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Key processes in asset management for 21st century—maximizing business and IT strategy integration

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Increased competition in today's global economy has put mineral industry under excessive pressure to effectively manage production assets to generate business wealth. Capital intensive industry (CII) organizations are seeking ways to manage skill resources, internal processes, and organizational networks with a view to reduce the cost of ownership of assets and increase efficiency of operations and service. The emerging concept of Enterprise Asset Management (EAM) is a collection of business processes that allow CII with right focus on return on investment on assets, to make right decisions on planning, acquisition, maintenance, operation, rehabilitation, and disposal of assets. Information technology (IT) can drive significant returns if the infrastructure covers seamlessly all business processes and all systems, like geographic information system, maintenance management, investment management, laboratory information management, and supervisory control and data acquisition system. The simple approach to IT in the past with disconnected silos of technology, information, and business processes cannot deliver the expected benefits under the modern business environment. Identification of business and application component is a prerequisite for the development of an asset management system that links effectively disciplined processes having characteristics of agility, speed, and integration. This paper discusses various issues and outlines the steps for developing an asset management roadmap in an organizsation. It also presents major business and application components of the system.

Keywords: Enterprise asset management, Business architecture, Business component, Application component, Asset ownership, Asset operations, Information technology, Capital Intensive industry

Introduction

Asset management is a framework to effectively manage production assets to generate business wealth. Its significance has grown considerably in the competitive business environment of capital intensive industry (CII) like mining, power, water, cement, paper, railway, road transport, airline, non-discrete manufacturing, defense. Mining organization faces challenges in managing capital investment and seeks ways to improve the business vision towards return on assets. Initiatives are taken to look for ways to develop skill resources, internal processes, organizational networks and drive out inefficiencies in the management of assets in all facets of production, and delivery of product or services to a customer.

Enterprise asset management (EAM), the expression coined by Gartner Group, is an enterprise level concept like ERP for asset intensive industries. EAM involves factors that influence profitability, maximize output allowing organization to make right decisions to minimize the total cost of ownership (TCO) of assets across its life cycle. TCO is expressed as the cost of owning, maintaining, and replacing assets in procurement, operations and disposal stages. Figure 1 presents the life cycle concept of assets. Long-term programme is adopted to track the life cycle cost of individual assets, improve service levels, increase efficiency in spare parts management, reduce duration and cost of planned and unplanned outages, automating field force.

Focus of EAM in capital intensive industry

In capital intensive industry, the focus has always been on the performance of equipment or plant as a system. The profitability depends mainly on the return on assets and the entire planning of the production targets depends solely on the predictions regarding the asset availability. Success in business depends essentially on company's ability to understand the bottlenecks related to functioning of assets and predict the loss if they become unavailable.

In majority of cases, the planning process in CII organization focuses mainly on scheduling of available production resources without properly addressing the asset requirements. The general assumption is, asset would always be available whenever needed. A fixed percentage is thus, always assigned to take care of maintenance of the assets. The assets are required to perform with maximum availability and perfect quality, at design capacity or functionality. However, assets fail to deliver required capacity as frequent breakdowns arise out of inefficient management of production assets. This disrupts the schedule generated by the production planning and makes it unreliable. Premises where EAM can generate value are:

- Earning is based on its asset utilization
- Investment for creation of new assets is a primary concern
- Traditional ERP packages lacks in asset care functionality

