Driving Sustainability – The Value of Operational Readiness

The notion of Operational Readiness (OR) gains momentum in all Industries and the Public Sector. What do we understand of OR? What does it mean? How does OR fit in with Projects? Asset owners / operators specify as part of the Project process the need to carry out an Operational Readiness review. Project Managers who have been asked about the inclusion of OR activities acknowledge that these days OR is part of a Project delivery. A majority still seem to be 'annoyed' by the distraction of having to deal with the operations people and their demands during the Project. Recent involvement of the Author in Operational Readiness activities indicate that by and large the elements of Operational Readiness are not defined with any clarity or embedded either in the Asset owner / operators processes or the Project delivery processes. Operational Readiness activities that are carried out add substantial cost to a Project. The paper examines the need for OR activities in the Project and identifies value add outcomes that are the compelling reasons for planning Operational Readiness as part of Asset Management.

Project delivery has been ailing for a long time. With increasing complexity of equipment, processes and deliverables, keeping projects on track and efficient has also become more complex. There have been over the years many attempts and improvements of the projects and their deliverables. In large scale projects improvements are still not resulting in better outcomes. It may be said that especially in large scale process plant projects such as in the Oil and Gas and Mining Industries, Public Uitlities, project delivery is focussed on delivering a scope of work and a plant (Asset) "to specification". Does that mean that the plant will function when we switch on the main switch to start production? Too many times have we been disappointed when during prolonged start up periods issues that had not been realised until the facilities were handed over are rectified. One way to remediate this long standing problem is the inclusion of Operational Readiness in the Project delivery plan. This requires the Project Manager to think differently, delivering a plant or facility that actually can be operated.

Generalised Anatomy of Project Delivery

Projects of today, when compared to projects of 30 or 40 years ago, seem infinitely more complex. The complexity not only relates to technical issues, but includes relationships with stakeholders, private and public agencies and multitudes of suppliers. Establishing effective and efficient Project Management is of significant importance, as it directly relates to the ability of the Project Team to deliver the Project Objectives. By definition, team capability is about competence of the people involved at all levels, the resources they have available to perform their roles and the processes or management systems they are able to deploy in fulfilling their function.

A project is initiated to create new or additional value and will generally depend on the forecast return on investment and expectations to help the Board or Management team to decide that it is worthwhile. These expectations become the reason for the project existence and should be in the terms of reference all personnel in the project must keep in mind. A statistic from the National Institute of Standards in the

US (NIST) states that there are only 30% of major projects that come in on time and budget.

Asset owners now stipulate that the Enterprise Resource Platform (ERP) system requires updating as part of project delivery, especially the maintenance management and materials management systems. Projects often deliver the update of an asset register and the identification and delivery of spares is a standard requirement. Maintenance strategies, tasks and plans are too often still a late delivery and more often than not incur high cost or are incomplete. Considerations and estimates of OPEX are often cursory and do not include life cycle cost calculations and evaluation of best options based on operating cost and renewal. Decision making in Projects is found to lack in definition and has no set boundaries, is often made by engineering judgement and in many instances by perpetuating decisions made on other similar projects. The chain of evidence is hardly broken, bad decisions follow project teams.

In the enlightened environment of Operator involvement in projects we find that operator training requirements are identified earlier than used to be the case. Operators especially those that work in a continuous process environment also suggest to the project teams the ways they would like to operate a plant or section or process. The decision on following this advice is not always well founded and often signifies the lack of operator understanding of a particular process or variation thereof. Often bad practices are found to be perpetuated in this fashion also.

It is not uncommon to find that stakeholder requirements are changed during a project with little feedback and consensus from those who identified the need for the project. Project Managers have the obligation to deliver the asset within the budget constraints, as it is difficult in their eyes to ask for more funds from owners. The results are documented in the public domain as failures to meet Stakeholder objective and in many Industry sectors manifest themselves in reduced output and requirement to finance costly repairs and upgrades to meet the initial nameplate capacities (which were subject to the project delivery in the first place).

While there is a great focus on managing project risk, the assessment of the likelihood of delivery of an operable and sustainable solution is not so often carried out and less often documented in form of competency requirements of all project team members. Project internal risk assessment must include the risk arising from personnel competency, whether engineering, maintenance or operations staff, or personnel co-opted from the Owner's organisation. If these points are not compelling enough to consider a change, Figure 1 should provide the drive to improve. It shows how Operating cost and requirements are locked in early in the life cycle of a project.

