

CHAPTER VI. AN OVERVIEW OF IMPLEMENTING A COMPREHENSIVE ASSET MANAGEMENT PROGRAM WITHIN THE POWER GENERATING INDUSTRY

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DEFINITION OF THE NEEDS OF THE PROJECT

Indonesia is a recent democracy, having emerged out of a complex political past that involved circumstances under which public assets had been undervalued and under maintained. Today, there is a National Priority to place the Indonesian economy on a footing that will allow it to compete with the other fast emerging SE Asian economies. One of the fundamental prerequisites for this is to provide an affordable, stable, dependable power supply. However, within Java Island, where the main concentration of industrial output and power consumption resides, the electricity demand curve is fast approaching the supply curve, and in some instances has indeed already surpassed it.

As an emerging economy that faces significant economic challenges, including the devastation of the recent Tsunami, Indonesia has restricted access to capital. Therefore, any strategy that is developed to address the power situation has to ensure that what little capital becomes available is employed to:

- Ensure the existing infrastructure operates as close as possible to its capacity; and
- Improve capacity factors, where possible.

PJB (PT Pembangkit Jawa Bali) is an Indonesian state owned power utility. It manages four major thermal generating stations together with two hydro generating units. It has a total generating capacity of 6526 MW. As a response to the national need to become a cost effective supplier, PJB has developed an asset optimisation and productivity program, the goal of which is to optimise asset contribution in order to become a more effective power generator. With the support of outside expertise, PJB developed a response to the situation and has implemented an integrated asset management optimization programme; abbreviated Maintenance Optimization Programme (MOP).

PJB developed a broad definition of what constitutes an asset, as anything which creates strategic value. As such, four classes of assets were defined. These are:

1. Physical assets (the plant)
2. Human and work culture assets
3. Knowledge assets
4. Accessible capital (for improvements)

In the following, we will describe the methodology and procedure that was followed in the design and implementation of MOP, the integrated asset management optimization programme adopted by PJB.

CULTURAL CONTEXT AND THE DYNAMICS OF CHANGE

Delimiting Factors for an Integrated Asset Management Strategy

Irrespective of the globalization of economies, fixed and human asset dependent production oriented businesses continue to operate within their specific cultural contexts. These contexts are highly formative and define many of the functional and behavioural characteristics of the businesses 'soft' assets - first and foremost, human workforce and knowledge and their degree of performance and utilization.

Key factors that determine the mentality of any human being are the religious and / or philosophical belief system as well as the set of social norms and values to which the individual subscribes. In the case of PJB employees, these key factors include:

- A majority Muslim religious orientation on Java Island, which has a strong influence and defines long term spiritual goals over short term material orientation;
- The historical background of a paternalistic mentality, which is particularly deeply ingrained in PJB as a state-owned concern that until recently was protected from capitalist free economy market forces;
- Indonesian social and behavioral norms which value non-confrontation, politeness, conformancy and obedience, co-operation and group orientation, while generally

despising of self-serving — let alone openly aggressive — pursuit of individualistic goals.

Under these conditions, the successful planning and implementation of a complex change oriented strategy faces two key challenges. One, key concepts such as 'strategy' or 'accountability' have to be communicated in terms that are culturally compatible to Indonesian (Java) mentality.¹ Two, the concrete strategy chosen — MOP — must be developed and implemented in as transparent a fashion as possible. This is a prerequisite for creating the necessary buy-in that will sustain the strategy's medium to long-term implementation and impact.

Accordingly, during the various workshops and training initiatives that were conducted throughout the organization three key aspects of MOP were constantly reinforced:

1. MOP is an integrated asset optimization programme. The programme fully acknowledges the *dynamic interrelation of four asset types* (physical, human / work culture, knowledge, capital) which interact throughout the business process. Within this scenario, MOP places particularly high value on the human and work culture dimension, and on so-called 'intangible' assets particular to the human domain.
2. MOP is a strategy driven programme. In other words, it is not just an import of ready-made solutions for pre-defined problems. Rather, MOP implementation constitutes of an *ensemble of mutually enhancing change processes that share a common strategic goal*. Each of these processes must run the full cycle of problem analysis, goal setting, potential benefit assessment, design and implementation of a customized optimization strategy for a particular asset, and strategy evaluation and adjustment.
3. MOP's effective implementation at PJB is dependent on and at the same time bound to reinforce a significant change in work culture. 'Work culture' is defined by the *de facto* (not just the outwardly professed or prescribed) set of mutually acknowledged norms, aspirations, habits, motives and cognitive procedures. In a work environment this set of behavioural determinants effectively governs *why people do what they do in the way that they do it*.

The impact of the third aspect on PJB's day-to-day business practice cannot be over estimated. For the majority of PJB employees, successful MOP implementation amounted to a mentality change from a re-active ("follow procedures and orders") to a pro-active ("think ahead and in terms of functional and business goals, take initiatives") behavioural orientation. One can only appreciate the difficulty of this change process when taking due cognisance of the individuals' cultural context, as outlined above.

Would the investment in such a far-reaching, carefully introduced mentality change be worth its while for a company like PJB? Would it not be more practical to identify concrete technical or business process problems and then immediately enforce new standards and procedures of asset management practice?