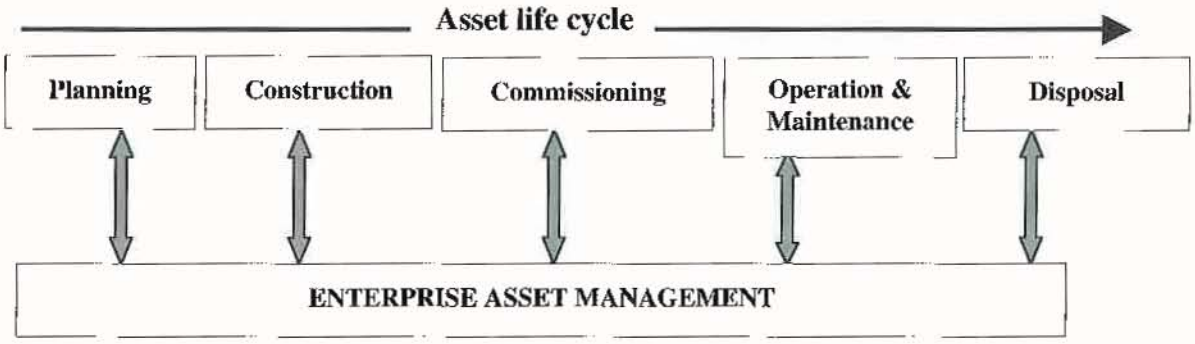

Figure 1. Asset life cycle management

- Emphasis on managing asset base scattered over a wide geographical area
- Upkeep of plant and machinery is important for revenue generation
- Compulsion to operate asset beyond controllable stretched limit
- Demand to extend the life cycle of assets for greater return from them
- Decision making to improve asset performance and utilization is based on in-process information
- Higher MRO purchases in an asset-centric operation environment
- Process upset usually leads to a failure of the process equipment
- Downtime results in a unrecoverable production loss in 24-hour operations

In mining industry, management has specific interests in the area of management of plant and equipment care, efficient handling of inventory, development of human skills, creation and distribution of process and functional knowledge, re-engineering of processes, management of mining deposit. Asset management looks into all these aspects and presents a transformation plan composed of cultural, process and technology strategies to move the organization from present to the desired state. It represents a comprehensive, top-down approach and systematic process of maintaining, upgrading, and operating production assets for better utilization and reduced total cost of ownership. It combines management principles with sound business practice tools to facilitate a more organized, logical approach to decision making.

Value creation through asset management

Financial services sector uses the term 'asset' to mean capital investments. In economic term, an asset is defined as a resource used to create economic wealth. In business perspective, an asset is an advantage that can be considered as wealth or property for increasing operational performance in a production environment by virtue of its worth, value and quality. In modern business philosophy, the definition extends beyond the capital to include professional management of equipment and physical infrastructure installed in the production facility, data and information, people, processes and knowledge to increase efficiencies in manufacturing or servicing. Asset is a term to describe key resources that a company may own or has an access to and which are critical to the company's long-term development and success.

In asset management, the notion of value creation is based around a key set of priorities, improving operating efficiency, removing wastes, and enhancing productivity. All three have interdependency at the strategic level to effectively maximize overall performance—or value. In resource planning model, asset management means cost saving. But, in a capital-intensive industry, asset management is perceived as a means for creation of business wealth. The value of asset management is best represented by the concept of Return on Investment (ROI). The profit component of ROI is the sum of the reduced costs in managing assets and increase in asset value by minimizing lost opportunity. To the owners and managers, the lost opportunity component hinges on maximizing value delivery to customer.

Asset management = profitability × productivity

From a financial perspective, organizational asset has value that, when efficiently managed increases in value. The economic value of asset management is realized by generating additional returns as a result of investment made to develop an asset management system. The return-on-investment (ROI) is represented by Profitability × Productivity. Substantial ROI is realized in two forms, by reducing development costs and increasing revenue from assets. The asset management system quickly pays for itself and generates potentially huge cost savings while increasing the 'revenue' of the enterprise by increasing its availability and use. The responsibility for value management generally lies with operational managers who are under tremendous pressure to deliver capacity to production, by improving operational decision-making in respect of management of assets. However, an interconnected, value-creating organization has to be established to provide clear linkages between strategic, tactical and operational thinking on asset management. Relationships between different management functions in the value chain and the balance of resources across the value chain has to be clearly understood for creating sustainable competitive advantage. This will also help in aligning objectives and performance measures across the value chain.

The philosophy therefore, has to be in line with increasing profitability and improving productivity. This can only be achieved by improving processes to reduce costs, to make assets available more quickly and reduce downtime, information availability to avoid unnecessary costs, information availability to reduce time to solve problems, optimizing capital budgets and deployment of capital in optimal fashion.

Realization of asset value

Asset management provides a strategy to move an organization from resource-driven to asset-driven state and

includes strategic, tactical and operational business processes to achieve better business performance. It includes interaction with external environment, development of asset strategy, nurturing key processes and handling core business functions across the organization. The overall business objective is to improve the quality of services currently being delivered by the business to customers. The concept is extended to involve asset owner, manager and operator by making the data, document and knowledge on assets available to the decision-makers. The capability addresses the requirements of regulatory bodies and customers, to measure total lifecycle cost of ownership of assets, to manage assets based on capital investment.

