Reliability Consideration while Plant Acquisition

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Abstract
In most of the plant acquisition cases, the number of factors are considered for an optimum evaluation of the plant before any purchase commitment is made. The exercise is generally focused around financial data including the operating costs, review of the current contracts involving suppliers and Original Equipment Manufacturers (OEM), administrative processes/ issues like Human Resources (HR) and personnel, management characteristics and ownership model, statutory and government regulations etc. The financial data commonly get higher priority with less consideration on Safety and Reliability aspects of manufacturing plant assets.

Before integrating an old plant with an existing set-up, it is of paramount importance to consider and assess plant asset's Reliability-related issues more precisely so that the new plant after transition can integrate and operate smoothly, economically and all the business systems including Enterprise Resources Planning (ERP)/ Computerized Maintenance Management System (CMMS) can be subsequently easily revised/ updated. In this paper, an effort has been made to identify and collate the most important acquisition criteria concerning mainly physical asset's reliability.

Keywords: **Acquisition, Assets, Asset Management, Evaluation Criteria, Reliability**

I. INTRODUCTION

While acquiring any old plant, most of the business systems and management aspects including finance and human resources are considered. Minute details concerning plant asset's reliability are not much drilled down during assessment. Since any lapses on the asset's current health condition and its associated support systems may jeopardize the future desired safe and uninterrupted running after transition, special care shall be taken while evaluating a plant. A reliability-oriented view can add much value in optimum assessment of the old plant.

Based on the available history of operation, maintenance and reliability practices along with current health data of physical assets, a fair amount of qualitative evaluation may be possible, yet a quantitative analysis intended to unfold any material degradation, especially in high risk plants like aerospace,

nuclear and process plants with high potential hazards is always much desirable and economically justified. However, the evaluation approach may vary depending on the plant's size and complexity also.

II. RELATED LITERATURE

Industries predominantly depend on the consulting firms' services for assessment when an acquisition project takes shape and bidding plant seek a realistic evaluation. Therefore, most of the related advanced works are found with the consulting firm's knowledge bank in terms of technical notes, survey reports, and customized rating norms. Scholarly articles in journals, books, international conference proceedings are very scarce except 'merger and acquisition' cases which are corporate diversification, investment and cost economic centric. However, research publications on Remaining Life Assessment (RLA) or Asset Life Assessment (ALA) or Fitness-for Services with the vast use inter-disciplinary diagnostic technologies and tools are available.

Recent investigative comparative analysis by Dusan Baran and Darius Saikevicius [1] for European Union industries was concentrated on mainly the level of gross value generation and assessment considerations were on strategic management, economy, finance, HRD issues and not pinpointed towards the main value-adding industrial physical assets.

Mike Sondalini of Lifetime Reliability Solution's Plant Wellness Way [2] and the Physics of Failure approach are the scientific methodologies for physical asset management that ensure world-class reliability. The approach is more industry-oriented and addresses much higher level of asset reliability needs and the customized tools, developed mainly for running plant's operational excellence, actually added value in collating reliability criteria while acquisition.

III. EVALUATION CRITERIA

A. Management of Life Cycle Costing

Total 'Life cycle costing' (LCC) approach is the industry's buzzword today for all investment decisions due to its completeness and practical relevance to the whole concept of asset management. LCC analysis provides a fair idea on total cost of ownership reflecting the LCC results in Net Present Value (NPV) of the machinery starting from the design phase passing through procurement, commissioning, and operation until decommissioning stage. However, it is wise to have a trade-off between Effectiveness (combining availability, reliability, maintainability, and capability concepts) and LCC data as illustrated by Barringer H. Paul of Barringer & Associates [3]. While evaluating an old plant on reliability point of view, it is necessary to ascertain the followings aspects:

- The strategy of prevailing asset care. The Life Cycle Costing (LCC) study was previously carried out and data is available. LCC approach indicates the plant own and operate in a cost-effective way of asset management.
- Due diligence in evaluation of alternatives during procurement and replacement of critical assets, spares, whether LCC concept is used or not.

B. Design and Technical Documentation

In old plants, availability of equipment design data including all drawings at times become very critical. Operation and maintenance documents are either not available or in dilapidated stage. It is to be noted

that In-house asset data add value to Reliability and Risk Assessment. The following points need attention:

- The plant and assets P&ID, Technical specifications, documentations related to operation and maintenance are to be checked.
- Raw material specifications and products data are equally important and add value in assessment. Considerations in Process Design is also worth noting. All these aspects of working stress along with the process chemistry are considered to have direct impact on equipment health.
- The details of upgrades, modifications and expansions done previously including cost-benefit analysis are also to be made available while assessing.
- 'Reliability in Design' philosophy is applied from the project and commissioning stage until the discard/ replacement stages.

