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Capital Projects Operational Readiness and Business Risks: Maximizing Returns on New Assets

This document describes how to recognize and address significant operational risks for businesses through New Assets Operational Readiness.

EMERSON

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Introduction

When a company invests in new assets, it makes a strategic business decision to improve its position in the marketplace. Building new facilities—or expanding existing ones—is a response to market needs. Investing in assets or new facilities may be required to launch new products or increase existing capacity. In some cases the nature of the industry requires close proximity to demand; in other cases it may be better to locate a new plant closer to specific raw materials sources. While some industries call for fast-paced continuous processes, others may require customized production with a completely different manufacturing strategy.

Market requirements impact the decision to invest in land, production processes, technology, and/or new equipment. Once a company decides to embark on an investment, it will typically rank the various choices and analyze them in different dimensions. The facility's optimum location, capacity, processes, and technologies must be addressed in order to fulfill the market's current and future needs. All of these factors must be considered when building a business case to justify funding for the new enterprise.

Once the investment structure is in place, the company sets up its major capital project plan and establishes the organizational structure necessary to manage and execute the various project phases. Significant resources are dedicated to design processes, procure equipment, and build new plants. The objective is to complete the project on schedule, on budget, and to have the new assets commissioned. Once the facility is put into operation, it must fulfill its intended role and deliver what was specified in the business-case strategy throughout its entire lifecycle.

Considerable effort is put forth during project phases prior to commissioning, but it is during the operational lifecycle that the new assets must pay for themselves by fulfilling their role in the market strategy that spurred the investment. Traditionally, the project-execution phase places less emphasis on ensuring optimal utilization of the assets during their productive life. Companies often fail to recognize and address significant operational risks, which results in paying a steep price in the form of less-than-optimal facilities and operational processes.

Operational Risks for Businesses

Risk is an inherent part of any business, and it is proportionate to the potential gains (or losses) an investment can deliver. Anything that can impact an investment's ability to successfully achieve business objectives is a risk. Some of these potential pitfalls, such as those associated with market drivers, are hard to estimate or control. Factors such as consumer preferences and competitive forces, for example, represent moving targets that can be challenging to assess, even over the near-term. With today's fast-changing consumer market, accurately predicting tastes and product features essential to succeeding in the marketplace is, at best, a complex task. Considering the total lifecycle of a new facility, even commodities present a difficult challenge when it comes to dimensioning plant capacity.

There are, however, risks that can be well understood and recognized. Operational risks fall into this category, and companies can accurately assess and efficiently mitigate such risks. In fact, well-mitigated risks can actually become opportunities. By minimizing operational risks, companies are rewarded with superior operational performance, greater margins, and a significant competitive advantage in the marketplace.

While operational risks are easier to measure than some other types of threats, they do have consequences that can be catastrophic for any company. Operational risks are related to:

- Safety, health, environmental performance
- Poor capacity utilization
- Excessive raw material waste
- Energy inefficiency
- Slow production ramp-up
- Elevated operational costs
- Quality non-compliance
- Unprepared workforce
- Excessive downtime due to failure and time to repair
- Sub-optimized design

Failure to address operational risks can endanger the performance of new facilities. There are countless examples of new plants that never achieved the level of performance specified in their business plans because they failed to assess and mitigate operational risks. In extreme cases, the whole company and its reputation can be destroyed as a result.

One of the most catastrophic cases in recent history is the Bhopal incident in India, which killed thousands and has impacted an entire community for generations. This disaster occurred in 1984, when a chemical plant leaked approximately 32 tons of highly toxic gases into the atmosphere. As a result 9,000 people who lived near the facility were instantly killed. Even today, many more suffer from soil and water contamination, while the surrounding area presents high incidences of illness and physical disabilities. Numerous investigations were launched and uncovered critical factors that contributed to the accident. All of them concluded that poor maintenance practices, safety-system failures, sub-optimal design, and poor plant location were key factors that allowed risks to escalate into a disaster with catastrophic consequences.

This tragic event can help us understand what is at stake when dealing with major capital investments in plants and equipment. All of the critical factors pertaining to the accident were operational risks that are discernible and well understood. Even when the probability of a given risk is low, potentially severe and expensive consequences justify a concerted effort to address operational risks. Processes that are designed to identify, evaluate, mitigate, and manage these risks are critical because they can avoid major catastrophes and help ensure that the investments deliver the expected business results. Failure to establish a consistent risk-management framework compounds uncertainty, turning a business venture into a careless adventure.