Asset management enhances the capabilities of traditional maintenance management process by streamlining maintenance supply chain yielding large financial and time-savings benefits. It re-engineers other processes like investment management, customer care. Control of documents like drawings, manuals associated with a particular asset or process will enhance the decision-making capabilities of the users. Asset management tools allow the user to drill down in the equipment hierarchy to a particular component showing problem areas. The use of hand-held palm tops assists in collecting data and instantaneously load information into the system from the field. The process also enables sending work orders to field force in remote locations. The value of asset management is realized through:

- Increased asset performance generates revenue
- Extend asset life delays in investment
- Improved maintenance practices reduces customer complaints
- Better strategy reduces MRO procurement lead time
- Investment management processes improve capital productivity
- Field force automation increases labour productivity
- Asset life cycle management reduces cost of ownership
- Better MIS monitors performance indicators
- Alarm management reduces breakdown and outages
- Document management maintains consistency in performance
- Knowledge management captures history and adds to better decision making
- Geographic information systems expedites redressal of customer complaints
- Condition monitoring improves asset life
- Improved work management processes reduce maintenance time and costs.

Extended area of focus

Consolidation is a fundamental enabler of integrated value chains. For any cost-conscious organization, consolidation is a practical undertaking to address strategic payoff that exceeds the operational and cost benefits. As asset management initiatives mature the business progressively, exposes its key processes beyond the boundary of the enterprise to include wider audience like customers, suppliers, and regulatory authorities. All these can be achieved by implementing an effective asset management system across the business enterprise eventually to manage business processes and consider taking a big step towards using information technology as a tool to manage business vision. The flexibility of an asset management system also helps in integrating other enterprise solutions like enterprise resource planning, supply chain management, customer relationship management systems.

Changing model of asset management

The enhanced annual expenditure on assets has changed the perspective of organization in order to maintain long-term view on asset base, towards building strong relationships with the customer and external entities. The increasing pressures to improve performance have led to a widespread reassessment of the core operating model of asset management. There are models being considered due to change in outlook of business houses towards managing their business. Organizations having experience in the management of multiple asset bases across various industrial sectors aim at delivering services through various self-managed service providers. Asset manager drives decision-making within the business to achieve the core financial and non-financial business values set down by the asset owner across the entire asset lifecycle. New business philosophy in asset-intensive industry necessitates best practice performance at each level of asset management value chain. No single organization can demand having core competencies, vision and commitment in all areas like asset ownership, asset management or asset operation. Each layer aims at functioning independently towards achieving its vision without compromising with other layers.

Asset intensive organization recognizes the need for a radical change to separate three layers to its internal extreme and operate each layer as separate business entities. Asset management functions are getting consolidated around these layers with emerging defined roles and responsibilities. Asset owner sets the business values and parameters of cost and performance. Asset manager focuses on asset strategy, policy definition, and investment management. Asset operator concentrates on delivering services to customers.

Asset ownership layer aims at achieving business excellence by focusing on business performance and developing business strategies that create opportunity and manage risk, building core competencies in forecasting and managing revenue and costs. This layer is responsible for ensuring return on assets, earnings growth, management of revenue/costs and responsiveness to stakeholders. Asset ownership layer directs asset management layer to meet asset performance goal.

Asset management layer enables asset-driven decision-making through policy definition, investment and maintenance planning and contract management. It builds core competencies in analysis, economic lifecycle and managing asset-related risk, leverages information technology to manage accurate and timely information. It drives strategic asset planning, balances financial, technical, and socio-political components of asset investments, holistic consideration of spending and delivers performance accountability. Asset management assigns activities to the asset operation layer.

Asset operation layer aims at delivering service excellence through core skill of delivering services to customer efficiently and effectively. It works towards creating values for customers by providing quality work. The core competency of the layer is in work management and operations. The layer drives best in class processes, effective use of resources, supply chain efficiencies, customer satisfaction.