C. Asset Maintenance Strategies

The prevailing maintenance strategies indicate the seriousness of the organization in the adoption of latest reliability-centered methodologies and the level of implementation, especially for Precision and Predictive techniques. The right strategies facilitate in the reliable equipment and availability of production line. The available data from add value in ascertaining the current and future health of equipment and assist also in life cycle costing. The points of consideration while assessing a plant are:

- Maturity level of implementation of reliability focused initiatives such as Reliability Centered Maintenance (RCM), Risk Based Inspection (RBI) etc.
- Strategy development following International Asset Management and Reliability Standards (ISO 55000, SAE JA1011/1012, RBI RP580/581, ISA84, IEC61882-HAZOP)

D. CMMS and Asset Management Enabler

An effective enterprise resources management system including equipment's maintenance management system accommodates an organization's data maneuverability that leads to measurement, assessment and control of overall asset's performance and business performance Key Performance Indictors (KPIs). The salient points to note while evaluating the plant during acquisition are:

- The level of CMMS implementation and quality data that provide right evaluation of various plant KPIs on production, maintenance and reliability.
- Ability to interface with mainstream Information Technology, ERP enablers and other application packages related to equipment.
- Understand CMMS, on how best the enterprise resources are managed & the internal customer relationship and logistics are organized.

E. Condition Monitoring Tools/ Systems

The Condition Based Maintenance System (CBMS) provides a picture on plant's machinery management. The assessors can have confidence once they are access to monitoring and diagnostic data. The following points are worth noting:

- The status and level of plant wide condition monitoring systems assure how best the critical assets' health are taken care of and how safe the equipment while start-ups and shut-downs in case of emergencies.
- Management's support to adopt advanced tools and techniques for equipment's Reliability & Risk Management.

F. Warehouse Management System

Right spare in right quantity in right time is the basic need of warehousing for any production process machinery. Effective warehouse system assures plant's capability on how best maintenance, repairs, spare stock-out issues are tracked and tackled. The points to be noted are:

- The preservation norms adopted for high value critical spare, the location within premises or outside, the standards followed as per OEM recommendations.
- Management of vendors/ suppliers (How vendors developed and OEM as well as sub-contractors are managed?)
- Employees' proactive readiness in management of assets.

G. Central Facility for Repair and Reclamation

The plant, being acquired, will have extra advantages in timely repairs and recondition tasks related to equipment if the in-house workshop with basic dimensional checks, non-invasive or destructive testing facility, tools and tackles are available. It greatly affects overhead costs, Mean Time To Repair (MTTR), spare management, quality checks etc. It indicates plant's response and promptness to breakdown repairs, reduction in maintenance hours and overheads. The points to assess are:

- Tools and tackles including lifting equipment, welding and machining facilities, alignment and balancing machine etc.
- Spare management data including Import substitution especially fast moving spare.
- Availability and adherence to maintenance-repairs procedure.
- Structure of "Receive/ Deliver" protocol.

H. Adherence to International Standards

Adherence to International Standards such as APIs, ASME, ISO.

- Compliance and adherence to international standards on asset management.
- Development of in-house customized standards on managing asset's safety and reliability.
- Best Practices on Equipment Management (largely depends on compliance to Standards).

I. Structured and Effective KPIs

The Key Performance Indicators are yardsticks of measurement of plant effectiveness. The relevance to equipment health, production, quality, reliability, risk, safety, competency of employees, environmental norms etc. are best be reflected in various KPIs. The important points to remember if the plant KPIs are:

- Relevance to asset's health, operation and quality needs and easy to analyze from CMMS data.
- Add value in trending, analysis and comparing in any operational and business performance.
- Simple analytics yet reflect core issues of various functions.

J. Risk Management System

In any project financing or any acquisition task, the risk documents are most valuable inputs in decision-making. The documents reflect how best assets are maintained and operated. The following aspects need to be ascertained while deciding on risk:

- Risk Management system of the organization
- Risk financing norms and regulations adopted, such as banker's involvement, obligations to lenders.
- Availability of scientific quantitative study such as Hazard and Operability study (HAZOP)/ Hazard Analysis (HAZAN), Probabilistic Safety Assessment (PSA), which are representative indicators.
- Contribution of Risk Management to local legal and insurance norms.

