in total could not be attributed to the successful EAM

implementation. The ROI analysis had stated a LTA improvement of 1.5%. This was not achieved at the pilot site but the 1.2% improvement must be seen in the full context of the asset management business case. The 1.5% LTA improvement was stated on a baseline LTA figure of 7%. This represents a 21.4% improvement. A 1.2% improvement on 3.9% equals a 30.8% improvement. It is generally accepted that the lower the LTA figure the more difficult it is to improve on it.

Full integration with the financial and inventory management systems using the M&R demand signal was achieved with a batch interface process. Client X has maintained the optimisation initiatives in the remaining supply chain functions. With the new visibility and insight from the EAM solution they should be able to drive down operating costs and continue optimising the silos. Although not stated as a KPI for the successful implementation of the EAM solution it is well worth investigating savings achieved by the integration of asset management with the supply chain.

This year (2002) will provide the second batch of LTA figures for the pilot site and the first for 8 sugar mills. This will provide conclusive evidence as to the success on the EAM implementation at Client X.

8.8 Conclusion

The purpose of the case study was not to document the implementation strategy and steps for an EAM solution but rather to investigate the success that such a solution can achieve. The case study proves the benefit of an asset management approach by seeking fulfilment outside the traditional boundaries of maintenance.