Application of information technology

The key to success in establishing best-practice asset management system is development of effective business process, which systematically draws information on the

performance of asset base. The lifeblood of the initiative is better information support to decision making on the management of asset base. Information technology provides the capability. It is also an important consideration to improve efficiency and ensure mobility of field force engaged in the management of assets. Technology involved in asset management is not new but the understanding of its significance on key business processes is crucial in developing the strategy to increase company's bottom line. Most important aspect of implementing technology is the framework that links various systems like geographic data management, field force automation, maintenance management, laboratory information management and data acquisition and management to meet the asset management vision. Business and IT managers are increasingly turning to key IT concepts such as mobile computing, alarm management, rule-based engine for maintenance to achieve business benefits. The simple approach to IT in the past has resulted in disconnected silos of technology, information, and business processes delivering poor business vision. Integrated asset management vision provides a holistic, overall business perspective that reflects the characteristics of agility, speed, and integration of disciplined process—from planning, designing to disposal of assets. It focuses on a holistic system needed by CII organization in a modern businesss environment.

Asset management system development

Asset management system helps in moving an asset intensive organization from a resource-driven state to an asset-driven state by aligning application component in line with business requirement, strategic, core and support processes. It is a prerequisite to implement asset management system, to initiate organizational changes, aligns processes and delivers operational excellence. The change warrants the engagement of entire organization focusing on implementing best practices across multiple sites to achieve operational goals. The philosophy of developing asset management system ensures that technology is deployed as planned in support of overall business goals of the organization and provides a simple and affordable means to exchange data between different applications. It also allows easy building of a comprehensive enterprise repository by consolidating information from multiple sources. An enterprise level system provides a clear and vivid picture of an entire business and delivers asset management capabilities in all their dimensions and complexity. When each employee in the organization is able to easily access, modify, and utilize valuable asset information in real time, the organization has transitioned from resource-driven state to asset-driven state. Asset management system extends the visibility and reach of individuals in the organization to achieve asset management vision. In a nutshell, the system provides a rich, continually updated picture of the enterprise accessible to all interested users. It combines strategy, structure, and core capabilities into a simple framework that helps prioritize business and technology initiatives, introduce and manage change, and evaluate performance against the universal benchmarks. Business, application and technical architecture are developed before finally arriving at the architecture to implement an asset management system in the organization. Figure 2 presents the development methodology of a system in the organization.

Business architecture is the basis for understanding and describing a business and serves as a blueprint for building application architecture in an organization. It is defined in terms of business layers, business component, and business

