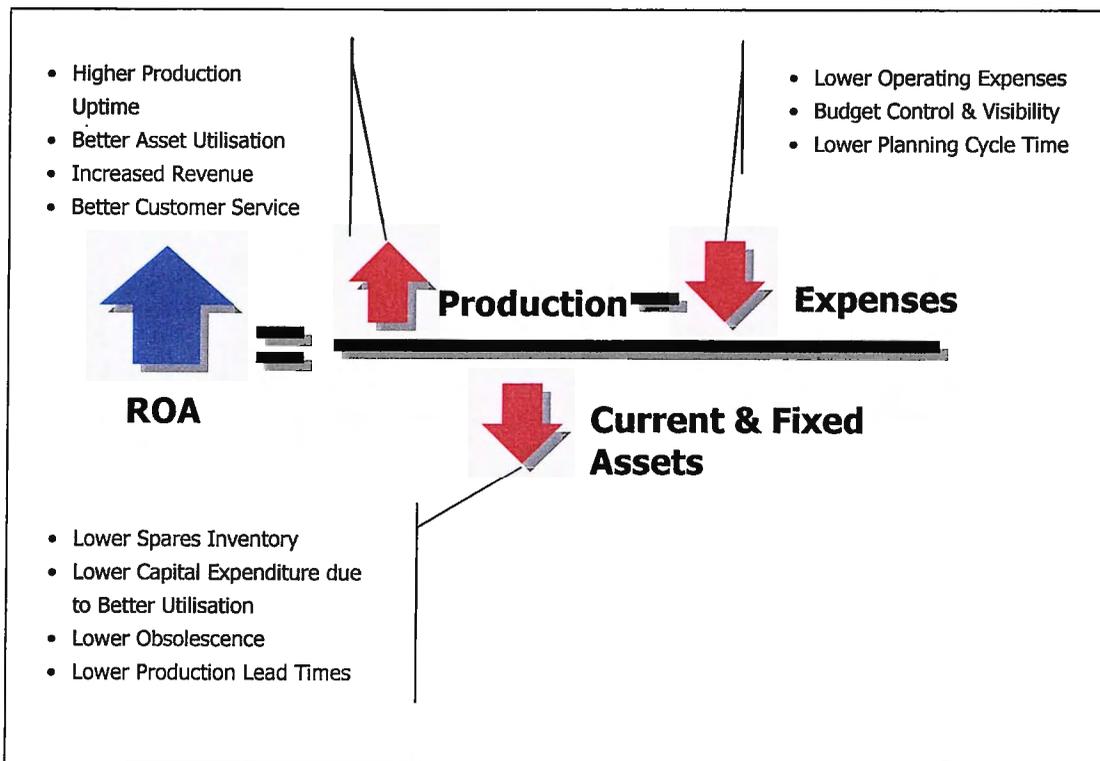


## 6 FEATURES AND BENEFITS OF THE EAM SC MODEL

### 6.1 THE VALUE PROPOSITION FOR INTEGRATION

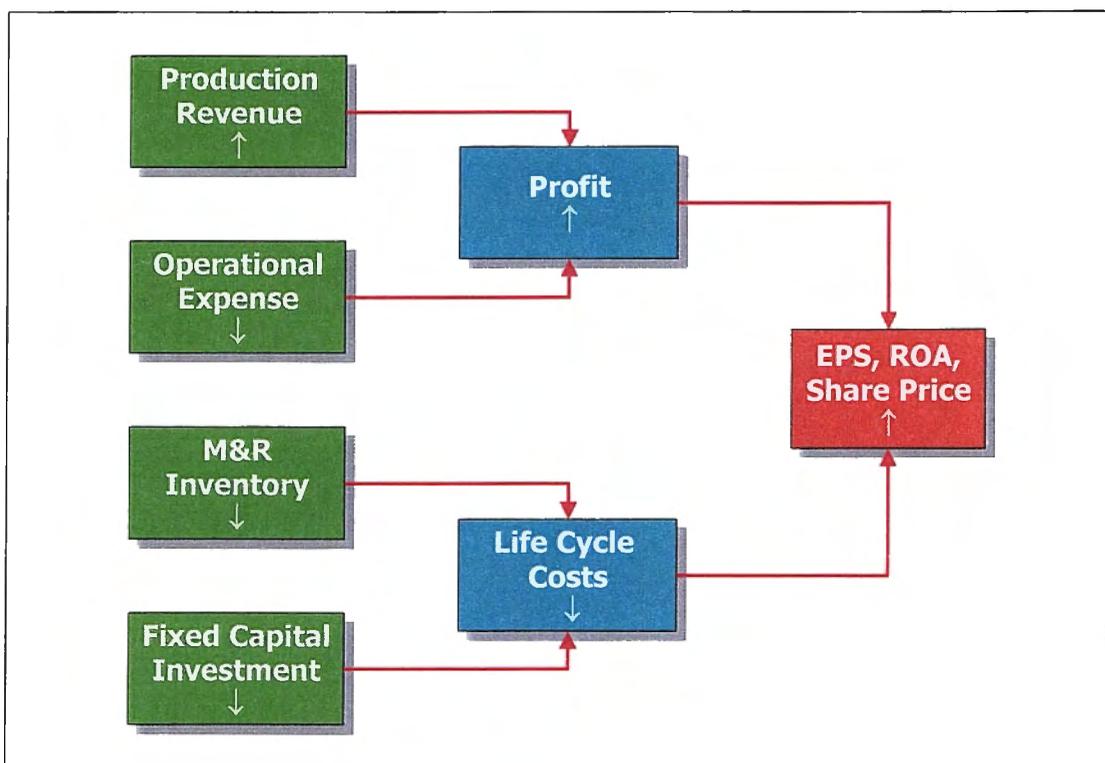
The value proposition of integration asset management with the supply chain is simple: Without integration each discipline, whether it is asset management, procurement, manufacturing, etc. cannot reach their full potential by operating in isolation of each other. Until recently optimisation has usually taken place within the organisational silos. Managers have realised that there are limitations to what they can optimise in isolation, since the way they operate is severely influenced by what happens upstream. Similarly, their decisions and the way they operate within a silo are not always beneficial to the receiver of their service or in support of the organisation's objectives in general. In the worst-case scenario, bad business practices are passed on to the next functional requirement. They make do with what they receive and compound the problem before sending it to the next silo. Something is required to give a birds eye view of the organisation and translate the business strategy into tactical and operational objectives to be executed, within the silos. The top to bottom approach assures integration of all the business structures and can change the way they operate. Upstream input and downstream output is defined according to the overall requirement of the indirect supply chain to the benefit of the organisation. Restructuring followed by optimisation of a business structure can now take place with the knowledge that it is in line with the bigger picture not afforded to them previously.



