Post-Implementation Reviews — Benefits to project and operations teams [1]

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Abstract

Failing to appreciate that project management and operations management are twin disciplines, project and operations teams generally mistrust and resent one another to the detriment of the whole enterprise—a frosty handshake at project kick-off meeting is often the omen of unholy war. Project teams are fixated on their Iron Triangle, whereas operations are seeking capabilities to exploit. Conducting Post-Implementation Reviews together should provide many benefits to both, the greatest of which being to reconcile, stop any unholy war amid project and operations teams.

Project Management versus Operations Management

A large project usually exists within a "broader" organisation involving other business endeavours. From a strategy implementation point of view, two streams are concomitantly needed: (i) Run the Business *through operations*, and (ii) Change the business *through projects*. Further, from a systems perspective, there ought to be relationships between the project, operations, and the environment. Project management and operations management are like unto "boy-girl twins" that are congenitally joined by their hip. As different as they might be, you would not see one of them without the other:

> "Project management fits within the general framework of business and management, but is a management discipline that is differentiated from the management of an organization's operations by the temporary and unique nature of projects [...] Operations and projects differ primarily in that operations are performed by relatively stable teams through ongoing and repetitive processes and are focused on sustaining the organization. Projects are performed by temporary teams, are non-repetitive and create original deliverables." (ISO 21500, 2012)

Whether the twins (viz, one being from Mars, the other from Venus) would behave in the same way or that they will enjoy each other throughout their "shared" life cycle seems to be a different matter. Most project managers would express some resentment towards operations teams—in most project circumstances, the feeling is quite mutual. It is as if anyone arriving late at a meeting attended by project and operations teams (thus, has missed the introduction part) could easily pick up the body language, and the "*us versus them*" sitting arrangement to figure out who might be on which camp. This simmering distrust between project and operations teams could reach beyond *skin-deep* levels and escalate into an *unholy war* between the two groups, to the detriment of the whole organisation.

While Operations and Maintenance teams generally lack project or design experience, "They know very well how a plant should be operating" (Krauss, 2014) and, accordingly, will be needed to enable operators to take on the variety of tasks they need to *reform* in day-to-day operations. Hence, their input is very important to projects. Operations and Maintenance considerations and requirements ought to feed back into the preceding Specification and Design stages of the project life cycle. This systemic loop supports the author's dictum of "*Putting Empathy in Operations*" (Mabelo, 2020b).

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The dilemma is most Operations and Maintenance personnel are not exposed to project processes. In most cases, Krauss (2014) bemoans, they would be (and have indeed been) out of their comfort zone and normal sphere of influence and activities. Similarly, project personnel are not always attuned to operations team and to their needs within the project (i.e., they seem to dislike their inflexibility and their "greasy" ideas)—still, they need to learn to work together. Therefore, just as Operations and Maintenance personnel understand their function in the useful lifespan of the system as deployed in its environment, "Engineering Design teams require being competent [not narrowly] in the project delivery, [but also in] the understanding of operation requirements and the connecting of all parts of the project and its deliverables to the business case for the project" (Krauss, 2014).

Project managers would benefit from involving Operations and Maintenance in projects. "Often the issues arising in a project in the formulation of solutions and the intricate problems [e.g., operability] that require solving in achieving a deliverable [i.e., a successful system] 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" (Krauss, 2014). What could perhaps get these teams working together? Would Post-Implementation Reviews assist?

Rationale for Post-Implementation Reviews (PIRs)

The Project Management Body of Knowledge (PMBoK, 2013) states that "Project Management is the application of knowledge, skills, tools, and techniques to project activities in order to meet project requirements"—the emphasis here seems to be on project activities, which sounds more like "implementation". The PMBoK definition of a project seems to give the same wrong impression:

> "A project is a temporary endeavour undertaken to create a unique product, service or result."