The answer to these crucial questions lies in the realisation by PJB of the long-term, sustained effect of effecting change in its intangible ('soft') assets. Provided the necessary resources are available, physical assets and other tangible elements of the operations domain can be changed or replaced at relatively short notice. However, the longevity of the effect of these interventions is also bound to be limited, among other by rapid technological development and the comparatively short life cycle of many fixed asset components. Conversely, investments into human assets and changes in the human domain may in general be slow to yield an initial effect. However, once successfully implemented they can be expected to be of sustained and long-term benefit. In an integrated asset management strategy, like the MOP adopted by PJB, both aspects go hand in hand. This relationship is illustrated in Figure 6.1:

¹ Our reference to Indonesian culture and mentality is necessarily sketchy. For a multi-faceted overview on Indonesian business culture, see George B. Whitfield, 'Cross-Cultural Training' (<http://www.expat.or.id/business/crossculturaltraining.html> ; seen 19.01.2006)

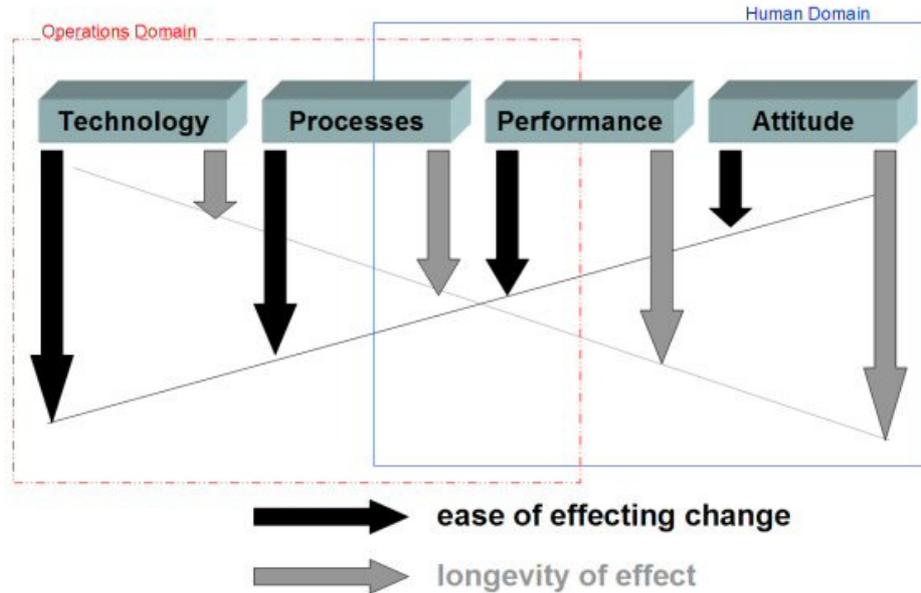


Figure 6.1 Change Management Input-Output Ratio in an Integrated Asset Management Strategy

These considerations formed the background to the MOP design and implementation process, which we will now outline in more detail.

UNDERSTANDING THE SCOPE OF THE OPPORTUNITY

As a start to the strategy development and implementation process, a series of workshops was held in order to clearly understand the scope of the opportunity which MOP would address. During these workshops a set of *Key Business Drivers* was defined. These *business drivers* were ranked as to their impact on the business as follows:

Business Driver	% *
Increase process efficiency & reduce fuel consumption	23%
Increase asset reliability and availability	16%
Increase utilisation of potential installed capacity	8%
Procure quality spare part cost effectively	8%

Figure 6.2 Table of PJB key business drivers.

* The % indicates the proportion of opportunity that this business driver represents.

According to a Pareto analysis conducted, the top four business drivers contribute to over 55% of the strategic opportunity at PJB. This is represented in a traditional Pareto Analysis Plot shown in Figure 6.3.

