Operational Readiness: From Project to Operating Asset

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SENOPS have assisted a major copper–cobalt producer in the Democratic Republic of Congo (the Project) with their operational readiness program. It entailed developing an operational readiness plan, in association with the client, that addresses all aspects required to bring this remotely located mining resource into production. This included developing systems, programs and materials required for start-up, maintenance systems and operational manuals. Training programs that are linked to the personnel ramp-up, hands on training, systems roll-out, commissioning and production ramp-up were also included. This paper investigates the benefit of implementing and integrating a budgeted operational readiness plan within the project execution plan to successfully manage the transition from a project to an operating asset. The investigation shows that risks are reduced following early identification of operational alignment and asset management issues. This includes clear staffing dates to ensure sufficient time for operations, maintenance and support groups to be trained, all aligned around common goals for ready systems, processes and procedures.

INTRODUCTION

Higher commodity prices are leading to increasing demand for various commodities and this in turn is leading to an increase in exploration for resources in remote locations, new and more cost-effective extraction technologies that are developed for these commodities and increased investor demand for new capital mining projects (Emerson Reliability Consulting, 2014a). Cobalt is one such commodity, seen as a driving force behind the revival and expansion of many existing mining projects and a driver behind many new capital projects.

The main uses of cobalt include manufacturing of lithium-ion batteries, catalysts and high-performance alloys. The key source of future cobalt is reliant on copper and nickel processing projects with cobalt being produced as a by-product of these processes (Tisserant & Pauliuk, 2016). The driving force behind market advances and increasing demand for cobalt is in the manufacture of rechargeable lithium-ion batteries which accounts for 50% of global cobalt usage (Nazarewicz, 2016). The new trend in cleaner, renewable energy and advances in new storage technologies therefore necessitates ongoing and increased cobalt production.

The introduction of a new capital project or large expansion project hinges on an evaluation of the value it can add in the form of estimated return on investment (ROI), net present value (NPV) and potential revenue and profit growth. Considering the estimation, a decision is made by the board or management team on the execution of a project (Krauss, 2014). It is important for all parties concerned to understand what is at stake should the project not be executed successfully.

With the commencement of a large capital project, an investment structure is set up dealing with various shareholders and their interests. A capital project plan and organizational structure is set up to deal with the management and execution of the project within budget and on schedule. Challenging cash flows and multifaceted design and engineering requirements place pressure on project management companies and investors in successfully adopting a business strategy.

Some of the major pitfalls encountered with large capital projects in remote locations include a shortage of talent with the required knowledge and skills, unpredictability of the marketplace, challenges with logistics and supply chain and continual changes in local and international regulations. This calls for an integrated methodology to be adopted in the execution of projects. Implementing project management systems integrated with an operational readiness plan (ORP) creates a foundation for project success and increases the effectiveness in meeting the projected targets. These pitfalls and the possible consequences they have on capital projects should be clearly understood and dissected to create a reference guide for increasing ROI and improved NPV within the project (Deloitte, 2016).

In this paper, the capital project lifecycle and the associated value appraisal are explored, together with industry operational readiness best practices. This includes setting up of an ORP and integration of operational readiness into the capital project lifecycle to reduce risks with moderate investment early in the project. With this improved commissioning, on-time ramp-up and a lasting operational performance is met.

WHAT IS OPERATIONAL READINESS?

Operational readiness is seen as a structured program that is applied to equip the owner/operator of a newly constructed or expansion project to undertake ownership of assets at project completion. This includes the safe and successful commissioning, start-up and operation of assets together with all business enterprise functions, meeting the planned business objectives and adhering to environmental standards (Christison, 2017).

There are many facets to operational readiness, some of which are investigated in this paper, that are crucial to the success of transition from a project to an operational asset.

BENEFITTING FROM OPERATIONAL READINESS

The challenges that exist with the transition from a project to an operating asset can cause serious value destruction in the overall business value of the project. By setting up and implementing an ORP, continuously measuring progress and posing corrective questions, value destruction can be minimised in the development phase of the project. This will guarantee the transition to run smoothly assuring time, budget and quality constraints are met (Accenture, 2012).