**Figure 17:** The EAM Value Proposition

A case in mind is enterprise asset management. EAM is the discipline of improving the ROI (Return Of Investment) and ROA (Return On Assets) of capital-intensive assets through their effective and efficient management. Figure 17 [DNA EAM] demonstrates the value proposition for asset management. To increase the ROA requires an increase in the production and productivity and a decrease in operational expenses and support costs for an asset. Maintenance and maintenance optimisation is the way to make this possible but to bank the money requires fulfilment in the indirect supply chain disciplines of production, procurement, logistics, and inventory warehousing. Increasing the availability of an asset means little if production cannot make use of it and produce more. Measuring the ROA then becomes of theoretical significance as asset managers only use it to report on their success within their KPA and KPI structures and is of no benefit to the organisation since it is not translated into increased production revenues or profits.

A value proposition is always reduced to a commercial proposition (something tangible). Figure 18 [DNA EAM] shows the commercial proposition for integrating asset management with the supply chain.



**Figure 18:** Indirect Supply Chain Commercial Value Proposition

It is a compelling and broad proposition. The first tier increases profits through the production revenue stream and decreases operational expenses (e.g. maintenance, procurement, etc.). The second tier aims to reduce asset life cycle support and investment costs through the reduction in M&R inventories and investment costs in capital assets. The difference between increased profits and reduced asset life cycle

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costs means a higher Earnings Per Share (EPS) and share price of a company. When substituted in the equation of figure 17 it reflects an increased ROA.