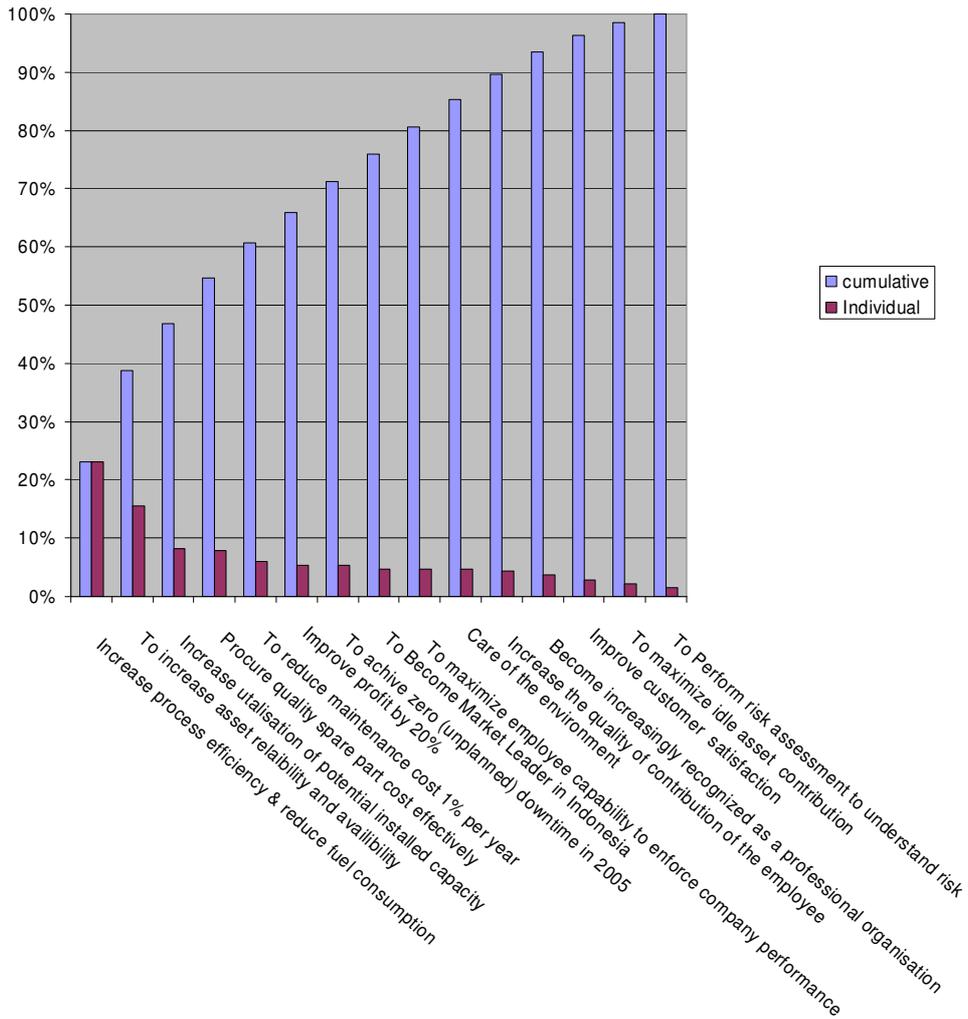


Figure 6.3 Pareto Representation of the Business Drivers

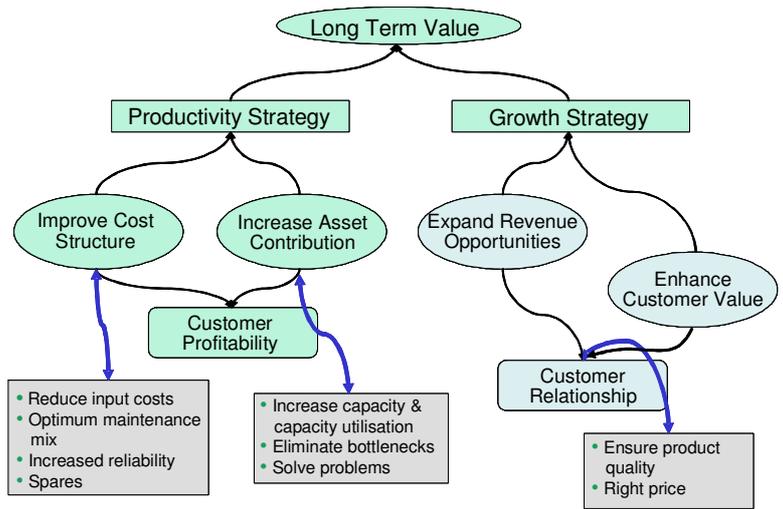


Figure 6.4 Mind-map of the Broad Strategic Themes of MOP.

From the understanding of the business drivers the management team concluded that a broad productivity and cost management strategy had to be put in place. A mind map outlining the interdependencies and synergies among the strategic themes that were discussed is presented in Figure 6.4.

Three areas of value contribution were identified and researched. These were:

1. Additional revenue from increased sales
2. Improved thermal performance
3. Additional potential cost savings

The investigation then reviewed the scope of lost opportunity costs and these were quantified as follows:

Contribution Factor	Lost Opportunity Cost
Additional Revenue (from increased sales)	> \$25m (per year)
Improved Thermal Performance	> \$7m (per year)
Additional Potential Costs Savings	> \$1.5m (per year)
Total lost opportunity costs >\$33m (per year)	

On understanding the lost opportunity costs, PJB management committed itself to embarking on a corporate program (MOP) to address and realise the opportunities. MOP was designed as a broad **asset management strategy** to galvanise actions broadly across the four main generating plants and the central head office support organization.

CREATING THE STRATEGY TO ADDRESS THE OPPORTUNITY

Strategy by definition involves change, doing something different or organizing an existing activity in a different manner, in order to realise a high-level goal. More importantly perhaps, strategies are by definition complex: they integrate, control and orientate a multitude of contributing processes and tactical actions. Due to these characteristics, strategy development and implementation is by nature disruptive and demands key resources from an organization. Strategies therefore have to be clearly beneficial and developed from the top down in order to ensure alignment towards an organization's high-level goals.

The development of the detailed PJB strategy was initiated with a multi day strategy workshop attended by executive management and the Board of Directors. This workshop reviewed the options available for setting up the organization to become a low cost high productivity producer, and transformed its findings into an asset management strategy. The workshop had the joint purpose of informing participants of the “asset management opportunities” combined with strategy formulation. Expert facilitation of the workshop ensured the balance between information and formulation.

Supporting the PJB mission— **“The reliable electricity producer for today and tomorrow”** — the strategy was further broken down into four supporting areas of strategic contribution: Reliability Strategy, Efficiency Strategy, Supply Chain Strategy and Fuel Strategy.

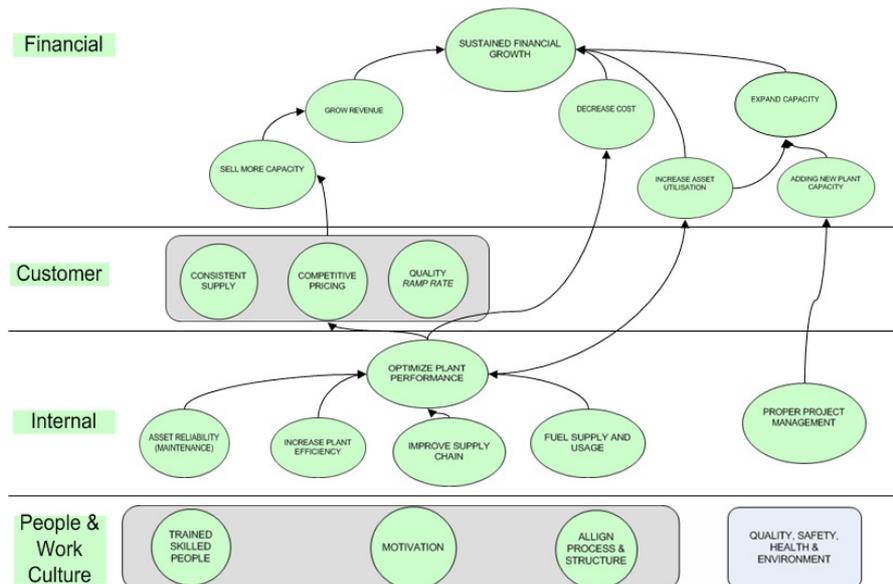


Figure 6.5 Developing the PJB Asset Management Strategy

The four supporting strategic aims are the core element of PJB's asset optimization program MOP. In other words, PJB focused on MOP as the central strategy to support the ultimate financial goals. The final graphical representation of the overall strategy is given in Figure 6.6, in the form of the Global PJB Strategy Map:

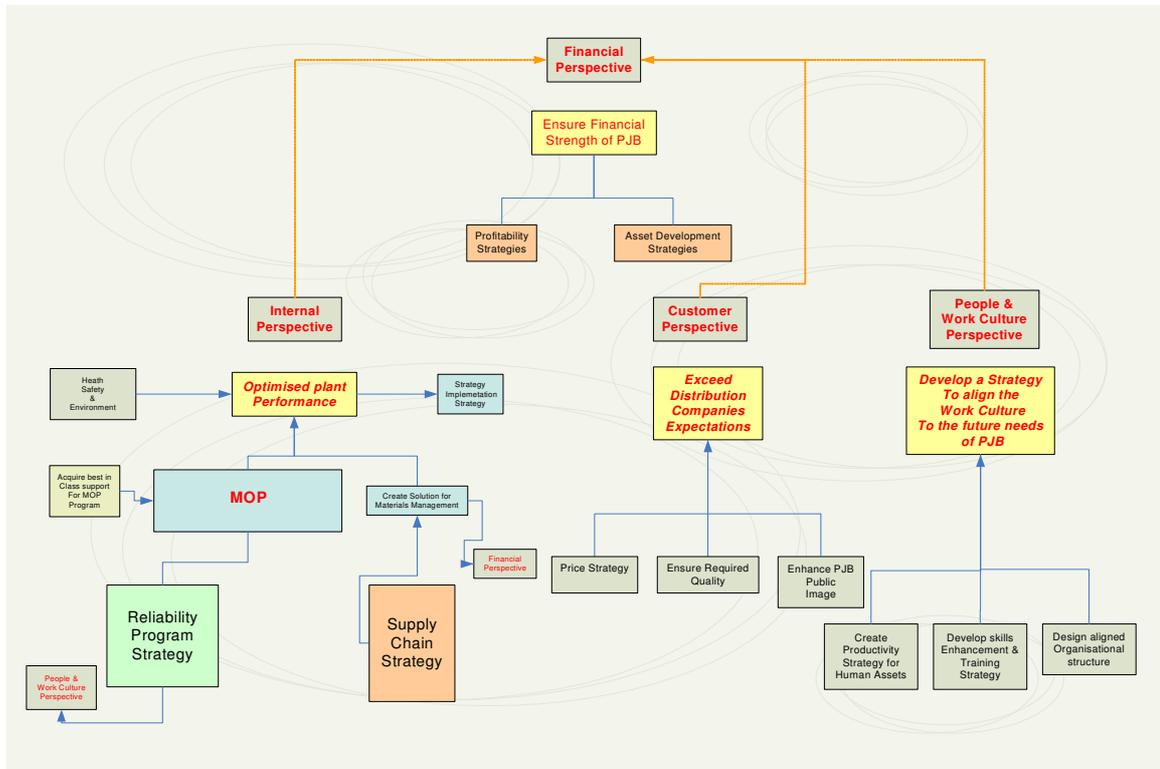


Figure 6.6 Global PJB Strategy Map and the Role of MOP as the Key Asset Management Strategy

Accountability for the project was defined and delegated to teams and individuals using what is referred to as action tables. Action tables define a single point of accountability for the execution of coordinated strategic actions. An example of an action table is shown in Figure 6.7.

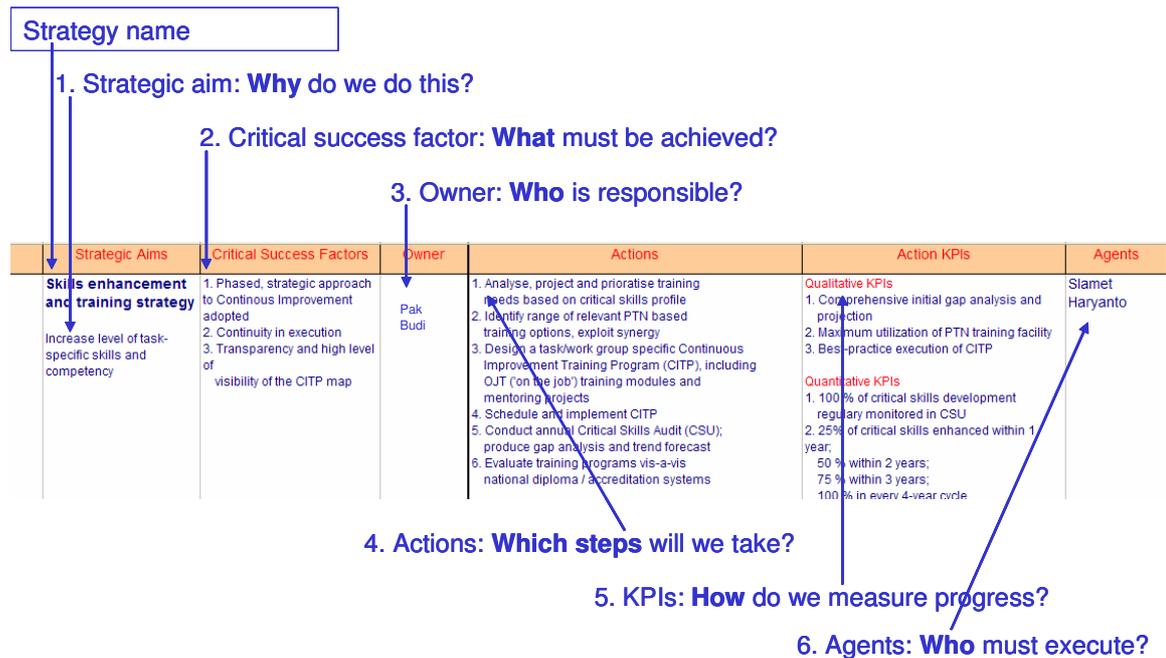


Figure 6.7 Functional Components of an Action Table

The corporate strategy was then cascaded to the individual plants in order to create a focused and aligned approach to local issues. Each plant then went through the same process of developing its specific individual strategy in alignment with the overall corporate strategy. Throughout this process expert facilitation ensured there was close alignment to the overall strategy.