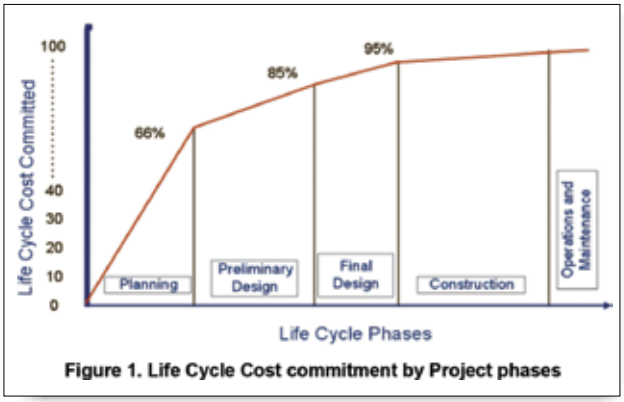

Figure 1. Life Cycle Cost commitment by Project phases

Blanchard (Benjamin S. Blanchard, Design and Manage to Lifecycle Cost; M/A Press, 1978, University of Michigan) provided the first clues, since corroborated by numerous projects, that operating costs are locked in as early as making a decision to use a specific process or a specific machine to achieve the outcome required by stakeholders.

A similarly compelling picture can be constructed from the analysis of value erosion during the project. All decisions contribute to this phenomenon of lost value due to non- life cycle centric or low sustainability (across the useful life of the facility / asset) of decisions or solutions. Highest value erosion occurs during the construction, commissioning and start up phases. Typically such erosion occurs due to these examples -

- Poor construction methods, requiring considerable rework
- Low competency in commissioning execution (Construction personnel)
- Insufficient quality control
- Lack of competency in commission practices (operations and Engineering support personnel)
- Incomplete and at times incorrect maintenance plans and maintenance instructions at time of commissioning
- Lack of direction and leadership at that stage of the Project (key personnel move to the next

project / location)

- Incomplete Operators, Maintainers, Support Engineer training
- Lack of supporting documentation or inability to locate relevant documentation
- Support IT infrastructure incomplete

Deloitte identified in a recent study that approx. 30% of Project value is lost during the critical stage of Commissioning and Start up. This not only has a direct impact on Production capability and reputation, the Net Present Value (NPV) and value return on the Project is seriously affected. In marginal projects, this might cause serious retrospect consequences to the governance team, project manager and others, as the achieved NPV will be well below the expectations and approval conditions of the Project. Figure 2 depicts the value erosion that occurs when a particular project completion strategy is employed. Lamentably, many only start to think about Operational Readiness at the time of commissioning and during the start up period. The resulting Value loss is the difference of the quantities represented under the respective curves. The aim is of course to meet best practice, the expectation of stakeholders.

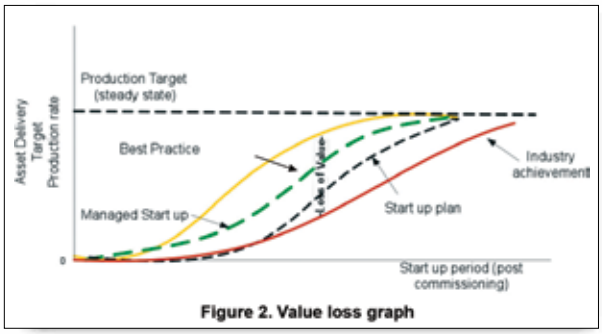

Figure 2. Value loss graph

"Industry achievement" shows where many organisations find themselves when starting a processing plant or complex facility. Start up plans usually improve the situation, but too often are started too late and fail to convince the Project Manager that the activity is value add to his priorities.

A start up plan usually assists the project and operations personnel to prioritise the activities that lead eventually to project completion and start up. Start-up plans do not provide assurances that the project deliverables meet stakeholder and business expectations, it merely ensures that tasks are carried out. It is not unlike a checklist to ensure that all tasks are completed. Operational readiness cannot be achieved with a start-up plan alone, as often they focus on the delivery of the hardware, documentation and budget compliance.