The next four paragraphs will address the value proposition of integrating enterprise asset management with the indirect supply chain functions of production, inventory management, procurement, and logistics. Not all of the benefits can be translated into a monetary saving or profit but assists the organisation to better understand and manage itself to become more streamlined and competitive.

## **6.2 EAM INTEGRATED WITH PRODUCTION**

In certain instances the benefit of integration is a one-sided affair as is the case with the integration of asset management and manufacturing. The traditional relationship between maintenance and production has always been strained. Maintenance is tasked with a service delivery to production to ensure that they can produce the goods. In return production hands back a plant in need of repairs, modifications or redesign. The uneasy relationship is severely tested when production figures are not met due to an unreliable plant that breaks down at the most inopportune times.

What the indirect supply chain does is place the focus on asset management and support thereof through maintenance and supply chain functions. Nowhere in the indirect supply chain is manufacturing / production directly mentioned but it is the biggest beneficiary when assets operate as intended and required.

One cannot over-emphasise the fact that the indirect supply chain gives an organisation the opportunity to view itself in a different way or vantage point. Because asset management is the focus of the indirect supply chain and is measured through the ROI and ROA of assets, production becomes a means of realising success. It becomes part of the cycle to fulfil asset management.

The possibilities of integration between asset management and manufacturing are endless and can take place at any level and need not be listed in table 4. Each organisation presents its own opportunity due to their unique way of doing things. What is important is that the opportunities are translated into benefits for both disciplines and the organisation in general. The typical steps that an opportunity will go through are:

- Recognise the opportunity.
- Gain knowledge and understand the value proposition for all concerned.
- Implementation.
- Measure and report.
- Optimise integrated function (usually at the source).

It is difficult to point out ways that disciplines can integrate with each other but it is safe to say that processes, information, communication, and people are popular methods that makes it happen.

Table 4 lists integration features, taken predominantly from asset management with the implication (usually on the production side) and benefits. It is not a comprehensive list. Each organisation with its unique way of doing business will present other opportunities and benefits.

FEATURES	IMPLICATION	BENEFIT
Change from corrective to preventive maintenance (Source:- EAM)	- Increased plant / asset availability and reliability	- Increased production revenue - Increased ROI / ROA - Reduced life cycle costs (LCC)
Planned maintenance schedules to execute preventive maintenance  (Source:- EAM)	- Scheduled equipment up and downtime - Integrated production and maintenance planning possible - Better production scheduling and forecasting capabilities - Predictable environment conducive to realistic production simulation to simulate resources, raw materials, etc. - Better end-product quality	- Increased production revenue - Increased ROI / ROA - Reduced operational costs (maintenance and production) - Reduced losses associated with unexpected stoppages
Planned corrective maintenance  (Source:- EAM)	- Arranged / agreed equipment downtime - Integrated production and maintenance planning possible - Production extension planning - Better maintenance planning	- Reduced operational costs (maintenance and production) - Reduced losses associated with unexpected stoppages
Maintenance history (e.g. failures) and understanding of assets  (Source:- CMMS and EAM)	- Identification of asset modification or redesign - Better operating practices and retraining of operators based on maintenance history - Better maintenance and production integration through shared responsibilities - Better end product quality	- Increased production revenue - Increased ROI / ROA - Reduced operational costs (maintenance and production) - Reduced losses associated with unexpected stoppages
Modifications and redesign (Source:- RCM, CMMS and EAM)	- Production de-bottlenecking - Increased plant / asset availability and reliability	- Increased production revenue - Increased ROI / ROA
Increased production and maintenance cooperation (Source:- EAM and Production)	- Multi skilling and training that reduces maintenance attention required by assets - Increased responsibility (ownership) by operators	- Increased production revenue - Increased ROI / ROA - Reduced operational costs (maintenance and production)

**Table 4:** Features and Benefits of Integrating EAM with Manufacturing

The list shows a progressive move, changing to preventive maintenance to full production and maintenance cooperation. The final result is a stable environment to work in, and scheduled and forecasted production. This in turn initiates a planned supply chain service for raw materials necessary

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for production. The supply chain provides the best service and benefit when it is timeously informed and activated.