A paper by Christison (2017) adds that benefits include:

- initial production plans being executed;
- early management and operational risk identification and mitigation;
- improved capability and knowledge transfer to ensure skilled operational staff;
- integrated schedules and procedures to achieve on-time commissioning;
- early definition of staffing requirements linked to integrated on-boarding and training schedules to ensure capable and informed operational and maintenance staff;
- execution of relevant information technology (IT) infrastructure;
- support systems and procedures;

- health, safety and environmental compliance through early identification and mitigation of relevant risks;
- reducing interruptions in commissioning and ramp-up due to equipment and system defects or integration between functional business units.

According to studies by Deloitte (2012), typical project value destruction of roughly 30% occurs during the start-up, commissioning and first-year operation phases, negatively affecting the production capability and reputation, which in turn directly impacts the project NPV and ROI. A graphical representation of value destruction in capital projects is depicted in Figure 1.

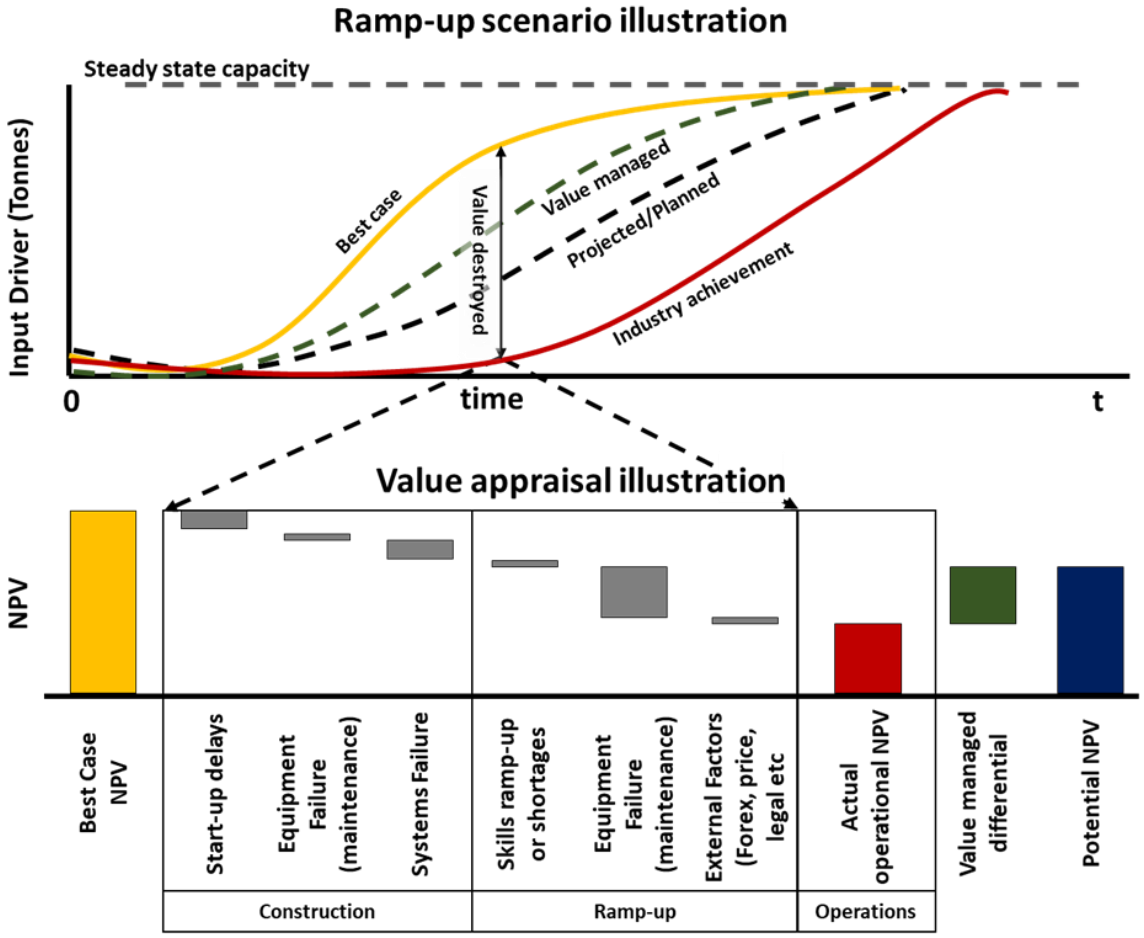

Figure 1: Capital project value destruction (Emerson Reliability Consulting, 2014a).