Yet again, it could be (and is often) misconstrued that the emphasis is on "*create a unique product*" —it should stop once a product is suitably created. Moreover, PMBoK (2013) states: "A project life cycle is the series of phases that a project passes through from its initiation to its closure". The below Figure 1 (spotted after that definition in PMBoK) might reinforce the wrong perception that projects are all about producing a physical artefact, as if everything should stop at Closeout (Mabelo, 2016). Thus, a project manager asked, "*What business is there of mine after Archived-Project-Documents?*"

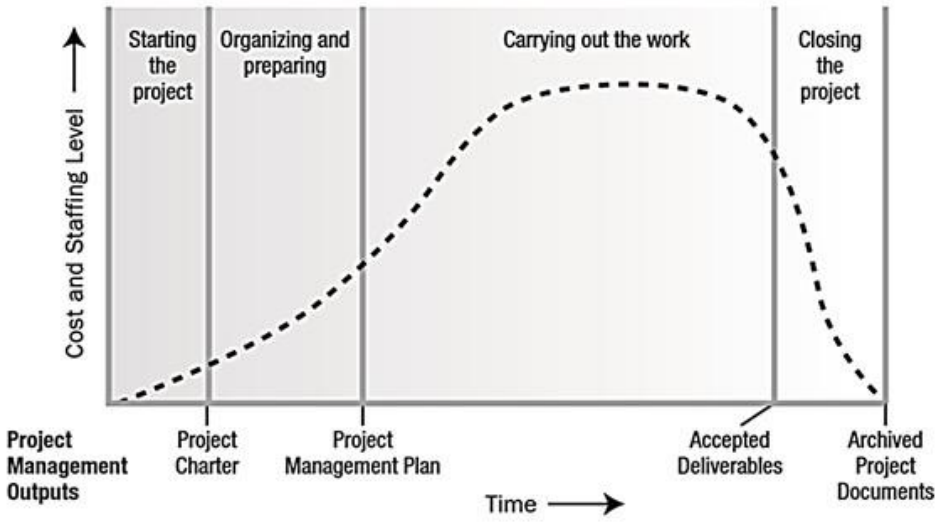


Figure 1 – Generic Project Life Cycle Structure (PMBoK 5th Edition, 2013)

Nevertheless, the PMBoK (2013) has taken care to dispel any such a misunderstanding as follows:

> "The project life cycle is independent from the life cycle of the [physical] product produced by or modified by the project. However, the project should take the current life-cycle phase of the product into consideration." (PMBoK, 2013) [*Underline added by author for emphasis*]

Indeed, by mentioning "[…] *the project should take the current life-cycle phase of the product into consideration*", PMBoK impels the reader to rather take an "operational" outlook of the life cycle. One major implication of this perspective is that project teams ought to consider how the product (i.e., system, asset, facility, infrastructure) would be operated, maintained, and eventually retired.

Therefore, project teams ought to invite and accommodate their relevant operations counterparts into the "delivery" life cycle (i.e., from Concept to Closeout)—since "*their input is very important to projects*", as Krauss (2014) advocates. It becomes similarly clear that project teams should also take a due interest as to what happens in ensuing operations, subsequent to the Closeout phase. At the very least, such an interest will afford them an *incentive* and an opportunity to experience and validate the outcomes of the delivery life cycle, whether the "*What to Build*" and the "*How to Build*" designs have translated to a deployed system that conforms to operational and transition requirements and is "adding value" to operations. In terms of strategy implementation, it is crucial that the new asset is put to use, exploited by operations teams to derive business and other benefits.

A good place to gauge as to what extent the deployed system (e.g., asset, facility, infrastructure) is performing as designed, as constructed, and as intended would be none other than after the said system has been *in operations* following a successful ramp-up, at "Post-Implementation Reviews" (PIRs)—which are often overlooked, even in Large Infrastructure Projects. PIR is where effective transition to operations should be tested: "*To what extent has the system improved operations?*" Hence, any "performance bonus" to the project team ought to be paid out *after* a satisfactory PIR.