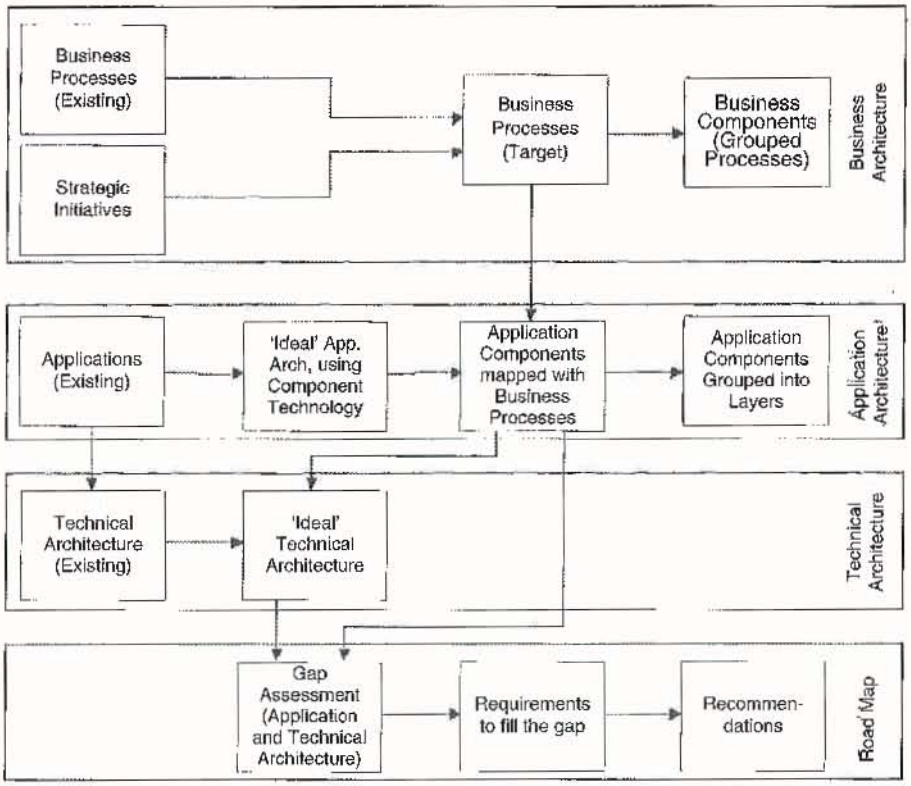

Figure 2. Asset management development methodology

Asset management business drivers	Asset management technology drivers
• Enhanced customer focus to provide maximum benefits to customers • Improved operational efficiency to generate revenue • Cost savings, better management of waste • Better performance in the areas identified by regulatory agencies • Consistent processes across the enterprise • Reduction in lost productivity, complete provisioning of resources to do job • Increased asset productivity, better utilization of resources • Improved synergies by exploiting cross group expertise • Introduction of best practices in asset management	• Real-time information on assets to make business decisions • Reduced maintenance and data carrying costs • Use of intranet-internet for applications and services • Regulated business processes • Automated field force, data collection system • Extending the functionality to partners to achieve benefits of collaborative workplace. • Open-systems approach to provide freedom to select complementary products • Ensuring flexibility of choice and an open approach to new and emerging technologies • Provides data extraction and transformation capabilities to satisfy decision makers • Linking tools to optimize performance