Once the individual plant strategies were in place, an overall project implementation plan was drawn up in detail. To create orientation and a graphic understanding of the elements of the project a visual “Project Atlas” was created which is illustrated in Figure 6.6. The MOP Atlas provides visual representation of the whole program. The atlas has since been used as the main tool for developing awareness across the organisation. It also serves as a common reference for all discussions regarding the implementation aspects of the project.

The MOP Atlas itself outlines six asset improvement themes. These themes are:

- Strategy / Change Management which develops and manages corporate and individual unit strategies;
- Business Process Improvement, which includes the work planning and control setup, CMMS/ERP alignment, business process integration and task execution/continuous improvement.
- Reliability Improvement, which includes reliability modeling, system / equipment criticality analysis, failure mode & effect analysis, root cause failure analysis, equipment condition assessment etc.
- Process Efficiency Improvement, which consists of development of a tuned heat balance model and the development of performance monitoring system
- People & Work Culture, which includes the organizational alignment to support MOP, training need analysis, training execution and level of awareness development, implementation of an Intranet-based knowledge management tool.
- Asset Contribution Measurement, including development of leading & lagging KPI’s to measure progress, development of a management “dashboard”, development of assessment and benchmarking framework.

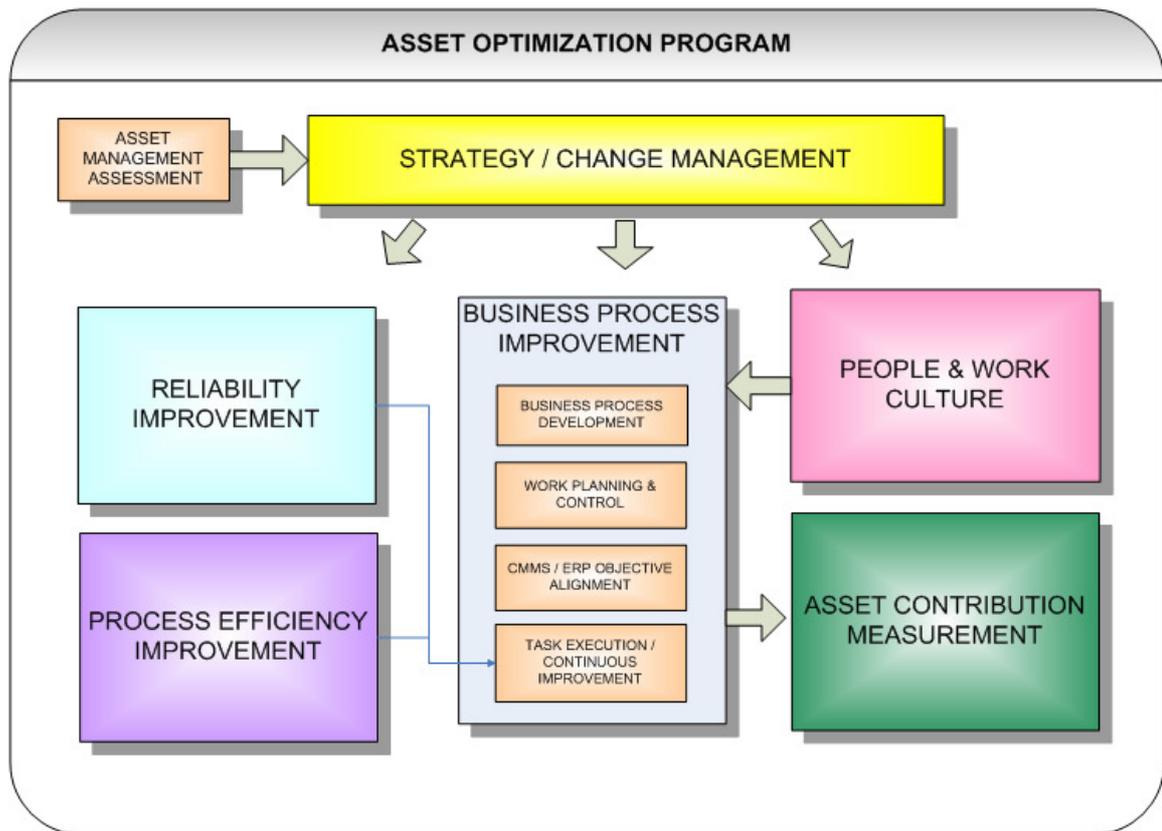


Figure 6.8 MOP Project Atlas

PJB has a total of four thermal power plants and two hydro power groups that are scattered throughout Java Island. To ensure the alignment of unit strategy with the corporate strategy, a series of activities were set to cascade the corporate strategy into individual unit strategies. This is essential since each generating unit has unique characteristics and differing asset challenges. Orientation of the individual plant strategy towards the corporate strategy and the overall implementation plan as defined by the Atlas was ensured by mapping the corresponding elements as illustrated in Figure 6.9.

