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RESEARCH ONLINE

THE ROLE OF ASSET MANAGEMENT IN ENTERPRISE STRATEGY SUCCESS

R Dwight & K El-Akruti

Summary: The paper reports on early work to research the connection between asset management and the successful implementation of enterprise strategies.
Several case-study examples are reported that highlight the nature of the connections between the asset management function and the enterprise.
This is part of on-going research to determine the mechanisms required by organisations to simultaneously deal with the coordination and integration of life-cycle management of physical assets. Together with managing the operation systems and the business systems within the organisation to drive toward performance improvement, sustainability and growth required for short and long-term success.

Keywords: Engineering, Asset Management, Strategy, Strategic Planning

1 INTRODUCTION

This paper communicates a live research activity and seeks input to it.

The development of a discipline called variously: engineering, physical, or infrastructure, 'asset management' seems to have been born out of the idea that the collection of activities it represents is important to organisations. Popular guides, particularly BSI PAS 55-1, 2004, propose the activities belonging to, or contributing to, an asset management system. Despite the popular movement surrounding the term asset management there remains a lack of understanding of the exact nature of its role in ensuring the competitive advantage of organisations.

Possibly most papers presented in these proceedings will contain a definition of asset management. Published answers, from some Swiss utilities(Kostic 2003) to the question; "What is asset management for you?': resulted in some interesting reflections: "It is mastering the state of the equipment at any moment, i.e. knowing quantitatively in what shape your equipment is;". "It is the identification of assets through the GIS (Geographic Information System);" "It is the support for computing the ROI (return on investments) and the value of the assets;" "It is about what equipment to buy, or whether to buy shares in a generating unit;" "It is all the legal issues related to asset ownership." Certainly, the essence of asset management can be drawn out of an amalgam of these responses.

In a run-down of the organisational functions that the survey respondents considered to be part of asset management is instructive: "strategy and policy definition, fault management, asset value history and location, planning tools (system capacity, security, losses), risk management (system security, asset criticality), system performance, health & safety policies, customer information, financial performance. This is consistent with the idea that a whole set of both technical and managerial activities, and not a single one, form the process of asset management.

While it is not the purpose of this paper to review or adjudicate on the range of published definitions of asset management, its definition does provide the context for the research. BSI PAS 55-1(2004) defines asset management as "... systematic and coordinated activities and practices through which an organisation optimally manages its assets, and their associated performance, risks and expenditures over their life for the purpose of achieving its organisational strategic plan." This specific identification of the focus on the organisational strategic plan is the focus of this research, i.e. the establishment of exactly what this link needs to be and how it should be enacted. A difficulty with this definition is that it is laden with words more relevant to establishing how well it is done as opposed to defining it in itself. Particularly the words 'systematic and coordinated', and 'optimally managed', imply that unless these undeterminable performance standards are met then asset management is not being practiced. It is suspected that the implication is that adherence to what this particular guide suggests is the only way to manage assets.

Topical to this conference, the 'Asset Management Council', (Asset Management Council, 2009) as an organisation, has published a succinct definition of asset management as: "The life cycle management of physical assets to achieve the stated outputs of the enterprise". We offer the following definition of 'engineering' asset management: "those activities that together provide the tools, or engineered means by which organisations satisfy their customers with reference to the competitive

strategy of that organisation" (Dwight, 2006). It is suggested that this definition is largely consistent with the PAS 55-1 definition but unburdened by imbedded performance standards. It contains the essence of the Asset Management Council definition. For the purposes of this research, it emphasises the interrelationships between the asset management activities and the business strategy and implementation activities of an organisation.

The success of an organisation often depends on its ability to utilise assets efficiently. Thus, asset management is regarded as an essential technical as well as a business process in many organisations. The objective is to identify its role in contributing not just to an organisation's financial objectives but providing the capability to cope with business and environmental change.

The work we report on seeks to develop evidence-based guidance on the important interrelationships between functions of engineering asset management and relationships with the organisational strategy development process. The fact that the problem exists needs to be established. Further, a research methodology is not obvious. It is expected that exposure of this work to the broader engineering community will assist in its focus on issues restricting the appropriate development of this discipline.