### **6.3 EAM INTEGRATED WITH INVENTORY MANAGEMENT**

Of all the disciplines within the indirect supply chain, inventory management has the greatest challenge in meeting the customer's needs and expectations. In a manufacturing organisation that is asset intensive they have two clients; production and asset managers. Both require that the correct materials be held in a satisfactory condition and immediately available when called on but have totally different inventory management principles. Production inventory management is characterised by the management of small to moderate numbers of items in very large quantities, from a small and constrained set of vendors, with short lead times and high inventory turnover cycles. Just the opposite is true for assets. Asset inventory management needs to manage small quantities of a very large selection of parts and equal large number of suppliers with medium to long lead times and low inventory turnover cycles.

Inventory management has come a long way in addressing the requirements of productivity. They have successfully integrated their processes with production through concepts such as Material Requirement Planning (MRP I) and Manufacturing Resource Planning (MRP II). MRP I is described as a system to support manufacturing organisations by the timely release of production purchase orders using the production plan for finished goods to determine the materials required to make the product. Purchase orders for regular demand items are phased over time to ensure that the flow of raw materials and in progress inventories matches the production schedule for finished products. Three inputs are used for the MRP I process. They are, the master production schedule, the inventory status records and product structure records. It shows that inventory management is fully integrated with the direct supply chain and MRP I and II operate on a pull system from inventories.

Inventory management for MRO materials was created for several reasons:

- The severe impact that an asset failure can have on production output.
- A requirement to have the M&R material immediately available when such a failure occurs.
- The need for a buffer to offset time delays to procure, manufacture and deliver M&R materials – referred to as lead time.

The fact that small quantities of a large selection of M&R materials from an equally large number of suppliers are required adds to the misery of an inventory manager. Not having M&R materials available to replace a failed item is referred to as a shortage cost. A shortage cost is defined as the economic consequence of an external or internal inability to meet a demand from stock. External impacts can include back orders costs, present profit loss from lost sales and future profit loss from loss of goodwill

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and reputation. Internal impacts can include lost production, production rescheduling and delays in completion dates.

The initial tendency of an organisation is to stock up on all possible M&R items. The task of selecting M&R materials to be held in stores is left to asset managers. If they have no scientific asset management database or inventory management knowledge it is difficult to make the correct selection. This creates a dangerous situation as millions are sunk into spares that cost a lot, have low turnover cycles and seemingly no return on monies invested by a company. It is due to this high asset support cost that the phrases "holding cost" and "stock carrying cost" were coined. Holding cost is the cost associated with holding one unit of an item in stock for one period of time incorporating elements to cover capital costs for stock, taxes, insurance, storage handling, administration, shrinkage, obsolescence, and deterioration. Stock carrying costs is the total cost associated with holding stock. The costs consist of the unit purchase cost, the reorder cost, the holding cost and stock out or shortage cost. They have different viewpoints but are both efforts to assist asset managers in understanding and quantifying MRO inventory management.

The unknown and unforeseen nature of asset management and the demand that it places on inventory management resulted in the development of terminologies to quantify and qualify M&R material demand.

They include:

- minimum and maximum stock levels
- minimum and maximum order quantities
- reorder points and reorder quantities
- safety stock (SS)
- strategic stock
- economic order quantities (EOQ)
- economic order interval (EOI)
- redundant / obsolete stock
- lead times
- shelf life
- ABC analysis, etc.

The case can be argued that some of the terms are as a result of raw materials demand but these terminologies are better suited to manage slow moving items with medium to long lead times – the typical profile of M&R material.

The challenge to businesses is to find the proper amount of inventory that is neither excessive nor unsafe in the case of unexpected events [Cook, 2001] and avoid stocking non-critical parts whenever possible.



FEATURES	IMPLICATION	BENEFIT
Integrated maintenance and inventory planning  (Source:- EAM and IM)	- Vendor analysis with input from both disciplines - Joint review of inventory holding levels and parameters	- Approved vendor, OEM and alternative supplier lists - Improved service levels for asset management - Reduced inventory stock levels

**Table 5:** Features and Benefits of Integrating EAM with Inventory Management

In certain instances it is inevitable that asset management and inventory management have to work together to gain the benefit of a new discipline or service. An example of one such a discipline is cataloguing. Cataloguing is a best practices methodology that incorporates engineering expertise with superior materials and inventory management principles in managing descriptions of spare parts. For more information to implement item cataloguing refer to appendix D for the high-level process flow chart. With cataloguing inventory items are uniformly described to pre-determined templates and bar coded. Refer to appendix E for item catalogue examples. This provides a common language allowing better communication between the maintenance end-users, inventory controllers and suppliers alike by providing easy access to correct item specifications. The data structure allows users to search, purchase and maintain parts in a consistent manner either by descriptions or supplier part or drawing numbers. An example of a service is consignment stock. Consignment stock places the responsibility to manage a selected range of inventory items, on site on behalf of stores on an approved materials supplier.