Two charts are illustrated in Figure 1, the first being a line chart depicting the input driver, which in this case is throughput in tonnes on a time basis. The second is a bar chart indicating the value appraisal of the input driver and indicates value appraisal of possible challenges. The black line is a good illustration of ramp-up plan. The yellow line/block indicates the best case or business case NPV that will be the benchmark. The red line/block indicates the actual operational NPV reached because of the various challenges in the construction and ramp-up phases. By implementing early corrective measures, challenges in the ramp-up phase can be reduced and this scenario is indicated by the green line/block. This increases the potential NPV illustrated by the blue block.

Implementing an ORP would minimise challenges in the construction, ramp-up and operations phases and the actual operational NPV can be closer to the best case NPV. This highlights the importance of early implementation of operational readiness from business perspective.

OPERATIONAL READINESS WITHIN THE PROJECT LIFECYCLE

The capital project lifecycle, as illustrated in Figure 2, is divided into three sections; namely, the development phase, the execution phase and the operation phase. The development phase normally involves project management companies closely working with owners to develop projects, prepare feasibility studies and front-end engineering design (FEED), which set the foundation of the project. In the execution phase, the detailed engineering design, procurement and construction, and the commissioning and ramp-up are carried out by the successful bidder. According to Navigant (2016), this area of the project lifecycle receives the most attention to assure the financial and time constraints are achieved. The operation phase of a capital project involves the owner/operator taking ownership of the project and transitioning into an asset that generates profit growth as well as increasing ROI and improved NPV.

Embedding the ORP within the project execution plan (PEP) is crucial in ensuring that the enterprise and capital project benefit from the appropriate governance, alignment and collaboration within the different phases of the lifecycle. In Figure 2, an illustration of the project lifecycle and alignment of project and operational readiness schedules are displayed.

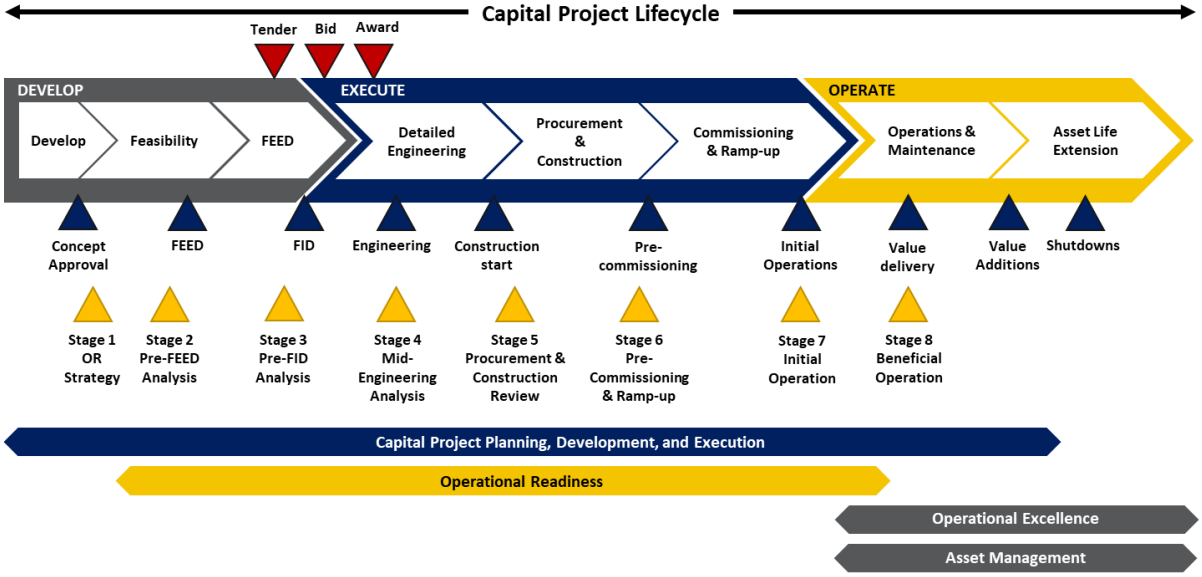

Figure 2: Capital project lifecycle timeline (Navigant Consulting, 2016).

The blue triangles in Figure 2 indicate the capital project milestones, whereas the yellow triangles indicate the operational readiness milestones. It is important for these milestones to align with the various phases as indicated.

In the capital project development and executution phases and their various sub-phases, operational readiness functions support the extent and detail of progression within the capital project. The necessary assesments to be carried out within the operational readiness functions should include the market, supply chain, and plant operations. These assesments are extended to personnel, process and technology requirments.