A Post-Implementation Review (PIR) shall constitute a Verification and Validation (V&V) point where a Verification exercise is carried out (i.e., *Is the deployed system/facility performing right?*), as well as a Validation exercise (i.e., *Is the built and deployed facility right for the client/users?*). While these V&V exercises are to be conducted during operations, after Closeout, they still prove to be of tremendous significance to the project teams in terms of not only ultimately verifying and validating (i) the selected Concept of Operations (which occurred during the preceding Concept and Prefeasibility phases), (ii) the "*What to Build*" and "*How to Build*" (which occurred during the Feasibility and Construction phases), but also (iii) the Lessons-Learned (which occurred at the Closeout phase) for the benefits of future projects (e.g., as input to future training programmes).

In the same vein, traditional project management often compares the projected costs and schedules against those recorded at Closeout. The sad reality is some major cost and schedule items are not available at that stage yet. Additional costs to the tune of 25% to 40% due to flawed/delayed ramp-up to operations often come in later and should be reflected against the project team's performance. This concern can prove even trickier over legal matters as the following two instances illustrate. First, the Ellis Park Athletics Stadium (Johannesburg, South Africa) was scheduled for completion in May 1995, but it was not ready until September 1995. Even when it was declared 99% complete, "further instructions" (during construction) led to the contractor claiming R 30 mil for extra works on top of the original "fixed-price" of R 51 million. After a drawn-out arbitration, the owner (City Council of Johannesburg) settled for R 19 million, plus legal fees. A total amount of R 74 million was disbursed, whereas the *final* cost report (as of Project Closeout) merely recorded R 51 million.

On another project estimated to cost R 7 billion (as of 2010), Closeout Costs reflected R 35 billion; yet the main contractor later lodged "extra claims" and stood poised to pocket a further R 32 billion. Surely those project managers (and teams) ought to "learn" from those mishaps they had caused, which may have badly affected operations (i.e., tariffs), maintenance, disposal, and future projects.

Post-Implementation Reviews provide both project teams and operations teams with an invaluable opportunity to perform a *backward-* and a *forward-* review of the deployed system, not only to learn what could have gone wrong and why, but also to better prepare moving forward. Therefore, if they could find excuses why they would not collaborate, here is a good reason they shall do so; and if they can learn to work together at PIRs, they would soon do so throughout the life cycle. Till then, it should not come as a surprise that many LIPs beget *white-elephants*—no value added!

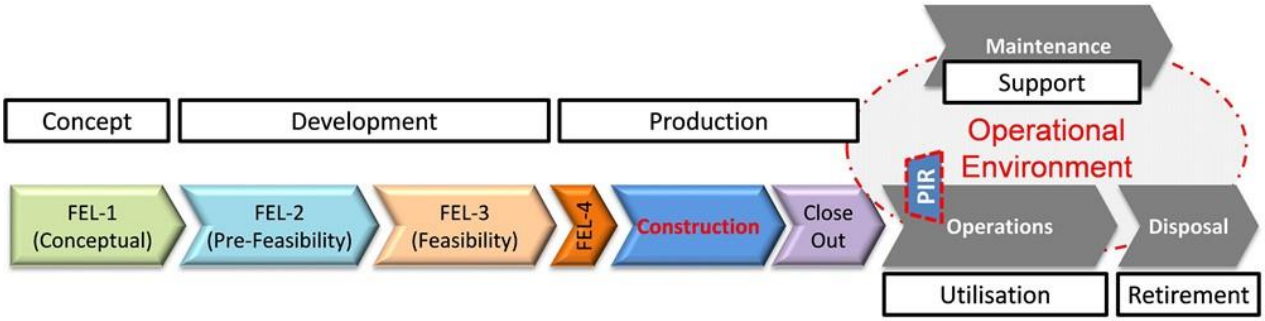


Figure 2 – Project Life Cycle depicting "Operational Environment" and PIR (Mabelo, 2021)

Benefits of Post-Implementation Reviews (PIRs)

Systems (e.g., facility, infrastructure) are indeed designed, constructed, and deployed for the sake of improving (or establishing, *in the first place*) effective, sustained operations (Mabelo, 2020b). From that perspective, PIRs are a welcome device for *gauging the measure of such improvements*.