One of the more common manifestations of operational risk is downtime. This is especially common in capital-intensive industries where downtime represents losses that are often never recovered. In oil refineries, for instance, production is sold out, throughput is massive, and margins are slim. Every minute of downtime translates into lost revenue, directly impacting profitability and ultimately affecting market share in a highly opportunistic environment. In refineries, planned downtime for maintenance must be kept to a minimum, and unplanned downtime is the number one enemy.

It is a mistake to assume that downtime risks can be mitigated through operational practices only after the new facility is commissioned. To ensure good operational practices throughout the life of the facility, it is critical to have the operational eyes and perspective participating from the early stages of project development. In each of the project execution phases, there are critical choices to be made that impact how efficiently a plant can operate. Because they recognize the value of addressing operational risks from the onset of new capital projects, an increasing number of companies have included Operational Readiness in their projects over the past decade.

Operational Readiness

Major capital projects for new facilities demand a comprehensive approach to addressing operational risks. From the earliest decision to pursue the investment to commissioning and start-up, there are countless choices that will impact business performance and determine operational risks. In the past, operational risks were not fully addressed in the early stages of the project's implementation. As project choices are made and the project moves from engineering design to construction and later to commissioning, the number of options shrinks while the cost to mitigate risks escalates.

Figure 1 depicts diminishing savings opportunities as the project moves from initial phases to steady-state operations. Once the new facility is up and running, there are limited opportunities to impact lifecycle costs. Accordingly, the cost to mitigate risks increases as project decisions are made. If risks are only addressed during operational phases, costs quickly escalate.

A simple example to illustrate this fact is equipment positioning in a plant layout. Many existing facilities have equipment, such as pumps or gearboxes, positioned in a way that makes it almost impossible to perform routine maintenance. There are cases where walls or piping have to be demolished or dismantled in order to access critical equipment. Such a hurdle significantly impacts operations, and fixing it can be an expensive option. This type of a layout mistake represents less production availability and additional operational costs, but it can easily be prevented if there is a careful operational approach during engineering design phase when changes in the project configuration are still relatively inexpensive.