With the operational readiness program extending into the early stages of the operation phase, a smooth transition from project to operation is ensured. This supports the intention of reaching operational excellence and effective asset management, setting a foundation for the enterprise to succeed.

In agreement with Krauss (2014), operational readiness is frequently delayed and implemented near project completion at the commissioning and start-up phase. This puts pressure on the owner/operator, the assets, and operational personnel and is often the reason for budget and time constraints in these phases of a project.

As viewed by Navigant Consulting (2016), early promotion of owner/operator involvement in operational readiness during the development and execution phases of the project lifecycle ensures:

- a suitable project operational readiness framework is set up;
- input is provided regarding operational requirements of assets;
- business processes and systems are generated;
- participation in economic evaluations and design reviews with consideration of alternatives;
- involvement in the revision of reliability, availability, maintainability and operability, and
- contribution in the revision of health and safety standards.

A study by Emerson Reliability Consulting (2014b) shows that as a project progresses from the engineering and design phase through to the construction phase and in the end reaches commissioning and ramp-up, the risk mitigation costs increase while potential mitigation strategies decrease.

As a new facility reaches steady-state, the opportunity to influence lifecycle costs is significantly reduced as most of the decisions leading up to reaching steady state have already been concluded. Consequently, an escalation in mitigation costs can be seen as the project progresses. Savings opportunities also decrease drastically as the project reaches maturity. Figure 3 is an illustration of this phenomenon.

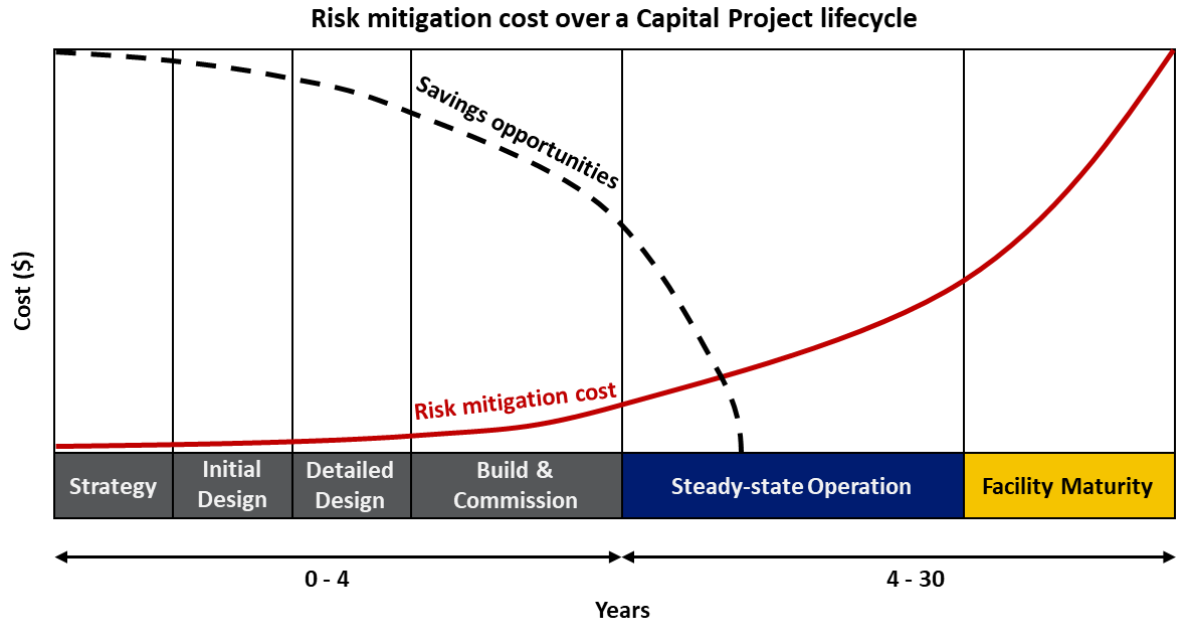

Figure 3: Risk mitigation cost over a capital project lifecycle (Emerson Reliability Consulting, 2014b).

According to Emerson Reliability Consulting (2014b), the typical costs relating to operational readiness implementation from the early phases of a large capital project amounts to approximately 1–2% of the total capital investment. Regardless of the relatively low cost, the benefits that operational readiness exerts on the total lifecycle of the project far outweigh the cost, enhancing operational performance and resulting in maximum business value.