Thus, PIRs provide opportunities for Verification and Validation and Lessons-Learned as follows:

(1) Evaluation of "actual" benefits derived from exploiting the newly deployed system
(2) Compilation of the "*As Is*" dossiers and comparison thereof against the "*Should Be*"
(3) Operational Adjustments deemed necessary for attaining Operational Excellence

Unfortunately, a recent survey (Mabelo, 2016) of the Large Infrastructure Projects (LIPs) industry across Southern Africa indicated that a mere 41% of the entities surveyed would agree that PIR is indeed taking place, whereas 18% (a fifth) could not even tell whether a PIR process was in place. This predicament explains the following "issues" that emerged from the said LIPs delivery survey:

(a) The adopted project life cycle methodology (if in place) was not being used consistently
(b) Project personnel were not satisfied with the adopted methodology (wherever applicable)
(c) Lessons-Learned were not shared with the project community, as almost half would admit; This "routine" should be planned and budgeted for [viz, Question Q_{45} ("*Lessons Learned on projects are captured and shared*")—45% of respondents disagree, a further 5% cannot tell]

It also transpired that up to 60% do not consider PIRs as "mandatory"—which is quite concerning. A mandatory PIR process ratifies to what extent the project outcomes are fulfilling their purposes. The same LIPs survey indicated through a correlation study that "*those entities that treat Post-Implementation-Review as mandatory generally seek to formulate clear project requirements at the*

outset" [Refer to p.128: Correlation between Q_{37} and Q_{21} could suggest that those entities that treat Post-Implementation-Review as mandatory [i.e., project must pass PIR] also seek to formulate clear project requirements from the outset—*formulating clear and correct requirements in the first place prevents wrong, unrealistic expectations (and unnecessary arguments) at the PIR*] (Mabelo, 2016).

The above findings not only make sense in terms of adopting "*project requirements*" as a yardstick for gauging the measure of project success, but even of the necessity of establishing organisational parameters (i.e., scope, success criteria, timing, roles and responsibilities) of a Post-Implementation Review; for instance, PIRs should never take place until ramp-up is complete, operations are stable. Many an organisation out there have failed to conduct PIRs owing to their "*lack of knowledge*", even confusing it with some form of "soft audit"—with devastating implications to their business. It should not be reduced to a review of project delivery, but rather of improvements in operations.

At a certain organisation, some general manager was urged to conduct a series of PIRs on projects. Owing to his lack of project management acumen, he enlisted the services of an auditing firm for guidance. They advised him to carry out "comparisons" between volumes of traffic before-project against the *as-designed* traffic and, on the other hand, against the after-project traffic, as well as to appoint a quantity surveyor to conduct a *review* of actual costs incurred on major equipment. Unsurprisingly, the report came out as satisfactory. However, two financial-years on, the Income Statement exposed how the billions of Rands invested in capital projects failed to yield any fashion or measure of *solid improvement* in operations. The company has later faced insolvency, of course.

Post-Implementation Review (PIR) is a crucial process for ratifying that the System *in operations* has effectively attained Operational Readiness and Operational Excellence and is indeed delivering the expected benefits as per the business case. For instance, how does the "actual" ROI (Return on Investment) and/or ROCE (Return on Capital Employed) and operational performance parameters compare against the projected and/or expected figures as reflected, promised in the business case?