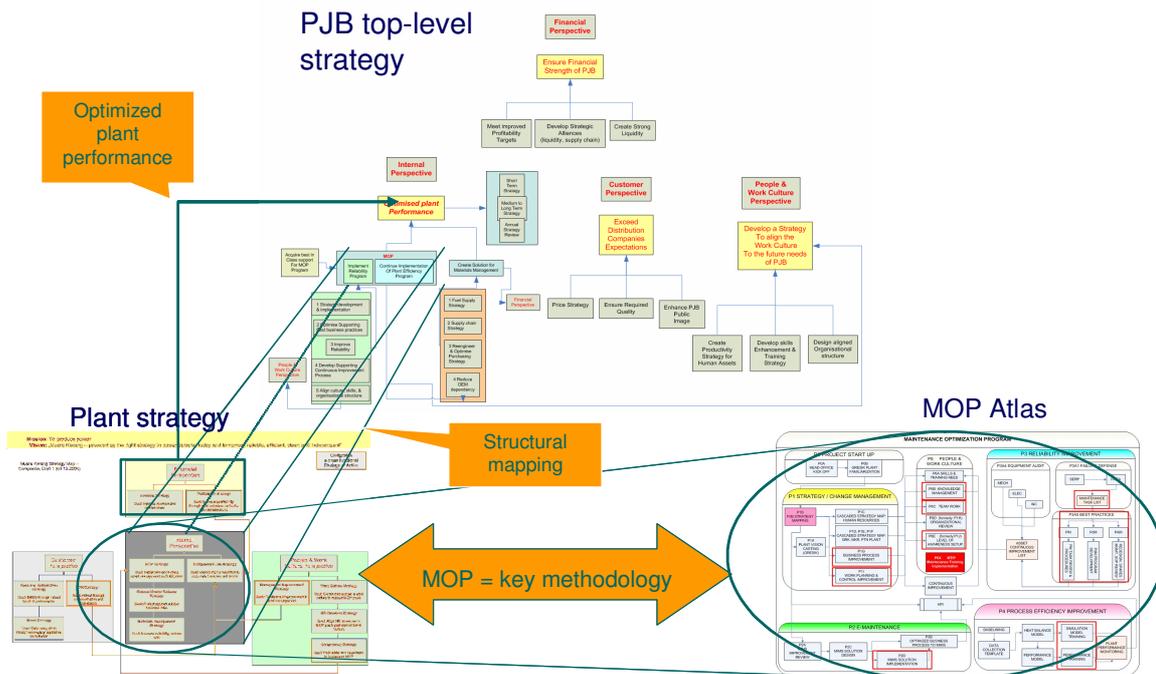


Figure 6.9 Mapping the Plant Strategy onto the Corporate Strategy and the MOP Atlas

In summary, PJB's top-level corporate goal – to become the leading high productivity, reliable power producer on Java Island — translated into six strategic goals which had to be reached by developing and executing appropriate action tables. These goals were:

1. The development of an overall strategic management plan which provides direction and creates accountability towards the corporate goals.
2. Optimise existing maintenance tactics to ensure optimum reliability.
3. Develop and ensure conformance to best practice businesses processes, especially within work planning and coordination and thermal efficiency.
4. Ensure a continuous improvement process was in place, and to create a continuous improvement culture which identifies and solves priority problems.
5. Create a supporting work culture which is aligned with the strategic intents.
6. Create a management culture which is focused on execution, and an execution plan which is visible and defines the accountability of all role players.

CREATING A METHODOLOGY TO MEASURE PROGRESS

In order to ensure that the strategy was working and to derive an overall accountability a measurement system based on key performance indicators (KPI's) was developed. This measurement system had to take into account combinations of overall long-term goals with necessary short term intents. Moreover, the measurement methodology was expected to employ shorter term leading indicators as well as longer term lagging indicators. The complexity of these various indicators is symbolized in the form of the 'KPI Ice Berg,' Figure 6.10. It demonstrates that the outwardly visible 'tip of the ice berg' – productivity, performance reliability and revenue earned – is in fact measured in terms of lagging indicators.

KPI Ice Berg

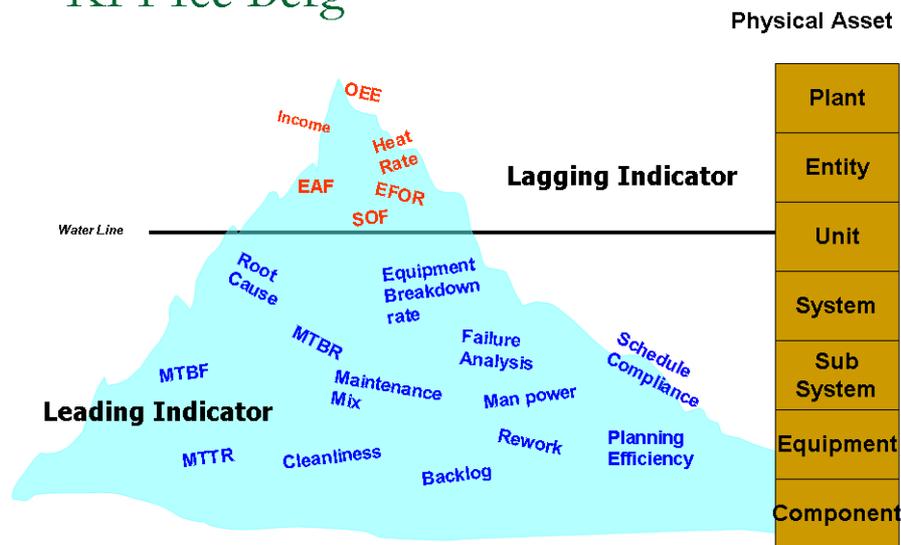


Figure 6.10 KPI Ice Berg – Leading & Lagging Indicators

As the overall key performance indicators (KPI's) for the project were all lagging KPI's, they could be expected to take a period of time before changes were observed. Among these, five key strategic KPI's were identified:

EAF (Equivalent Availability Factor)

Function of unplanned downtime (reliability, planning, skills; measured by availability & downtime).