2 NATURE OF THE PROBLEM

To establish this research, the problem needs to be established. The scope of asset management: the possible functions involved and the basic interrelationships may be well understood. The problem put forward is that organisations are not sufficiently aware of the required activities and interrelationships between activities to properly prioritise their establishment.

Systems engineering principles are synonymous with asset management. In fact the issue considered here stems from a view that the enterprise is a system. Changes to that system require consideration of their effect on the system as a whole. Of course this is not a new idea. Sub-optimisation was drawn attention to in management literature many years ago.

For the record, the definition of a system used here is as stated by : MIL-STD-499B:

"A system is a composite of people, products, and processes that provides a capability to satisfy stated needs. A complete system includes the facilities, equipment (hardware and software), material, services, data, skilled personnel, and techniques required to achieve, provide, and sustain system effectiveness"

Al Marsomi(1997) draws attention to other critical aspects of a systems view:

"A system is also defined as an orderly set of interdependent, interactive elements functioning together to achieve a central objective or set of objectives (e.g. a factory, department, university, hospital)"

The point here is that these general concepts raise the question as to what the key interrelationships are. How do these impact on organisational performance, particularly its implementation of changes in strategy? How do these interrelationships and so implied functions within the organisation and its asset management system need to be configured to sustain the competitive advantage of the organisation? It is proposed that these are questions yet to be resolved.

A view of asset management from a life-cycle perspective

In order to progress the discussion on asset management and its key interrelationships, an appropriate view of the phases of asset management is required. Most authors view the life-cycle from a product perspective (for example: Blanchard and Fabrycky,2006, Eyre-Jackson and Winstone, 1999, Ouertani, Parlikad et al.,2008).

Figure 1 illustrates a view of the asset life from an asset owner/operator's perspective. It considers that the focus of an asset management system is on a collection of assets, not a single asset, i.e. not a product that is sold to a customer but the means of its production. The focus is on how an organisation manages its existing assets in conformance to all stakeholders' requirements. Concurrently organisations must identify the need, and make decisions, to launch any change project for the enhancement of their operation, maintenance, logistics support, innovation, upgrading, development, expansion or extension, technology insertion or knowledge support and their refurbishment, early replacement. The organisation must also manage asset retirement and disposal. From this perspective, the activity of asset management begins with an existing organisation. Typically, this organisation has existing assets. It follows that the starting point and central stage in the life is the utilisation stage. Any decision concerning other stages in the life is built on the accumulated information of managing this stage.

The acquisition, or procurement, phase of the total system is considered to have a project management focus. However, it provides the basic information for asset management to use and build on to establish the asset management practice. Conversely, asset management must have a strong influence over the performance standards for the acquisition phase.

The utilisation phase is the longest and involves many stages as depicted in Figure 1. The operational stage is not limited to operation and maintenance but involves any change that may be done on the assets or in the way assets are managed. The stage includes all activities involved in most effectively maintaining asset availability (condition or health), longevity, capability and

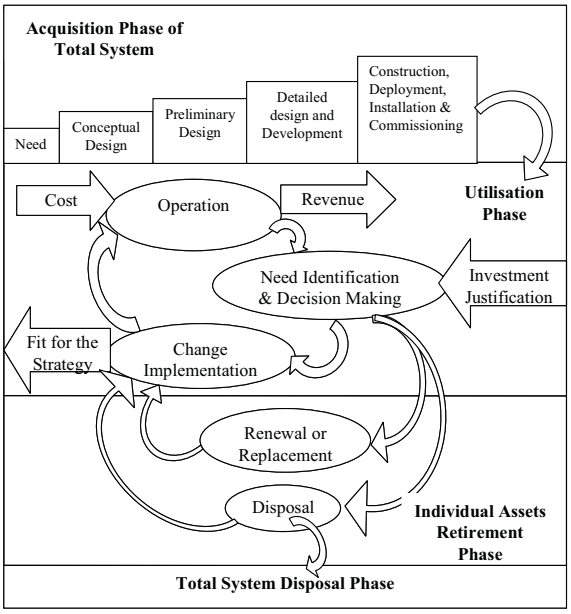

Figure 1 Stages in the Asset Management Process

performance for the optimum operation output. During this stage of operation and maintenance it is essential to simultaneously monitor, define and prepare the information for the next stage, which is the identification of changed needs and decisions to alter the assets: the need identification and decision-making stage.