A managed start up is observed as achieving a closer fit to the stakeholder expectations, but delivering short of best practice. This strategy includes the participation of operations personnel during the project and alignment with the requirements for operational concerns in a project. Commissioning also drives some of the project activities, which generally improves Project success and moves the start-up capability closer to best practice, still leaving some shortfalls in the expected early delivery capability of the facility.

The Atomic Model of Operational Readiness

To define or find best practice, the issues surrounding and constituting risk to the project and failure to deliver need to be understood. The complexities of a Project, its interfaces and interactions are well known and described in literature. To visualise these complexities, we can use Niles Bohr's atomic model describing the parts of an atom. The nucleus (project) cannot exist in isolation from the electrons. Knowledge has to be drawn from the 'electron cloud' of Operations and Maintenance information that is circulating in most organisations. Each aspect of the atom must be held together by a shared pursuit of best practice between project personnel (nucleus) and operations specialists (electrons) without constraint of the electrons and all within the economic realities of the project such that the molecule (company) gains another complete atom (asset). The chemical nature of the atom is changed without the necessary electrons.

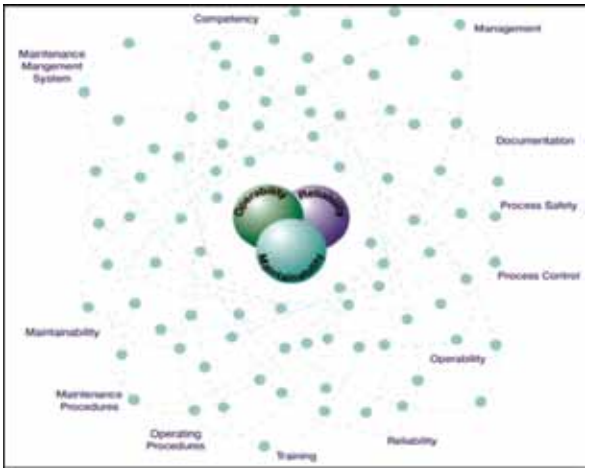

Figure 3. The Atomic Model of Operational Readiness

In the model in Figure 3 we list a number of the elements that represent operational requirements that must be addressed by a Project. It is a representative diagram only, acknowledging that there are many more elements that may have a bearing on Operations and readiness to operate. The nucleus and the electrons must be in equilibrium to form a stable system. The electrons, the various aspects of operational readiness requirements, circulate around the nucleus of the Operational phase and its main elements Operability, Maintainability and Reliability. Electrons moving to different levels require energy (the drive to make changes) and ultimately deliver a stable system. Of course there is no guarantee that the electron will be in the right place at the right time (uncertainty) there is only probability. Associated with each of the 'Electrons' is risk or the uncertainty whether the item is there in the first place and secondly if the 'charge', the attributes and competency to keep the equilibrium. In other words, the more uncertainly, the greater the risk that the goals of Operability, Maintainability and Reliability are not achieved.

To achieve this, best practice in each phase of a project regarding the different aspects of integrity, planning and competency, requires starting from the beginning of the project to put those practices into place and identify relevant control mechanisms. Done correctly, what already exists as project controls should meet these criteria. If a Project does not proceed in line with best practice, different mitigation approaches must be identified and implemented.

Identification of the operations requirements is best done at the outset of the Project. This approach commencing at the concept stage considers what is the most operable approach, which is the least complex, the easiest to construct and maintain, ensuring the highest possible level of integrity. The earlier the risks can be identified the less remedial work will be required to mitigate the risk. To visualise the way the various elements described thus far are connected, we can use the "Atomic Model of Operational Assurance" in Figure 3.

Operational Readiness Assurance Driving Project Delivery

Operational Readiness is often performed at the end of the project together with commissioning and start up activities. Operational Readiness is more often than not treated as a Project 'add on', but it is an integral and critical success factor of project delivery. Operational Readiness is a process by which a Project can constantly review itself about delivering the right outcomes and can regroup when found to be straying from the business case and the delivery intent.

Operational Readiness in the Project phase

Operational Readiness, embedded in the Project delivery process and following a quality standard model, becomes a risk management activity. It mitigates risk for the Operator to receive something of high cost and low compliance with business requirements. The Operational Readiness team embedded in the Project initiates mitigation measures for all the high and medium priority risks and even for a number of low priority risks as well. A Risk Register is established and managed by the Operational Readiness team and thus becomes an assurance device to demonstrate how operational risks are managed and mitigated.