Planned downtime (planning; maintenance tactics, skills; it is measured by MTTR).

Derating (design capacity – actual capacity) — generating stability (reliability).

NDC (Net Dependable Capacity)

A measure of the net power output; calibrated over defined period (measure of the ability to sustain stable net power generation).

It is a function of generating efficiency (system performance) and generating stability (reliability).

Heat Rates

Efficiency of the transformation of the energy source to power.

Key Spares Management

Hot parts, OEM issues, critical spares, capital deployment.

Generation Costs

\$ / KW hour produced.

The project was faced with measuring short and medium term progress towards improved performance in the above categories, such that the combined influence of the effects would alter the lagging KPI's. To achieve this, the influencing leading KPI's were identified and encapsulated in a structure which would show their direct impact on the lagging KPI. This is illustrated in Figure 6.11.

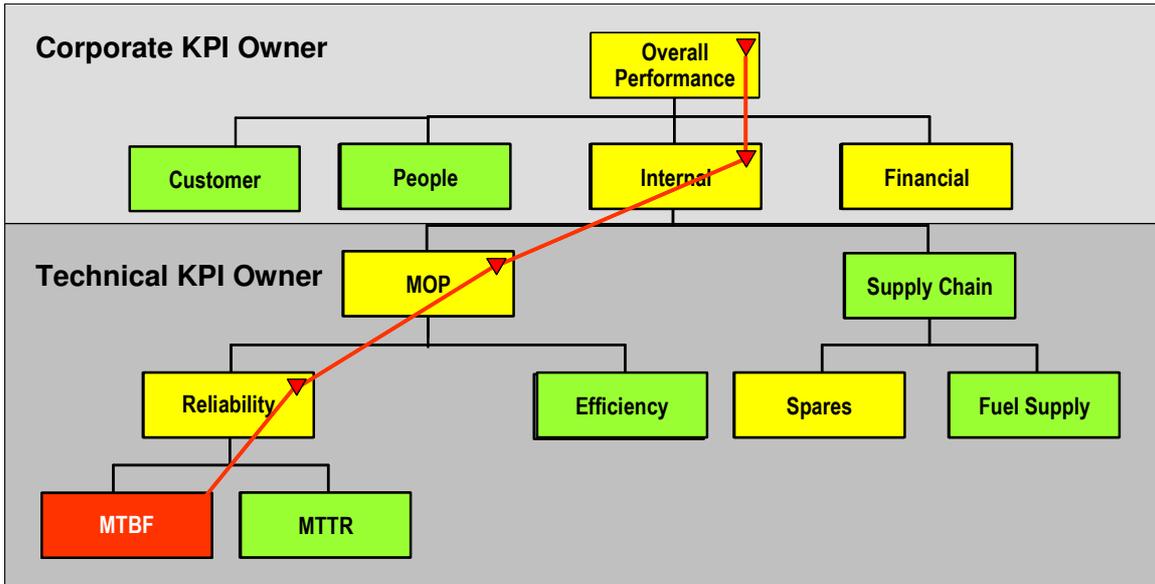


Figure 6.11 Leading – Lagging KPI Hierarchy

Today, many of the leading KPI's are already indicating a positive change as illustrated in Figures 6.12 and 13.

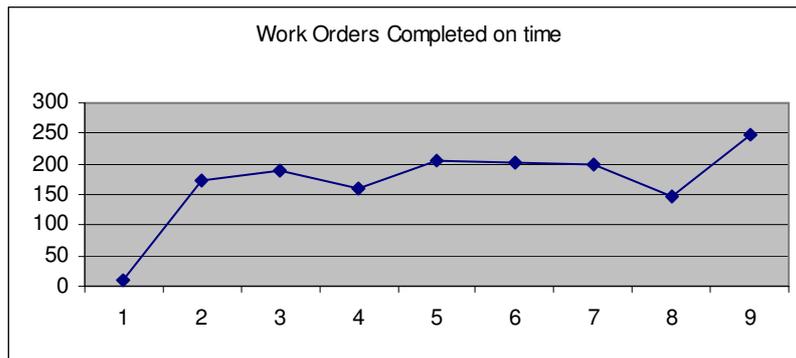


Figure 6.12 Example of Improving a Leading KPI: Work Order Completion

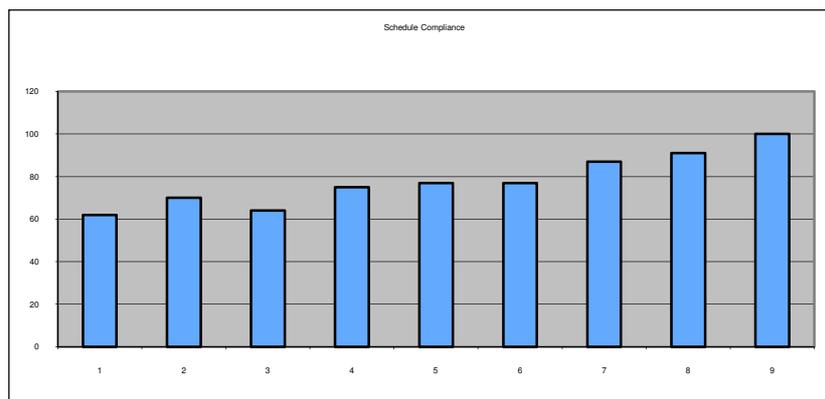


Figure 6.13 Example of Leading KPI: Schedule Compliance

In addition to developing and measuring the KPI's, an assessment tool which accurately measures specific progress has been developed, so as to be able to precisely measure performance at any point in time. The assessment framework was developed during the first

phase of implementation. It consists of ten targeted Key Performance Areas. Performance in any of these 10 areas can be measured with a degree of precision:

1. Strategy Management
2. Reliability Management
3. Work Planning & Control
4. Performance Management
5. Organizational Alignment
6. Material Management
7. Information & Knowledge Management
8. Continuous Improvement
9. Work Culture & Motivation
10. Life Cycle Engineering

The assessment methodology is designed so that the assessor will be able to measure both business practice maturity and related KPI performance in each of the 10 areas. Assessment results are then used for management to identify both positive and negative performance and prioritise areas of attention.