This monitoring process should be aligned with appropriate analysis to trade-off the cost of improving asset condition against improved performance, functional capability against future strategic expectation, revenue and benefit against cost, risk and conformance to stakeholders' requirements.

The implementation stage: acquisition and deployment of new or modified assets, involves acquiring all activities involved in technical and financial analysis, justification, and planning for acquisition of new requirements such new assets, components or technology and know-how, as well as managing the acquisition process.

Renewal or retirement is treated separately to the implementation stage. It involves the replacement or refurbishment of individual assets according to the benefits of improved condition.

The retirement stage of the whole system is conditional on the last two phases. It may not occur due to the continuous replacement, upgrading and developments within the previous two phases.

Suspected drivers of limited integration of asset management and enterprise strategy development

The challenge in managing the entire asset life effectively lies in the fact that costs are isolated and addressed in a fragmented way through the various stages. During the acquisition phase, the emphasis is on implementing a project within the boundaries of the approved budget and prescribed time frame, while ensuring that the facility conforms to the technical specifications. The need identification, alternative analysis and project selection are largely dominated by a business management focus. The decisions are considered strategic and not normally closely linked to the engineering technical perspective within the organisation. The technical facet of asset management is often left in isolation of the organisation's strategic process. Maintenance is typically considered as a 'necessary evil' and not involved at the strategic level as a business issue. Ouertani, Parlikad et al. (2008) give voice to the argument that, being the longest and most complex life stage, operate/maintain often deserves additional attention. However, maintenance is only one of the variables in managing assets. Others include choosing the right assets, using them appropriately, and balancing short-term performance against long-term sustainability.

From a life cycle perspective, natural barriers exist between the stages of the asset's life. It is reasonable to suspect that the various stages, as identified in Figure 1, occur sequentially. They typically require different skills and different organisation structures to conduct effectively. Interfaces need to be built through numerous barriers. These include temporal, cultural, knowledge, organisational objective, and often-commercial barriers.

These barriers can only be overcome with management structures. The effort required, the types of structure and the benefits gained from such structures are context specific and, we argue, not yet proceduralised. Organisations have difficulty in devising these structures and justifying them. It is hoped that some general rules, based on a specific context, can be compiled. This is to be done in this research by examining some actual organisations. Through this process it is suspected that the nature of the required rules can be built up.

Difficult nature of the asset management process

It is suggested that an organisation's management system can be viewed from two disciplines: the operations management discipline: purchase material-operate-deliver goods or service; and, the assets management discipline: identify need-acquire

assets-maintain- keep, develop or replace. While these two disciplines are interdependent in action, the former is directly related to the business and easily governed by the finance budgeting for short-term cost and profitability. The latter is more directly associated with strategic value. This value is hard to quantify due to the uncertainty or risk involved that influences the investment decision and also the unclear intangible relation with business or stakeholders needs in general.

Asset management in an industrial or engineering perspective is distinguished from other operations management perspectives by asset life considerations. These include optimisation of performance and cost, budget and investment justification as ratios to return on spending, impact due to alternative business strategies as effects on improvement, innovation of assets and their management systems and risk as to quantifying and preventing failures.

It has long been recognised that asset management is interdisciplinary by nature (e.g. Geraerds,1972) and its system implication in the various contexts may be manifest in many ways. These include:

1. The continuous process of evaluation and control of asset status during their life commencing at the definition of need or stakeholders' requirements and as a project management and carrying on through the rest of the asset's life until disposal.
2. The management of innovation or change: upgrade or/and adjust in design; technology; knowledge of the systems and its complexity of interdependencies of elements or assets, to achieve a certain level of improvement or sustainability.
3. The institution of a planning and control board to review and evaluate potential impact of changes in the environment externally or internally the effectiveness of possible changes or adjustment within the system, to maintain system harmony and manage the incorporation of such change and the retrofit provision.
4. Organisation-wide cooperation, coordination and team-working between departments such as maintenance, operations, engineering and business departments through the institution of structure and the incorporation of mechanisms: the dynamic capabilities of the asset management systems. This allows integration of business processes such as financial investment and accounting budget, technical processes such as production planning, quality control and asset reliability in maintenance and innovation processes such as R & D, market research and project management.
5. The system that allows for alignment through interfaces not just for asset operation links but also to pursue reconciliation of objectives and integrating for achieving a common goal.
6. The integration of information systems to link assets performance to the overall performance and allow for common goal achievement.
7. Involvement of people to stimulate them into one organisation-based workforce to transform objectives, policies, plans and control procedures around the assets into effective action to achieve the overall goals.
8. The configuration of the 'value chain' between strategic goals and asset performance achievement and associated cost and value drivers, for the contribution to the organisation's competitive advantage, growth and sustainability.

As such, the study of interrelationships between entities within organisations is a key.

3 EXPLORATION OF RESEARCH METHODOLOGY

Given that our objective is to develop evidence-based knowledge to guide organisations, the derived problem is that research to establish and quantify these relationships requires careful consideration in order to build a credible body of knowledge. While this is not the forum to argue the finer points of research design, the nature of the problem and our proposed solution can usefully be exposed.

Physical assets constitute the focus of concern and purpose on which asset management is developed. However, human or social aspects provide the means by which asset management can manage those physical assets. The combination of the two and the exposure to other perspectives such as business or environment makes it impossible for 'controlled experiment' (Geraerds, 1972) as a means to satisfy the purpose of research; instead other means based on trial of application, case studies or surveys must be adopted.

Iravani and Duenyas (2002) indicate that the common practice of making maintenance and production decisions separately can be rather costly and that there are significant benefits for making these decisions in an integrated fashion. The same was demonstrated for a make-to-stock production system consisting of a single deteriorating machine, which produces a single item. Jonsson (1999) re-emphasises that integration of maintenance produces better results. Data gathered and analysed from 293 Swedish maintenance managers in manufacturing firms showed that integration and long-term planning of maintenance affects prevention, quality improvement and manufacturing capabilities. Here, the survey method is useful in highlighting the existence of a relationship but does not provide or suggest how the relation takes place or how it can be managed.

Research on TQM, JIT and TPM, for example, generally investigate the implementation and impact of these programs in isolation. However, many researchers believe and argue conceptually the value of understanding the joint implementation of these management approaches. Cua and McKone et al. (2001) investigate the practices those three programs simultaneously. They provide evidence of compatibility of the practices in the three programs. This is not surprising since the programs either originate from the same need or were built one on the other.

Research methods so far employed in asset management vary but typically:

1. Conducting a case study, or case studies, dominates as the method used. This is not without good reason as we later explain.
2. A large number of the case studies are descriptive, involving a description of a technique already in practice. Its applicability more generally and the underlying reasons for any success claimed is not normally provided.
3. Surveys are used but mostly as a tool to prove a theoretical point, such as evidence of the existence of a relation between elements or parameters. These do not provide a means for managing such relationships. For example, using a survey, Jonsson (1999) established that integration of maintenance produces better results. How the relation takes place or how it can be managed is not elicited.
4. There are problems in applying quantitative optimisation models including data problems and the gap between theory and practice. Thus applications of these models are very limited in industry.

In designing research in asset management there also exist a variety of problems of interdependence and unclear boundary due to the open-system nature of the activity. This makes it hard to assigning variables to causal relationships. Asset management problems are hard to distinguish from operations' management or general management. They necessarily overlap into these areas.

The boundary line between production or asset management and the operation or maintenance techniques is hazy at best. This is also an inherited characteristic of the research process in asset management. For example, Dwight (1999, 30) defined the maintenance system as: "those activities in an organisation that apply resources to control actual technical system behaviour, given the operation undertaken and the configuration of the technical system, with the aim of achieving the goals of the operation". The relative importance of systems was emphasised. Problems must be analysed in terms of the overall performance of the organisation. A concentration on technical systems, asset management, may not be justified and the real issues may be in marketing or finance or personnel for that matter (Dwight 1999,82).