In this integrated relationship asset management is the receiver of services from inventory management. It is now possible to set up service levels and, if problems persist, retrace them through the inventory management demand signal and EAM processes. In inventory management service levels are understood to be the desired probability that a demand can be met from stock, which can be expressed in a number of ways:

- Percentage of orders completely satisfied from stock.
- Percentage of M&R materials demanded which are met from stock.
- Percentage of M&R materials that are delivered on time.
- Percentage of time there is stock available.

These percentages are referred to as fill rates and is an item based measurement that shows the percentage of demands that were met at the time they were placed. Fill rate only measures what happens when demand occurs.

In conclusion, inventory management integrated with asset management has tremendous benefits for both disciplines and the profitability of the company. Such integration results in a pull system when asset

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management changes to preventive maintenance and the demand signal can be used for inventory forecasting. The integration principle is very similar to the MRP concept. It can be described as a system to support manufacturing asset intensive organisations by the timely release of M&R material purchase orders, using a preventive maintenance schedule for maintenance significant assets, to determine the materials required. Orders for critical demand items are phased over time to ensure that the flow of M&R materials and in progress inventories match the maintenance schedule. Three inputs are used for the integrated process. They are the maintenance schedule, the inventory status records, and the asset bill of materials (BOM).

## **6.4 EAM INTEGRATED WITH SOURCING AND PROCUREMENT**

At first it would seem that procurement has little to benefit from the EAM SC model. Procurement will always be performed irrespective of whether the Purchase Order (PO) has a high priority or not.

In paragraph 4.2 it was stated that the demand signal initiates the procurement function. As the current situation stands, a company that is reactive with regards to asset management will be characterised by a high number of purchase orders, with high priorities, few line items and small purchase values. Purchase Requisitions (PR) are placed on a low level within the organisation (on the maintenance execution level) and maverick purchasing is the order of the day. Each time a PO is executed an administration fee is incurred. In South Africa this cost is anything between R250 and R500 a purchase order. A company pays the price when the M&R demand signal is poorly planned and erratic.

The EAM SC model has a role to play in purchasing although the benefits are less obvious. It is partly correct that EAM with the improved demand signal must initiate procurement of M&R materials. The ideal situation is reached when asset management with inventory management are integrated so that both initiate procurement. Remembering that inventory optimisation becomes possible with the input from asset management, procurement of M&R materials becomes an informed decision or an automated process due to inventory management parameters such as minimum stock levels, lead times, economic order quantities (EOQ), economic order intervals (EOI), etc. Ideally asset management should only initiate procurement of M&R materials for two situations. They are:

- Planned corrective maintenance.
- Plant modifications.

Table 6 shows the progressive integration features and benefits as asset management and inventory management is integrated with procurement. New technologies are available to complement an integrated asset management and procurement solution. One such technology is source-based or image

based procurement. Image based procurement is a process that converts physical catalogues to on-line digital searchable catalogues and links it to an online transactional (procurement) system. Using a mix of