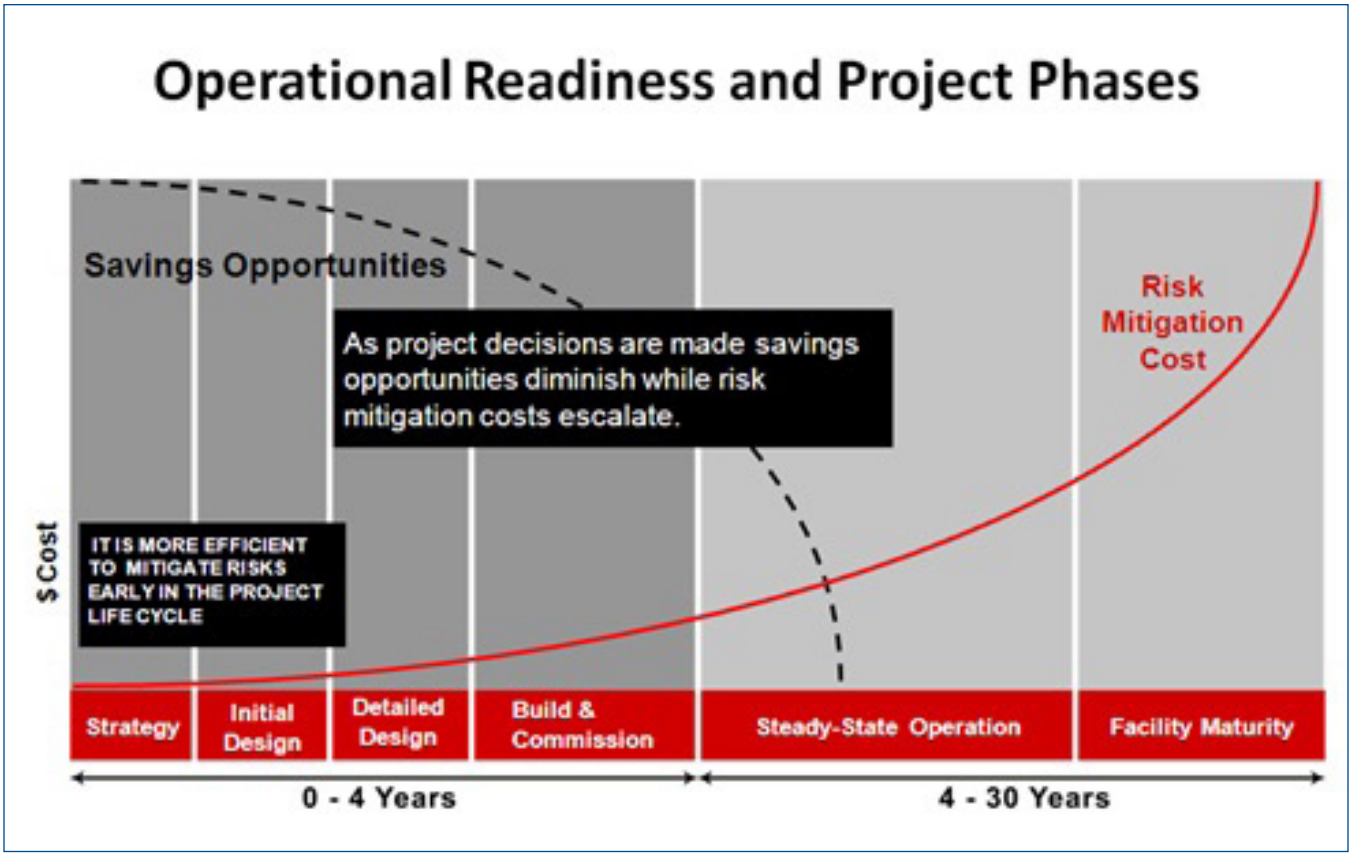

Figure 1 — *Risk Mitigation Costs and Project Phases.*

Operational Readiness is a concerted program to address operational risks from the early stages of project execution, develop mitigation activities, and prepare new projects to be efficiently operated and deliver optimal performance. Different industries, companies, and even specific situations will determine which aspects and characteristics the program needs to cover. Each and every Operational Readiness program will have unique features to match specific project characteristics.

For major projects and when implemented during the initial phases, the Operational Readiness application cost typically represents one to three percent of the total capital investment. Despite the low relative cost, Operational Readiness delivers compounding value and benefits for the entire life of the new enterprise, optimizing operational performance and maximizing business results.

Emerson New Assets Operational Readiness

Emerson has been delivering value added Asset Management and Reliability Services, where we have built a vast body of knowledge across a broad range of industries. Through a combination of wide-ranging experience and qualified professionals, we have created an effective New Assets Operational Readiness solution.

The overview in Figure 2 shows the modules or elements of the Emerson Operational Readiness process. Using a modular approach, the program is designed to be flexible, take advantage of existing procedures, and add knowledge to match specific requirements. Activities are selected from the comprehensive framework and customized to project-specific needs.

The program starts with an operational risk assessment for the particular project. Working with cross-functional teams, consultants build an operational risk-management framework to identify potential risks and probabilities, assess consequences, and pinpoint what needs to be done in the form of mitigation strategies.

As operational risks and mitigation needs become known, a customized Operational Readiness Master Plan is built with activities scheduled against project execution phases. The resulting Operational Readiness Master Plan is a graphical representation of the risk-mitigation strategy; it identifies the sequence of interrelated activities as well as the roles and responsibilities of the project participants.