In the light of this view, researching asset management is differentiated by its integrative reconciling nature. Its purpose is the balancing and bringing together the objectives of a wide range of disciplines within an organisation. Asset management links physical assets, business systems, humans and processes to the overall goals of the organisation. In terms of content, from the practical challenge, research in asset management is inherently interdisciplinary.

Figure 2 provides some illustration of the relationships within the activity of asset management and its research.

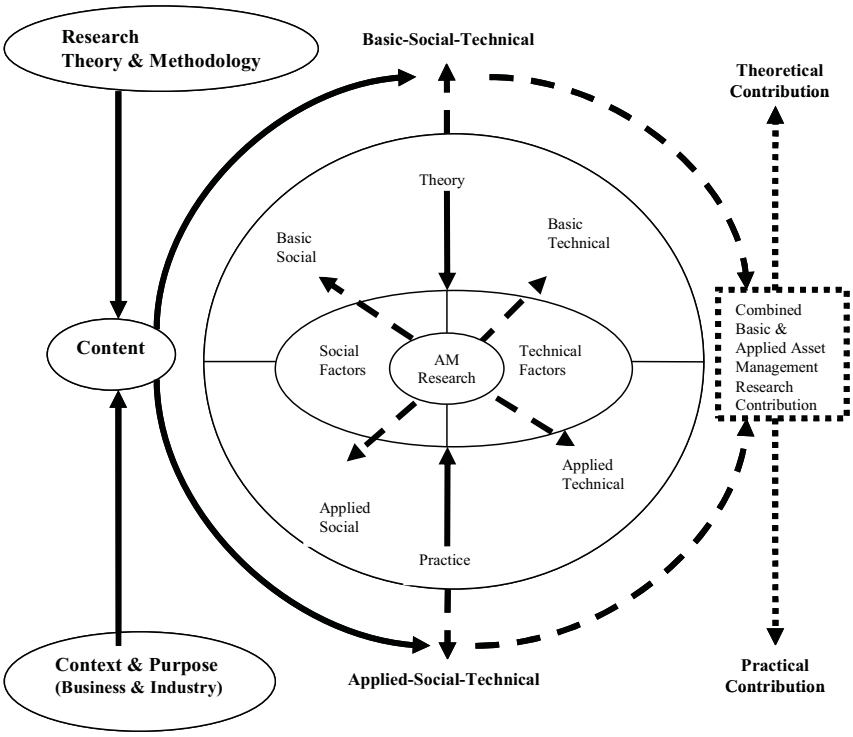

Figure 2 Purpose and Context for Asset Management Research

For knowledge generation and dissemination in theory and practice the research process in asset management requires the involvement of researchers and reflective practitioners. This balanced approach to research will not only contribute practically and theoretically but will provide bi-directional learning environment.

The research method chosen for this research is termed 'retroductive'. The researcher constructs a hypothesised model: structure and mechanism, which can then be used as a template. The aim is to search for evidence of the consequences of its existence; if it exists then certain events would occur. Blaikie (2000) states that: "The retroductive strategy uses creative imagination, metaphors and analogy to work back from data to an explanation".

The aim of this research is to identify the real underlining structure or mechanism that has been previously hidden or requires selection from a number of possibilities. This extends to a lack of knowledge of the required relationships between the asset management system and the strategic change process. These are depicted in Figure 3.