FEATURES	IMPLICATION	BENEFIT
Change from corrective to preventive maintenance  (Source:- EAM)	<ul style="list-style-type: none"> <li>- Planned M&amp;R material usage</li> <li>- Replacement frequency for M&amp;R material</li> </ul>	<ul style="list-style-type: none"> <li>- Improved procurement practices</li> <li>- Planned, consolidated and scheduled procurement</li> <li>- Reduced maverick purchases</li> <li>- Reduced procurement administration costs</li> </ul>
Integrated maintenance and inventory planning  (Source:- EAM and IM)	<ul style="list-style-type: none"> <li>- Predefined replacement and procurement parameters               <ul style="list-style-type: none"> <li>- Reorder points and reorder quantities</li> <li>- Minimum and maximum stock levels</li> <li>- Minimum and maximum order quantities</li> <li>- Economic order quantities (EOQ)</li> <li>- Economic order interval (EOI), etc.</li> </ul> </li> <li>- Approved vendor, OEM and alternative supplier lists</li> <li>- Asset and inventory management parameters as procurement parameters</li> </ul>	<ul style="list-style-type: none"> <li>- Reorder management (Automated procurement)</li> <li>- Consolidated purchasing</li> <li>- Reduced administration costs</li> <li>- Reduced maverick purchases</li> <li>- Optimised procurement practices</li> <li>- Simplified procurement processes</li> <li>- Lead time management</li> <li>- Effective order expediting process</li> </ul>
Supplier management  (Source:- Procurement)	<ul style="list-style-type: none"> <li>- Consolidation of orders on suppliers</li> <li>- Procurement forecasting</li> <li>- Price benchmarking</li> </ul>	<ul style="list-style-type: none"> <li>- Increased bargaining power to drive down item procurement costs</li> <li>- Strategic sourcing possible</li> <li>- Able to set-up service level agreements with suppliers</li> <li>- Reduced item procurement costs</li> <li>- Peace of mind that company is getting good or the best prices</li> </ul>

**Table 6:** Features and Benefits of Integrating EAM and IM with Procurement

cataloguing technologies, automated business processes and a holistic data model, product information and images from suppliers' documentation are extracted and the data is then replicated into searchable "knowledge libraries". This can be integrated with dynamic information, such as price and availability. Refer to appendix F and G for more information on how image-based procurement works as well as an example. The benefits lie in the ease of procurement as the procurement process is simplified, selection of material is fast and accurate and a streamlined workflow process ensures that the right people are informed of the purchase (for approval).

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## **6.5 EAM INTEGRATED WITH LOGISTICS**

Procurement initiates the logistics process to collect or deliver M&R materials from suppliers and deliver it to stores. Logistics is the furthest removed from asset management and receives no direct benefit from good asset management principles and demand signals.

Where cost can be saved is when the logistics function belongs to the organisation (directly through transport assets owned or indirectly through the management of single service or 3PL's, or a 4PL service provider) and when the demand for M&R material is planned in order to provide sufficient time for logistics to work its magic. Logistics optimisation is a field all on its own with unique methods to optimise a distribution or collection network. As input, it requires a demand signal to collect and deliver M&R materials within a specified time from a predetermined location. Within logistics this is referred to as visibility and planning capacity. The better the advance warning and time the greater the cost savings opportunities within the logistics supply chain through techniques such as load consolidation, route planning, etc. This can only be achieved when an organisation decides on a proactive approach to asset management, inventory management and procurement.

The ultimate proof that an organisation has integrated asset management with the supply chain is when it can practice and sustain the Just In Time (JIT) principle for M&R materials. JIT is a dependent inventory control philosophy, which views asset management as a system in which all operations, including the delivery of M&R materials needed for maintenance, occur just at the time they are needed [Cook, 2001]. Thus stock holding of materials is virtually eliminated. JIT is only possible if a good demand signal exists and asset management has successfully been incorporated with the supply chain. JIT fully supports the principle of getting the right part in the right condition at the right place at the required time.

## **6.6 CONCLUSION**

The overall value proposition of integrating asset management with the supply chain lies in the increased understanding and cooperation between organisational structure "silos" which is to the benefit of the company. The indirect supply chain provides a bird's eye and overall view of the business and uses a top to bottom approach to translate business strategy into tactical objectives and operational execution. The commercial focus is to increase profits by increasing production revenue and driving down operational expenses, and reducing the life cycle cost of assets by decreasing M&R inventories and asset support costs.

Integrating EAM with the supply chain means integration with production, inventory management, sourcing and procurement, and logistics. This chapter has sought to explain, not only the benefits of integrating EAM with the SC functions, but also what benefit this is to asset management. The EAM SC

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model encapsulates all the disciplines needed to fulfil the mandate of asset management. In other words, to improve the ROI and ROA of assets through their effective and efficient management. In isolation, asset management is unable to affect any results.