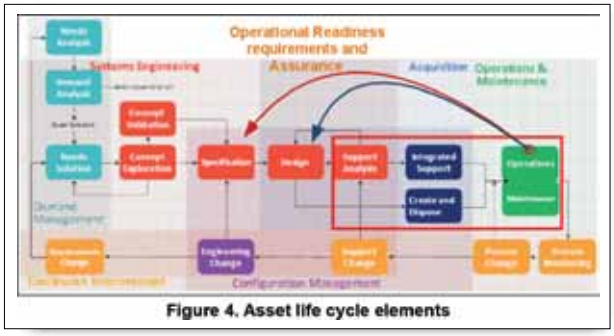

Figure 4. Asset life cycle elements

Operational Readiness Assurance is now a feature within the project and provides the Owner beyond punch lists with a validated assurance that the organisation, the support processes and the people are ready to receive and operate the new facility.

The operational and project interfaces are of increasing complexity, not the least through the present manufacturing, construction and engineering practises that span global locations. To better understand these complex activities, defining interfaces and risks across all the elements, the Asset Management Council delivery model (Figure 4) highlights the stages in an Asset Life Cycle. The individual blocks focus on the development of the Asset as well as the underlying standards that assist in the definition of achieving required outcomes. The Atomic Model of Operational Assurance fits into the overall delivery model as well as within all the boxes leading up to the operation and maintenance period.

Within each of the delivery model building blocks, there are numerous other blocks of activity which in their sum make up the whole project. Across each of the blocks the risks that arise through the underlying activities and the risks of through the interfaces become tangible and quantifiable. In Figure 5 the main elements of 'People – Processes – Tools' that enable the transformation of thoughts into functional and operational assets and facilities are highlighted. The Atomic Model as well as the delivery model cannot function without these elements.

Operational Readiness Assurance when embedded in the Project structure becomes a best practice element that is further underpinned by Standards.

This way of working and integrating the operational readiness requirements directs focus on the capability of the project team as well as the operations team that is involved. Too often we find people who are classed as competent moving from one Project to the next. This propagates the same mistakes from one plant to another. We can't just assume the project team themselves are competent. When we assign operations personnel to a project to assist in achieving operational functionality required for the final deliverable, we often send the second team to do so, as the most experienced personnel are required in the day to day operation of the current facilities. The same outcome as with project personnel is to be expected, as the operations team will do their best to direct the project team with their knowledge. We need to ensure people in critical roles are truly competent. We need to demonstrate that a thorough and robust approach is applied to competency, by having actually assessed and verified competency.

Competency Elements in Operational Readiness Assurance

Operations personnel often have no or little project and design experience. They know very well how a plant should be operating and would be needed to enable operators to take on the variety of tasks they need to re-form in the day to day operations. Similarly, maintenance personnel understand their function in the useful life period of the facility. Often the issues arising in a project in the formulation of solutions and the intricate problems that require solving in achieving a deliverable are lost on the operations teams. They have to find their way into the project environment and learn to work with multiple disciplines, engineering, procurement and other personnel delivering the outcomes. They are more often than not out of their comfort zone and normal sphere of influence and activities. Similarly, project personnel are not always attuned to the operations team and their needs within the project. Both need to learn to work together.

Both teams require being competent in the project delivery, the understanding of operation requirements and the connecting of all parts of the project and its deliverables to the business case for the project. Operational readiness if carried out correctly will provide the level assurance for all of the elements with Value erosion being minimised.

This possible improved outcome can be represented by the value add chart in Figure 5. The "Managed Operational Readiness", when started early in the Project, can achieve outcomes close to best practice. Potentially early implementation of Operational Readiness steps result in a value adding outcome that reduces the duration of wet commissioning (the period where process fluids are introduced into a system) and the plant start-up at full rates. Personnel trained in all aspects of operation, Equipment that has been operating early to enable wet commissioning, has been maintained. The potential for unexpected plant trips is somewhat reduced.