Krauss (2014), believes that by embedding operational readiness in the PEP aligned with a suitably structured ORP, it becomes a risk management tool. The risk of delivering a project with low compliance and high cost is mitigated by initiating mitigation measures of high- and medium-priority risks early in the execution process.

Valuable experience was gained in the authors' engagement with the Project in setting up an ORP to attain successful project execution and transition to operations. Consequently, the authors agree with Krauss (2014) and Emerson Reliability Consulting (2014b) regarding the benefit exerted in early implementation of operational readiness, which includes mitigating risks early in the project lifecycle at a relatively low cost, and increased possibility of savings.

THE OPERATIONAL READINESS PLAN

An Overview of the Operational Readiness Plan

The ORP is compiled as a working document and based on the guiding principles and tested experience surrounding well planned and executed pre-production phase operational preparations. The purpose of this section is to provide an overview of the key principles involved and essential elements required of a structured approach to operational readiness planning.

Hickson and Owen (2015) describe the key objective of an ORP as guaranteeing the complete consideration and planning of essential personnel, training, systems, processes, and services needed to execute, ramp-up and operate a fully functional facility. Successful project commissioning and ramp-up to nameplate capacity requires planning definition and preparedness across all operational disciplines and supporting group functional areas, ahead of project completion and handover.

Operational readiness requires the identification and integration of all key business drivers and associated tasks required to contribute to a smooth transition from the Project phase to the Operational phase. Key tasks are funded, scheduled and accountabilities allocated, to ensure the ORP deliverables are met in a timely manner. The ORP will form the foundation for the interface between execution of the Project, Construction milestones and the meshing of operational readiness inputs.

The combination of history and experience gained from prior engagement in the operational readiness of the Project has proved that the difference between well-defined and de-risked projects that apply well-prepared operational readiness planning and those that do not, can vary from profound loss and failure, to diminished value generating opportunity, if ORP is ignored or not applied in time.

Development of the Operational Readiness Plan

A significant task in developing the ORP entails recruitment of a core operational management team with the appropriate experience and knowledge to initiate and develop the ORP and create operational capability within the operational organisation. This involves the administrative facets regarding personnel, procedures systems, information, and support infrastructure within the organisation (Hickson and Owen, 2015).

By a combined effort from the Owner's team, the engineering, procurement and construction (EPC) contractor and the core operational management team, operational capability documentation is assembled and developed. This includes:

- the overall operating strategy;
- organisational policies and procedures;
- 1-and 3-year operating plans;
- 18-month start-up plans;
- mine and production plans;

- facilities to be operated;
- resource requirements, and
- the facility construction timeline.

Development of operational capability also entails identifying possible risks, assessing the probability and consequences and developing a mitigation strategy and needs analysis for successful mitigation of the identified risks. Whether the project is a new greenfield or a brownfield expansion project, a grassroots project or part of group of facilities, the level at which operations development has been completed, the remoteness of the operation, the type of workforce, skills available, and workforce legislation are some of the main concerns to be investigated.

With the development of operational capability, a facilitated session with cross-functional teams allows for organisational planning to occur. In this planning, the project destination statement, operating philosophy/culture, health and safety management system, environmental/social requirements, and management required are defined. Timelines are also developed for business system implementation, IT system implementation, recruitment and training of personnel, enterprise resource planning (ERP) system implementation, supply chain system implementation and the hiring or contracting of contractors for critical activities such as mining, plant services, security, and logistics. Figure 4 illustrates an example of a process plant on-boarding and training timeline, which is displayed against the project development schedule.