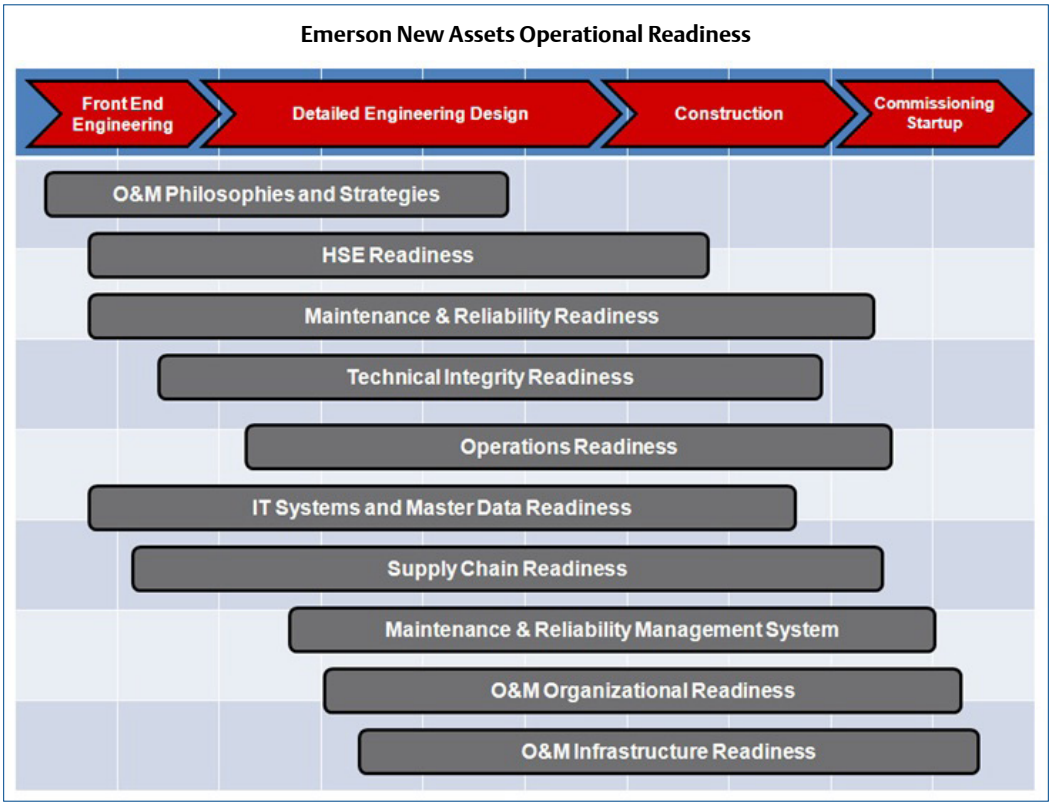

Figure 2 — *Comprehensive Operational Readiness Plan.*

To ensure a successful execution, Operational Readiness must be integrated from the earliest stages of the project organization. Operational Readiness's comprehensive reach requires an organized interface, both with other project disciplines and different organizations such as EPCs and equipment suppliers.

Operational Readiness practice requires a project management framework with a solid interface under the auspices of the overall Project Management structure to ensure proper coordination with stakeholders. It is critical that Operational Readiness activities be planned, scheduled, and staffed in coordination with key project activities.

The Operational Readiness project-management framework requires:

- A detailed Operational Readiness execution plan with activities distributed among project stakeholders, including well-defined roles and responsibilities;
- A specific Operational Readiness schedule with references to the project master schedule activities and key milestones;
- A change management procedure to organize data, information, and documentation resulting from updates during design and construction;
- A quality assurance process with reviews and audits to ensure the quality of the intermediate and final deliverables; and
- A communications plan establishing different strategies to interface with stakeholders at different levels in the project organization.

The Operational Readiness program's modular framework facilitates understanding, collaboration, and execution across the project organization. Each module contains a number of correlated activities in a precise sequence designed to match project execution phases. Following are brief descriptions for each Operational Readiness module and key activities to reach Operational Readiness objectives.

Operations & Maintenance (O&M) Philosophies and Strategies

Tailored to each project, the O&M Philosophies and Strategies describe and document high-level operational context necessary to support the business case requirements.

Key activities:

- Operational risk management framework
- Strategy development
- O&M manuals and procedures
- Lifecycle costing structure
- Performance baseline
- Operability and maintainability reviews process

Health, Safety, Environment (HSE) Readiness

HSE Readiness defines the necessary health, safety, and environment principles; it also establishes the analyses, practices, procedures, support, staffing, equipment, and systems to be addressed during all project phases in order to enable safe steady-state operations.

Key activities:

- HSE philosophy definition and local regulatory framework
- HAZOPS (Hazard and Operability Studies)
- HAZID (Hazard Identification) study
- Ergonomics and human factors engineering
- Fire protection strategy
- SIMOPS (Simultaneous Operations) studies
- SCE (Safety Critical Elements) development
- HSE management system

Maintenance and Reliability Readiness

A key component of the overall readiness initiative, this module supports the development of the project-specific maintenance and reliability strategy. Development includes required risk-based studies, personnel, tools, processes, and information necessary to support maintenance activities. Proper maintenance strategy ensures maximum safety, reliability, and availability of the equipment and systems at a minimal overall cost.

Key activities:

- Asset- and equipment-identification strategy
- Equipment maintenance and reliability specifications for procurement
- Risk-based studies definitions (RCMA, FMEA, RBI, etc.)
- Equipment criticality definition
- RAM (Reliability, Availability, and Maintainability) study
- Master equipment list and functional location development
- Equipment criticality development
- RCMA (Reliability Centered Maintenance Analysis)
- FMEA (Failure Modes and Effects Analysis)
- MOM (Maintenance Optimization Matrix)
- Activity cost based model
- PM (Preventive Maintenance) development
- PdM (Predictive Maintenance) development

Technical Integrity Readiness

Technical integrity addresses the risk of failure and consequences for static equipment, such as vessels and piping, to maintain risk as low as reasonably practical. Technical integrity readiness defines the necessary framework of activities, inspections, and resources to achieve the above objective.