BENEFIT REALIZATION

Typically similar integrated asset optimization initiatives will show tangible benefits after 2 to 3 years of rigorous implementation. Therefore measuring leading indicators will enable PJB in the short term to control the progress towards the overall longer-term goals.

Other tangible benefits were driven from Plant Efficiency Improvement Program. Here PJB individual plants have been able to improve their fuel consumption and dependable capacity by implementing computer based modeling using GateCycle platform. An example of the Heat Rate calculation can be seen in the following charts.

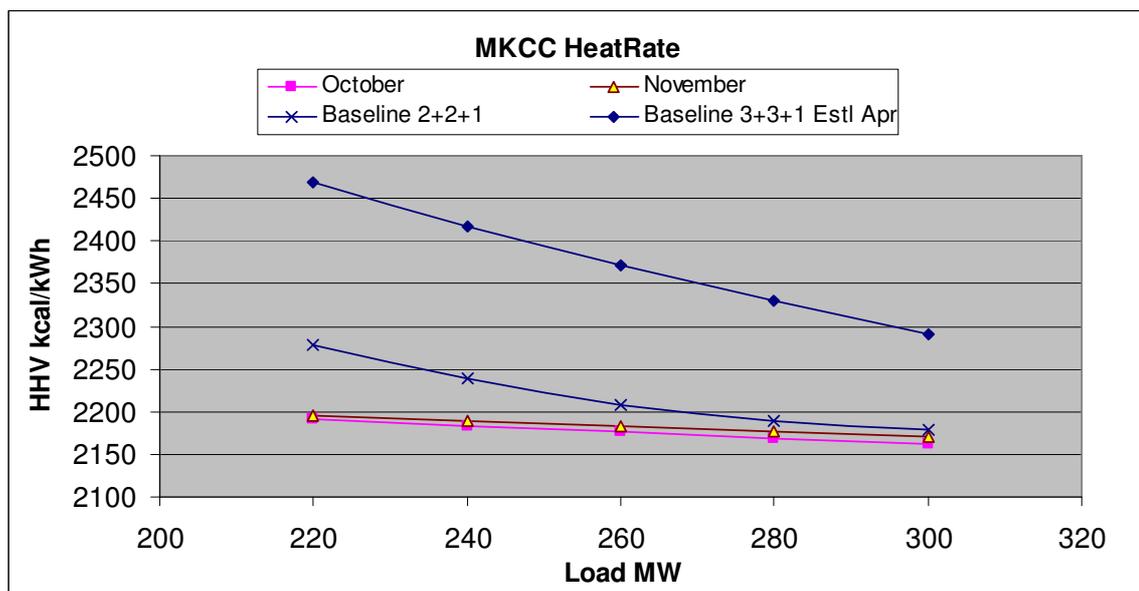


Figure 6.14 Heat Rate Improvement Calculation at Muara Karang Plant

In this example, the respective plant was able to save up to US\$ 160,000 in the first 2 month of implementation, based on the fuel price of US\$2.45/mmBtu. The savings are realized from a series of performance driven maintenance actions that are carefully calculated using Cost-Benefit Analysis.

In the short term a series of detailed assessments were undertaken, using the assessment tool which measures both business practises and leading KPI's. Current results show that the business practices maturity continues to grow along with implementation. An example of an assessment result is shown in Figure 6.15.

Business Practices Maturity Level August 2005

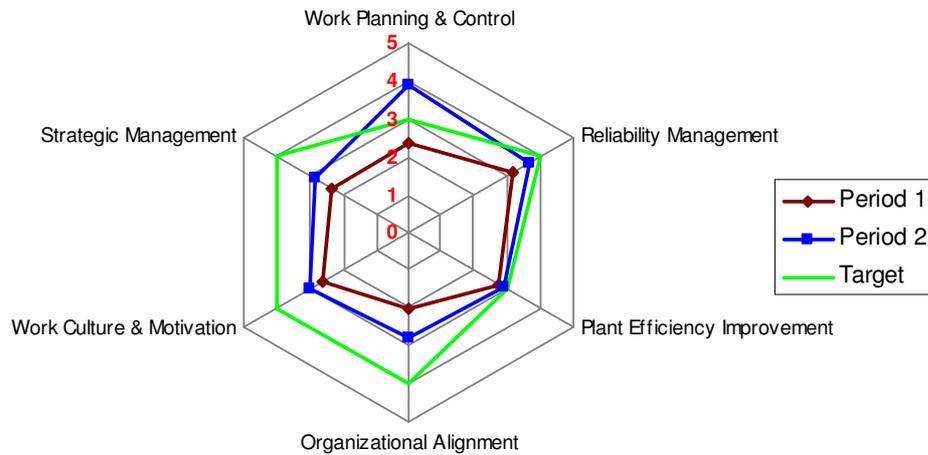


Figure 6.15 MOP Business Practices Maturity Assessment Result for Gresik Plant.

A crucial benefit that has been realized from MOP in the domain of intangible assets is the gradual change in work culture within the PJB work force. Most managers up to supervisor level are demonstrably more conversant in MOP terminology and able to explain their respective activities in relation to strategic concepts and goals. New business processes also require the work force to spend more time to do planning and analysis. Furthermore, the implementation of the leading KPI's & KPI measurement hierarchy has ensured that each individual can now understand their role in achieving the ultimate PJB strategic goal: to excel as: ***“The reliable electricity producer for today and tomorrow”***.

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