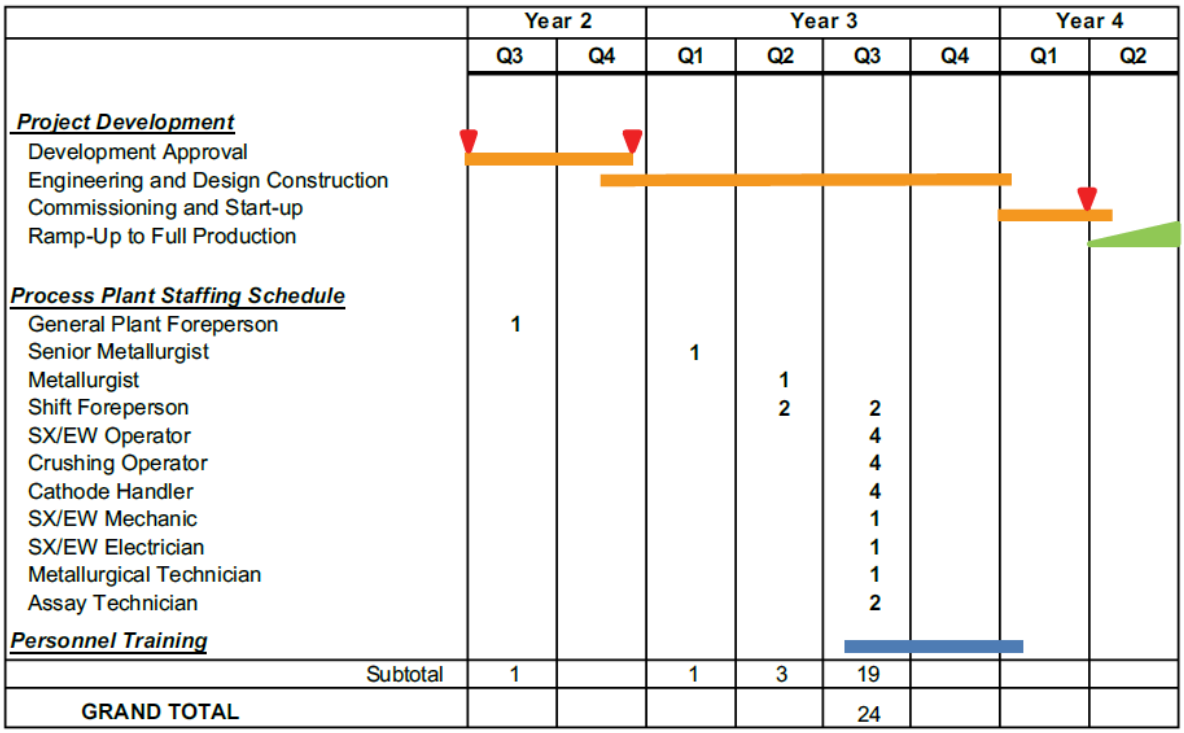

Figure 4: Process plant on-boarding and training timeline – example (Hickson and Owen, 2015).

The development of organisational subdivisions or departments is crucial in the responsibility division of different tasks. These departments should be well defined and separated to properly track progress and manage any cross-functional issues.

Tasks are identified and specified according to capability, community responsibility, regulatory compliance, business performance, and quality standard compliance and are integrated into a high-level schedule, as illustrated in

Figure 5, which provides an example of framework used to monitor, manage and report results relating to each task to be completed. Tasks are integrated with the PEP to align parallel phases within the scope of the project and operational readiness tasks. This minimises risk and ensures performance standards are met. The framework serves as the foundation on which the ORP is built. As the development progresses, the maturity of the ORP progresses and more layers are added.