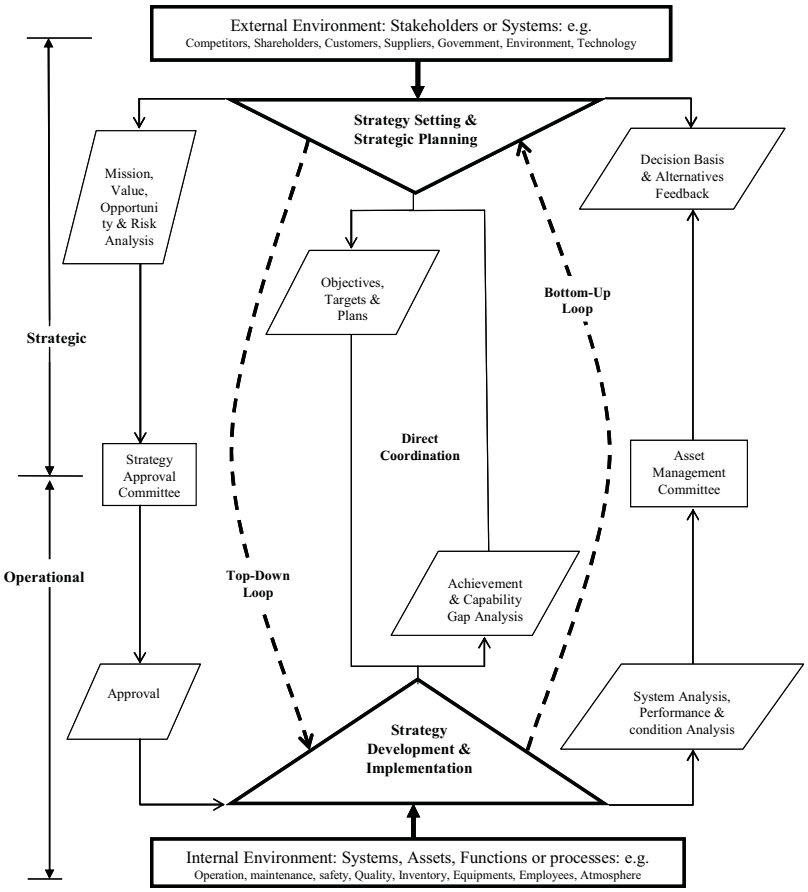

Figure 3 Strategy Formulation Cycle

4 ILLUSTRATION OF THE PROBLEM

The difficulties surrounding integration and interrelationships associated with the link between strategy development and its implementation have been identified as a general issue. Varma, Reklaitis et al (2007) observe that in the area of new product development, management may opt for a portfolio of projects to position the firm into preferred market segments only to later discover that current resources are heavily overbooked and will not be able to meet commercialization targets.

Some anecdotal evidence of the problem focused on asset management has been collected. Some initial work using the research methodology selected has also yielded some examples that highlight the problem and the scope to provide solutions. Research has begun within a major, off-shore, steel producer. Preliminary work in an off-shore steel company using key informants identified apparently missing elements. Results of interviews capture what is a wider issue:

"my experience tells me that [capital project] initiations [are] somehow not well connected to our company objectives [or] the rest of the systems in the company and some of them turned out not fully satisfying our need".

Organisations need decision processes that account for the interrelationships within the total organisational system. An example is the typical decision of whether to outsource an activity, evidenced by the following extract:

"there are different opinions on outsourcing..debates on adopting it.[could be resolved well] if the organisation has some sort of mechanism to make the analysis".

Specific details of a example offered was stated as:

"After 25 years of operation, our company has invested heavily in rolling mills expansion projects…to increase capacity and final products mix for real opportunities in the market. These expansions were based on full utilisation (3 shifts-8 hours/shift-7 days/week) of all six furnaces…However, no consideration was given to the increased requirements of maintenance of the furnaces and casting machines. Now days we are facing a decline in the performance of furnaces and casting machines as well as experiencing many breakdown events due to operation overloading and high deterioration rate of many components. This has led to unutilised capacity of these new projects due to the decline in the production rate of [upstream processes]. Now the company cannot afford any investment for expansion in these [upstream processes] and suffering from the high maintenance cost for steel making and casting processes. It is good that this financial crisis gave us a break."

Other relevant comments include:

"I am having a hard time convincing the purchasing department to buy internal cooling rolls instead of the old external cooling one"

"There are many new technologies that we should be using … but who is going to take the decision about adopting these technologies?"

"Usually we achieve our production targets but cases where targets were not achieved were because of inadequate coordination between operation, maintenance and quality. Breakdown or failures of some components and the required maintenance are usually the limiting factors."