Figure 3. Sample asset management business and technology drivers

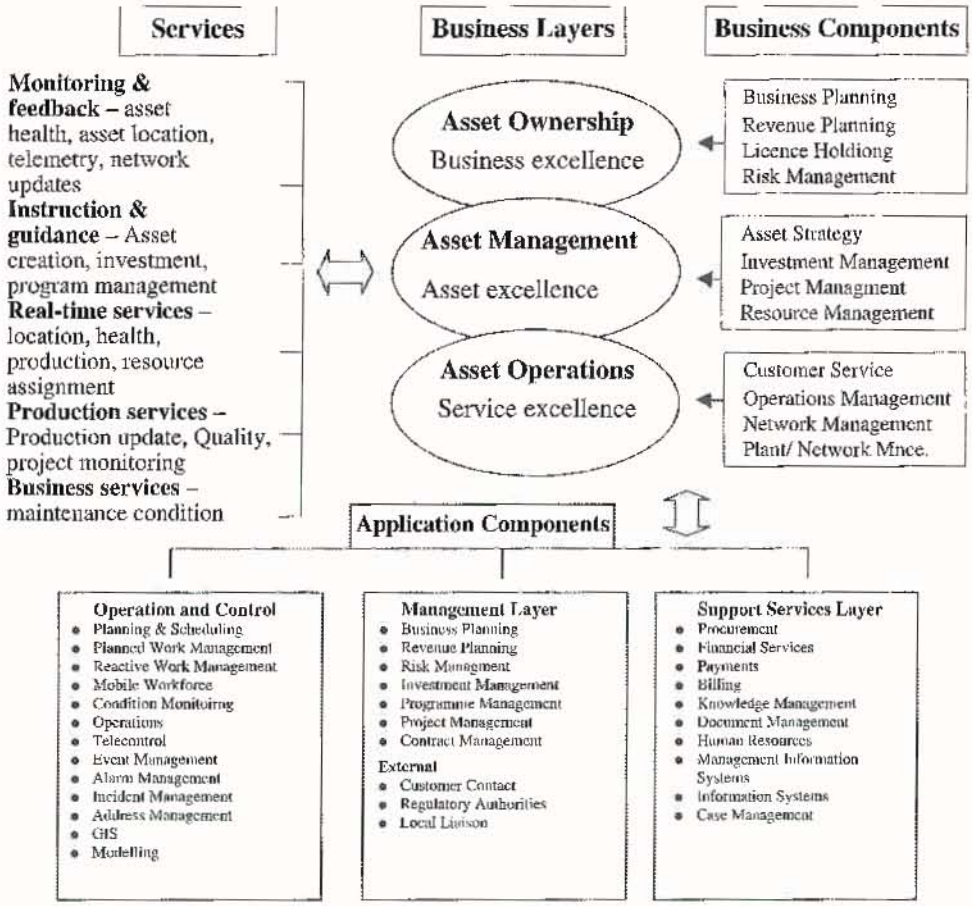

Figure 4. Business and application framework of asset management

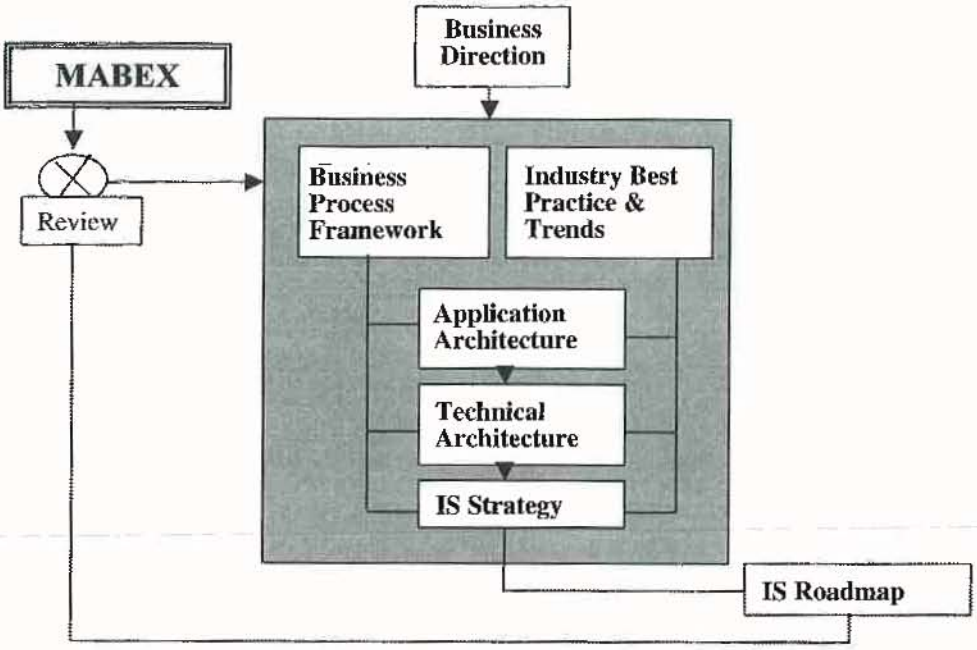

Figure 5. Developing EAM information systems with MABEX

processes. Business layers are defined by the type of business functions; strategic, tactical, managerial, operational, and support and are composed of business components. Business component, independent of the organization structure is a coherent and logic set of independent business processes, based on current and future business requirements. They are made up of a set of inter-related business processes that change in response to business/strategic changes in the corresponding business area. The component is assessed against the strategic drivers and capabilities, assuming that the corresponding IT capabilities are enabled, the functional gaps that need to be filled in order to support these capabilities are identified along with a link to the associated IT capability. These include processes that need to be enhanced, and processes that need to be created afresh. Proper definition of business architecture is considered as a key to success in establishing best practice asset management and developing an information support system for management of asset base. Based on the technology drivers, application architecture describes the applications to enable integration and grouping of functional and data elements of business processes achievement of both functional coherence and business homogeneity. Figure 3 presents the sample business and technology drivers in an organization addressing asset management requirements.

An organization after identifying strategic, business and technology drivers understands current system and future initiatives to map them with the required capabilities. The gaps highlight the business and application components required by the organization to implement an effective and state of the art of asset management systems. Figure 4 presents the business and application framework of asset management.

Manage Business Excellence (MABEX) of asset life cycle

Information System (IS) strategy of any organization is driven by its business goals. It provides clarity of direction for IS to deliver future capabilities to the business (Figure 5). The business needs, identified in the strategic purpose is the basis for developing information system solutions. MABEX is a model developed to capture information for asset management organization. The model assists capital intensive organization, like utility and mining, understand their asset management business gaps. Mining companies can use this model to plan their asset management systems. MABEX presents an objective view of business focus from information perspective and enable organization to align IS function better with business structure. It also ensures that the company gains competitive advantage through usage of this model, especially in the age of fast changing technology.

Conclusions

Asset management is now a proven concept in capital-intensive production value chain. An organization can develop a competent business and application structure to use information technology as a tool to harness the benefits of asset management. The outline of the methodology presented in the paper to develop an asset management system in an organization will be useful as the sole agent of change. The system will help decision-makers to get information on all aspects of asset management at their fingertips. It will present a clear picture of conditions, relationships and resources across asset life cycle and accurately evaluate the potential consequences of investment on new assets in the business. As every layer of organization is interrelated and interdependent, the system helps in mitigating the impact in one area by enabling the organization to access a highly detailed information base on every significant element of asset management. With the help of the system, an enterprise can implement, monitor and maintain mission critical business processes in desired balance across the enterprise and enable integrated use of information to support business operation.