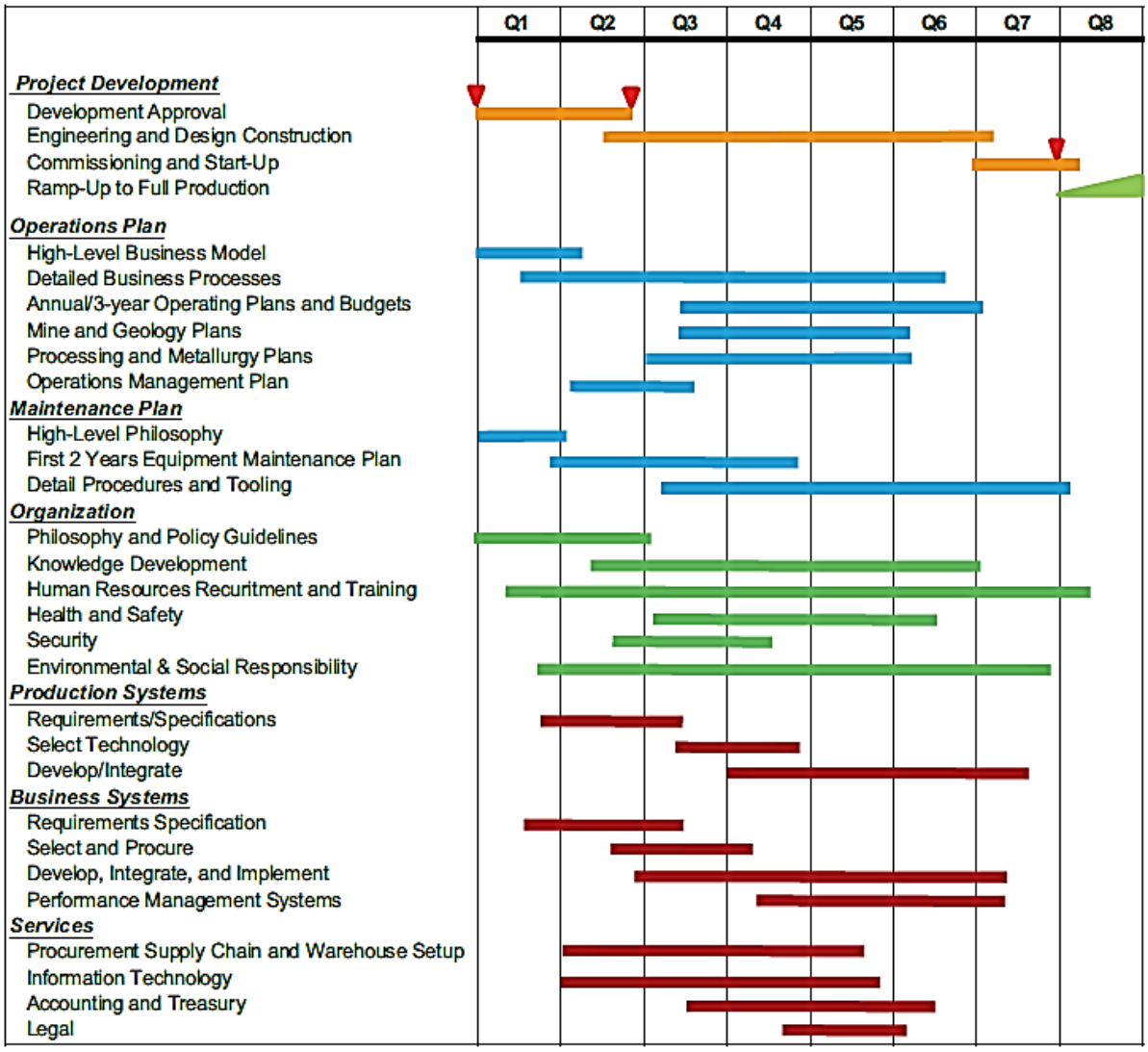

Figure 5: ORP development framework (Hickson and Owen, 2015).

Implementing the Operational Readiness Plan

The ORP should be managed as a project by defining the scope, obtaining resources, setting up and delivering according to a schedule, and reviewing progress weekly. An operational readiness project management framework is set up to ensure proper coordination between different stakeholders in the ORP.

The project management framework requires:

- a detailed ORP with tasks distributed between stakeholders, clearly stating roles, responsibilities and time constraints;
- a schedule linked to the ORP and integrated into the project master schedule tasks and milestones;

- a management of change procedure to arrange updated information, documentation, and data received from stakeholders;
- a quality management system (QMS) to ensure the quality of various deliverables of the ORP, and a communication strategy to ensure the effective interface between different stakeholders.

The developed schedule is aligned with an activities list stating key activities to be completed with the responsible person and completion date ensuring the ORP execution stays on track and any slippage of the schedule is mitigated or can be managed. An example of such a list is displayed in Table I.

Table I: Operational readiness activities list – example.

1.	Human resources		Actions	Responsibility	Deadline sate
1.1	Job profiles	1.1.1	Job profiles for each position need to be developed and approved in line with local government regulations.		
1.2	Labour recruitment histogram/plan	1.2.1 1.2.2	Identify all positions where skilled staff will need to be recruited. Develop recruitment plan for finding and securing these skilled staff.		
1.3	Labour recruitment	1.3.1 1.3.2	Identify local resource pool to recruit from Identify any recruitment companies need to recruit local as well as EXPAT staff. Identify and prepare policy for recruitment process.		
1.4	Key ramp up skills - operational	1.4.1 1.4.2	Identify all key skills needed for start-up and ramp up of the plant from a commissioning and operability perspective. Ensure these staff are recruited and trained first before administration staff is recruited.		
1.5	Defining skill competencies (Technical & Non-technical)	1.5.1 1.5.2 1.5.3	Develop manning schedules for each phase of the plant life. Identify contractor requirements. Identify consultant requirements.		