K. Root Cause Analysis of Failures

The quality of Root Cause Analysis (RCA) establishes to resolve permanently plant has repeated issues. It is also an indication of inter-disciplinary team's experience in in-depth quality analysis of perennial problems and lays foundation of lessons learned. The points to note during assessment of plant are:

- The existence of proven assessment process.
- An effective RCA system in place indicate the company's seriousness in responding to the breakdowns and the mitigation of unreliability and risk.
- The quality of RCA reflects the company's Expertise and Resources.

L. Bad Actors Management and Reliability Analysis

Hundred-percentage reliability is a myth. Even superbly engineered machinery fails. A comprehensive and quantitative approach to Bad Actors (Performance Killers) management is a boon to plant sustained performance. The points to look into these aspects are:

- The rules and procedures of identification, the system of resolving the same.
- The procedure of attending and restoring past failures and since then the running condition of equipment.
- Scientific Reliability Analysis / Failure Analysis / Reliability growth as well as the Cost of Unreliability.

M. Emergency Response Management System

The speed of Response following any unfortunate breakdown/ incident/ accident is better indicator of plant's responsiveness and utilization of resources. The following few aspects to be checked:

- From the previous incidences, the response and restoring time, associated costs, the records of relevant learning rightly captured and shared.
- The frequency of such emergencies/ exigencies.
- The start-up time, safety and equipment response, synchronization history.

N. Supply Chain

A good system of Supply Chain Management in the company is well presenter to in-house effective process flow between functions while processing raw material to finished goods, to external OEM and suppliers. It leads to better material and spare Management, company's reputation and corporate communications. The points to look are:

- The reliability of each chain and the impact of each unreliable chain on the plant's reliability, considering total supply, process and distribution activities.
- Not only the reliability of chains is worth-considering but also the reliability rate of relationship among chains is far more important and needs critical assessment [4].

O. OEM and Specialized Service Providers

OEM/ Parts suppliers are major stakeholders of business. Their involvement throughout the life cycle of equipment is most important in any company. It is wise to check the following while acquiring plant:

- The major OEM/ parts supplier's details with indication of workshop and their facilities.
- Specialized and professional services list and the related details add value to equipment management as the vendors and service providers may be from different locations or lately OEM have merged with other company or have workshop in different locations, have proprietary issues related to services being provided now.
- Agreement norms on maintenance and spare.
- Insurance liability issues with Users.

P. Utilities Management

The energy needs, whether self-sustained or through purchase agreement; the water and air supply management are crucial while deciding to integrate the acquired old plant with the new set-up. The points to be considered are:

- Availability of captive power plant within complex, power purchase agreement through national grid, type and availability of fuel used.
- Water availability and treatment such as desalination, demineralization, cooling, heating, storage facility.
- Air supply, in quantity and quality, for the purpose of process cooling, machinery sealing, process mixing in burning/ reactions.
- Existence of a supply plan in case of emergencies.

Q. Reliability Leadership and Reliability Culture

Reliability leadership is responsible for bringing up and establish a reliability culture within organization. The behaviors of Reliability Leaders are expected to be little different than other Leaders due to the nature and complexity of tasks in Manufacturing Industries operating in a turbulent business environment globally with high risks involved in operational assets including human capital. Leaders need to have unique mindsets and their actionable behaviors to attain the objectives of plant Reliability Movement.

The plants with Reliable equipment are considered also safe. A recent research survey in USA's 63 nuclear power industries reveal that there is a strong relationship between safety culture and performance [5]. Among the nine factors for safety culture considered, management's commitment to safety was found to have very strong bond. Behaviors and mindset of leaders bring conducive culture towards reliability and depends on leader's strategic and tactical views on failures, effective engagement and communication with employees. The points to note:

- Reliability Leadership and Reliability Culture conducive to organizational reliability performance or not. It is best be reflected during audit, discussion, interactions, visits, survey.
- Reliability activities are taken, as forefront like safety and a mood 'failures are preventable' are visible with every employee.
- Leaders has ownership, start the day with 'reliability talk/ lessons learned', focus on 'effectiveness rather than 'compliance', respect front-liners suggestions, challenges current practices, have an eye on reliability KPIs and track competency level etc.

IV. CONCLUSION

The reliability criteria when integrated with other acquisition criteria, the decision-making becomes realistic and more economical. This is an effort to collate the most important considerations while plant acquisition from the reliability point of view based on authors' long experience and literature reviews from few renowned consulting organizations.

V. REFERENCES

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