Key activities:

- Technical Integrity strategy
- RBI (Risk-Based Inspections) analysis
- Process and pressure integrity procedures development
- SIL (Safety Integrity Level) instrumentation and control procedures
- IOW (Integrity Operating Window) strategy

Operations Readiness

Related to the operation of the facility and its processes, this module establishes the necessary framework of personnel, procedures, tools, and information to support the plant operators' roles and responsibilities. Development is based on the production processes and the equipment's operational needs.

Key activities:

- SOP (Standard Operations Procedures) development
- Operability reviews
- Production and manufacturing strategy
- Performance management plan
- Quality assurance and continuous improvement plan
- Commissioning and startup process and handover plan

IT Systems and Master Data Readiness

This module pertains to activities for building data and establishing the IT structure to support the project in steady-state operations. Asset data must be collected, structured, and organized from different sources into a variety of operational systems such as Enterprise Resource Planning (ERP), Enterprise Asset Management (EAM), Computerized Maintenance Management System (CMMS), Asset Performance Management (APM), Electronic Document Management System (EDMS), etc.

Key activities:

- Asset data standards management strategy
- Master data interface from engineering design to asset management
- Master data configuration
- Asset data validation and loading process
- Materials data, storeroom, and procurement strategies loading process
- Work plans and procedures data loading process

Supply Chain Readiness

This module establishes the necessary supply-chain framework for direct and indirect materials to support steady-state operations for creating logistics, inventory, sourcing, and procurement strategies. It details the warehousing and storeroom needs as well as the replenishment strategies to make sure optimal availability is maintained, including critical spare parts and capital spares.

Key activities:

- Direct materials strategy development
- MRO materials definitions
- BOM (Bill of Materials) processing
- Internal logistics for materials distribution
- Materials inventory ROP/ROQ criteria definitions
- Spare parts and capital spares strategy
- Procurement strategies and processes
- Storeroom procedures

Maintenance and Reliability (M&R) Management System

This thread details the processes and procedures for maintenance and reliability execution in steady-state operations. Planning & scheduling, performance management, downtime tracking, defect elimination, root cause failure analysis, and continuous improvement are the key elements for developing the M&R management system.

Key activities:

- Planning & scheduling process
- Change-management procedure
- Downtime-tracking system
- Reliability management system
- KPIs (Key Performance Indicators) management
- Turnaround and shutdowns management framework

O&M Organizational Readiness

This activity designs the organizational structure necessary to support operations and maintenance functions. It focuses on establishing departments, a hierarchy structure, roles, responsibilities, culture, and qualifications. Included in this module are activities to recruit and train personnel to match the O&M requirements for the new facility.

Key activities:

- Organizational structure definition
- Contract services process
- Duty task analysis
- O&M human resources recruitment process
- O&M personnel training program

O&M Infrastructure Readiness

This module includes the planning and implementation of physical resources including buildings, offices, storerooms, tools, equipment, and vehicles to support operational activities from the early engineering design in order to ensure optimal configuration of operational installations.

Key activities:

- Shops, laboratories, and offices positioning and layouts
- Shops and laboratories equipment
- Mechanical handling and vehicles requirements
- Specialty tools
- Direct materials warehousing or storage
- MRO materials storeroom
- IT and telecommunication infrastructure
- Physical infrastructure setup

Conclusion

Investing in new assets is a critical business initiative intended to actualize a company's strategies and business plans. By addressing operational risks early in the project cycle, optimal performance and best return on investment (ROI) can be ensured. A concerted Operational Readiness plan identifies operational risks, organizes actions to mitigate those risks, and prepares new assets to be efficiently and safely operated.

Emerson's customized Operational Readiness Master Plan arms companies with an action plan to mitigate risks at the earliest stages. By employing this plan, companies stand to enjoy long-term cost savings, optimized operational performance, and maximized business results because integrating operational perspective into project activities streamlines engineering design and provides new assets with operability and maintainability characteristics. Operational Readiness is a comprehensive approach that addresses different disciplines, thereby organizing efforts to build an optimized framework for steady-state operations. A well-managed Operational Readiness plan is a concise strategy for both coordinating these activities during project execution as well as ensuring optimal performance throughout the entire lifecycle of new facilities.

Emerson
Reliability Consulting
1100 Louis Henna Blvd
Round Rock, TX 78681 USA
+1 888 889 9170

www.emerson.com/opcertcon

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