Some preceding work (El-Akruti, 1999) provides a more specific example of the problem:

In a capital intensive steel production company, an effort was made to reduce the final product unit cost for the purpose of gaining a better competitive position in the market. In response to this mission a decision was made to purchase lining refractory from one supplier, the cheapest. The previous acquisition strategy was based on maintaining continuous supply of the lining by long-term purchasing contract from three suppliers. The decision to change the purchasing approach, a strategic change, was based on comparing the life cycle length which was relatively the same for three of them but with big difference in purchasing cost. Eventually it was realised, however, that the cheaper product resulted in a significant increase in minor stoppages which far outweighed the initial cost advantage. The annual refractory lining life cycle cost had increased by a percentage ranging from 10 to 15% on what is a major contributor to maintenance costs of that facility. The results were shocking and hard to see or understand for many managers because this increase of cost was mainly a contribution from lost production due to stoppages and delays and not really much from refractory lining capital cost or repair material cost (El-Akruti 1999,167). The increase in refractory lining cost was not reflected by the final product unit cost because of the contribution to cost reduction from other areas.

This procurement example is put forward to illustrate how a sub-optimisation strategy in purchasing ends up with negative impact on operation cost and the contribution to the overall strategy of optimisation and the final product unit cost reduction was value destruction instead of the intended value creation. This functional decision process within the purchasing system did not include the appropriate analysis because such analysis was not on its agenda. The decision process focused only on the direct acquisition and manufacturing cost but failed to foresee the intangible costs perhaps because these intangible costs are not presented in the accounting and financial sheets. In fact, there was no responsible management entity allocated to carrying out such analysis, requiring integration of operational and asset management factors. The structure and mechanism to do such analysis, integrate the decision process between departments, and define the real impacts, was not established in the organisation. This case indicates one of the roots to the impact of asset management on the strategy development and implementation and highlights the need for doing this research.

5 SOME GOOD PRACTICES OBSERVED

Organisations whose business success is inextricably linked to asset management tend to place importance on an integrated asset management system. A study of asset replacement at MTRCorporation, Hong Kong, (Scarf and Dwight et al, 2005) for example, highlighted the value of establishing key interrelationships.

It was found that the asset replacement process required: "sound engineering know-how and an understanding of the system and its functional requirement; appropriate decision criteria; the availability of data and methods for the collection of data; a decision making process that is adaptable to both business conditions and engineering factors as they evolve; and re-appraisal and stopping rules for the consideration of emerging factors since a decisions process is sequential in nature."

It was discovered that the asset replacement decision procedure at MTRCorporation, embodied in an 'asset replacement management framework' included key activities:

1. Identification of asset lives based on the 'design life' stated at initial purchase.
2. A number of key horizons triggering analysis and decision making.

3. Supported analysis of options by the line manager in conjunction with as Asset Replacement Manager.
4. Study working group formation to develop options and recommendations.
5. Process for the inclusion of justified projects in the [capital] budget.

What was evident was that the processes surrounding the asset replacement process were integrated into an overall asset management process. Line staff were provided with support to allow them to initiate and analyse asset condition and remaining life through an 'asset replacement steering group'. The decisions taken rely on an overall system of setting asset criticalities, tracking asset life and budgeting processes informed by this information.

A published case study (Holland, Shaw et al. 2005) reports that "BP connects its business processes with over 1500 suppliers to co-ordinate the maintenance, operation and repair of specialised exploration and production equipment. The research illustrates the innovative use of business-process management software within an analytical framework that incorporates strategic, business process, technological and organisational perspectives….The common system enables a common organisation in terms of management …business processes are the fundamental building blocks in the system."

The question remains as to the key interdependencies for organisations in general and the benefits gained relative to any cost involved in establishing and maintaining asset management processes that support them.

6 CONCLUSION

The evidence is that a well-coordinated asset management system leads to better outcomes for organisations. The interrelationships between organisational strategy development and implementation and the asset management system is considered to be key to an organisation's success. The nature of asset management results in natural barriers to the linking of processes to support the required interrelationships. This is driven by the interdisciplinary and disparate nature of the various life phases of the system of assets that combine to support an organisation's productive capacity.

So far the nature of the support required to facilitate the required level of interaction between asset management functions and other organisational functions in the context of changes in strategy have not been proceduralised sufficiently to guide organisations.

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