An operational readiness project manager (ORPM) is appointed as the advocate of the ORP and is responsible for setting objectives and monitoring the execution of tasks by focussing on risks and opportunities as well as promoting organisational policies and procedures.

The ORP is divided into subprojects or individual ORPs for the various departments within the organisation. These ORPs should be initiated at least six months before commissioning. Functional leads are appointed and responsible for the development of individual ORPs, complete with the necessary procedure, systems and controls in place, and directly report progress to the ORPM.

The progress of ORPs for the various departments within the organisation is also monitored and reviewed to ensure alignment with the overall ORP schedule, which in turn should be in sync with the PEP and the project master schedule. The ORP is continuously tracked, updated and progress reported to organisational stakeholders.

Emerson Reliability Consulting (2014b) believes that the integration of operational readiness from the earliest stage of organisational development will ensure successful project execution. An organised interface and good communication between different project disciplines, EPC contractors and equipment suppliers are crucial in successfully executing an operational readiness plan.

PRACTICAL BENEFITS ENCOUNTERED WITH IMPLEMENTATION OF AN OPERATIONAL READINESS PROGRAM

The authors' initial scope of involvement with the Project included:

- assisting the client in further development of the ORP;
- analysing and identifying gaps in the ORP;
- finding solutions to address these gaps;
- development of a responsible, accountable, consulted and informed (RACI) matrix to differentiate and allocate various responsibilities within the ORP.

With the identification of gaps in the ORP, certain responsibilities were allocated to SENOPS. The management, provision of requisite skills to lead various functions as well as engaging and managing sub-contractors required to develop/populate systems or services required were included in the scope of responsibilities. The activities to be carried out included:

- personnel and ramp up scheduling;
- development of training procedures and operating manuals for process and maintenance departments;
- maintenance system population;
- reviewing the organogram, job descriptions, positions and advise on key process areas (KPA) and key performance indicators (KPI);
- development of training manuals, training plans and standard operating procedures (SOP's) for unit process operations;
- providing guidance on operator training;
- developing training manuals, plans and SOP's for maintenance disciplines;
- aligning the activities with the ramp up schedule and the construction program.

With the ORP schedule analysis, it was found that the progress of the personnel ramp-up, training and recruitment were starting to slip. This slippage, remoteness of the operation, shortages of skills and complex recruitment legislation supported a decision to put the operation and maintenance of the facility, including the recruitment, training and ramp-up of personnel out on tender. The successful bidder would have to show previous experience in a similar location and similar facility as well as the ability to ramp-up in the given timeframe.

Early identification and finding a suitable contractor mitigated the risk of possible failure to recruit, ramp-up and train suitable personnel to operate and maintain the facility, thus keeping operational readiness on track.

A similar approach was taken in terms of the ERP system. The client's team responsible for the implementation of the system was experiencing implementation problems and the schedule was slipping. This led to a decision to include possible solutions in the tender document for a suitable contractor to implement or propose a unique solution to be implemented in the given timeframe, subsequently keeping the operational readiness schedule on track.

CONCLUSION

Operational readiness is an intensive program that is initiated in the early phase of a new or expansion project to address risks, develop mitigation strategies, and ensure the project is fully equipped to reach operational capability and nameplate capacity with project execution. Each project is unique and has its own unique features, be it different industries, companies or even different location. The ORP of each project differs and is uniquely applied according to these different characteristics.

Seeing that the execution of a capital project is measured by the value it can add in terms of NPV and ROI, by effectively implementing an operational readiness program in the early stage of project, the risk of a 30% value loss in NPV is mitigated. This highlights the benefit and role that operational readiness plays in the execution of a capital project and supports the decision of integrating the operational readiness program into the PEP with an individually managed budget. Another supporting factor is the indication of costs relating to operational readiness implementation from the early phases of a large capital project, which only amount to approximately 1–2% of the total capital investment.

The ORP is seen as the vehicle to achieving operational readiness by considering and planning all the essential organisational functions required to execute, ramp-up and operate a fully functional facility. These functions are defined with tasks assigned according to a schedule, with responsible advocates, and time constraints to keep track, monitor and ensure completion. This makes it a risk mitigation tool that supports the recommendation of operational readiness being treated as a separate project, managed by its own team, yet integrated into the PEP and project master schedule, and reporting progress to organisational stakeholders to ensure all parties are working towards the same goal.

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