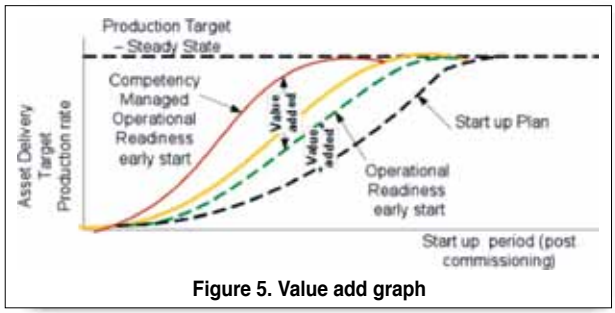

Figure 5. Value add graph

The introduction of a Competency Managed Operational Readiness strategy as described below, can add another dimension of early production and hence early Capex recovery. The value add is potentially multiplied due to reaching early production steady state.

Competency as Risk Management Tool

Project delivery demands the streamlining and standardisation of processes and methodologies as much as possible. Operational Readiness will also look at the project processes and ideally they

are aligned with the Systems Engineering Standard. Risk management in projects requires the management of risk across multiple interfaces, such as engineering design, drafting, procurement, fabrication, commissioning, documentation development to name a few and operations. Risk mitigation is effective when the competency of people is strong and management systems are mature.

Competency can be identified therefore as another method of mitigating risk in a Project, and to mitigate risk to operations. The task then of Operational Readiness is also to ensure competency of personnel involved in the Project, and competency in the people that will operate the new asset or facility.

Competency assurance requires the development of documentation, training material and supportive information to recognised standards, and the training of personnel in the fields in which they are required to be competent in. This requires mapping of the tasks, be it in the project or in the operating environment, and assigning a level of understanding and ability required. One methodology uses a simple scaling of increasing ability to gauge the maturity of the capability:

- Awareness – the basic understanding of a process, method, outcome
- Skill – the awareness is applied in the working environment, it is entails supervised actions
- Knowledge – the understanding of underlying principles and the ability to apply the knowledge in the work place to high standard and operate with minimal supervision
- Mastery – the ability to develop processes, work unsupervised and have a deep subject matter knowledge, enabling the guidance and direction of others

Part of the project delivery process then must be the competency assessment of all personnel to form the basis of the confidence level in the delivery of the Project. This has been identified in Figure 5, the value add graph, where the qualitative result of the possible value add through competency assessed personnel in project delivery is shown. Competency of course needs to be mapped for each project role, and the level of competency required must be ascertained and documented. Then it becomes possible to progressively increase people's skill and knowledge levels, and devise training requirements for each role. It is often not an objective of projects to train personnel, but if that does not happen, where does

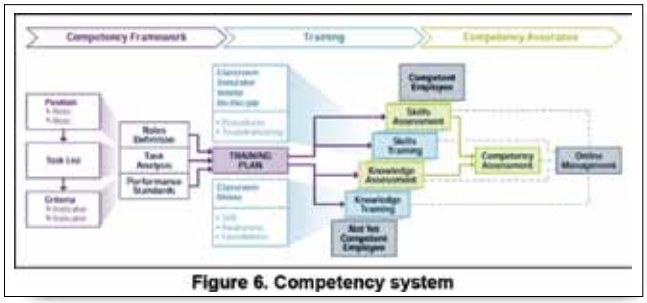

Figure 6. Competency system

the next projects' competent personnel come from?

Cost effectiveness will demand that a plan is established by which outcomes are achieved. The structured process used by Clough AMEC and AMEC Larastia, such as the one below (Figure 6) aligned to the Australian Qualification Framework, will aid in the achievement of this target.

Conclusion

This paper is a high level appraisal of issues that continue to plague projects and their owners in achieving effective delivery and system start up. Operational Readiness has become a more prominent phrase in project delivery, promising the earlier delivery of value from the complex new systems that are the subject of these undertakings. Operational Readiness as subject cannot be open to interpretation:

- The process of preparing the custodians of an asset under construction, and their supporting organisation, such that, at the point of delivery / handover, they are fully ready to assume ownership of the asset and reassuring the various stakeholders in a project that their asset is in a state of Operations Readiness

Aligning Operational Readiness with Asset Management principles and assessing project and operations personnel for their competency to carry out the work has significant benefits to all parties involved. A major impact of aligned and coordinated activities resulting in true Operational Readiness will find its ultimate benefits in the potential of reduced life cycle costs. The maturity of these approaches to exceed best practice expectations as a matter of course is unfortunately not observable across Industry. PET

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