> "Once strategies have been implemented [through delivery of projects], the following step is to monitor and observe whether the intended improvement in system [or plant] performance actually occurred. [For] One should also be careful to identify any unintended degradation in the performance of one subsystem, due to policies aimed at another subsystem. The capability to monitor the success of policy alternatives is often absent, and therefore one may include monitoring systems as part of the strategy for [project] implementation." (Dodder et al., 2005)

After the project outputs have been in use for a period, good-practice recommends conducting a PIR to ascertain the extent to which planned business outcomes and other benefits have been achieved. The timing of a PIR should follow completion of ramp-up, after the system is *notably* stable and is part of the day-to-day operations of the organisation—which generally occur some 6 to 36 months after System Deployment (deemed to have occurred following a successful ramp-up to operations). Any hastened PIRs could prove futile since its precipitous timing may not allow "issues" to manifest.

Post-Implementation Review (PIR) reporting must include any flaws in System Requirements as well as in technical features. Inconsistencies and deviations at the interfaces between the system, in its operational environment and systems that enable Utilisation Stage shall lead to requirement changes and corrective actions (viz, operational adjustments). Thus, PIRs should reveal the gaps between the "realised" and "Real" needs regarding any *undesirable* situation in the organisation. Hence, the series of PIRs should guide operations teams in identifying, planning what operational change initiatives might be needed—ipso facto, the *firstmost* PIR should involve the project team.

At that *firstmost* PIR (viz, first review to occur within 6 to 36 months after successful ramp-up), the initial Verification and Validation should entail confirming that the applied ConOps reflects the optimal method of operations and that operations respects the method specified in the ConOps. Here is a place for project teams to validate the choice of ConOps made at Concept/Pre-Feasibility. In addition to the V&V process on ConOps, PIR shall entail the following implementation aspects:

(a) Delivery of business benefits (or any contributions thereto) in line with the business case—including a hierarchy of objectives, ROI/ROCE, capital value of assets, operational benefits from a stakeholder's perspective (e.g., owners, users, customers, regulators, communities)

(b) Extent of attainment of Operational Readiness (at ramp-up) and of Operational Excellence

(c) Context-System's dynamics (i.e., *unanticipated* changes to laws, socio-economic drivers, ecology, and operations may have imposed significant adjustments to the *deployed* system)

(d) Realisation-System's suitability (i.e., project and system requirements, planning and design assumptions, processes, tools, and skills utilisation), considering the "actual" performance

(e) Analysis of above considerations, and any emergent issues to determine improvement areas

(f) Proposed Corrective Actions (in line with current organisational and operational strategies)

(g) Lessons-Learned, which should apply to both the project and the business environments

From the perspective of traditional project management, there should be no need to conduct a PIR on a failed project that did not even make it to operations after Closeout. This outlook could prove problematic for two main reasons. Failed projects, particularly those that sunk near or during ramp-up should also be investigated in *post-mortem* mode to determine operational aspects that failed; secondly, projects that failed after Closeout (i.e., white elephants) are even more interesting with regards to what exactly may have turned them into failure, seeing they were physically completed.

Most *white-elephant* projects manifest in the form of failure to meet the current and/or projected needs that motivated the project in the first place (i.e., improvements in operations). Should the PIR (or post-mortem version) raise red flags in "Needs Gaps", the following questions will apply:

- Main causes (e.g., errors in requirements, design, execution, ramp-up) of operability gaps?
- Implications to the project (anything chargeable to contractor) or operations (malfunctions)?
- Impacts (e.g., approval, descoping or deferment) on other current or planned/future projects?
- Impacts (e.g., financial performance, pollutions) to *overall* business and to the environment?
- Lessons-Learned about "Delivery" (i.e., planning, design, construction) and/or operability?

But traditional project management is not necessarily conversant with this manner of discourse. The PMBoK (2013) openly states that "The performance of a successful team is measured in terms of technical success according to agreed-upon project objectives (including quality levels), performance on project schedule (finished on time), and performance on budget (finished within financial constraints). High-performance teams are characterized by these task-oriented and results-oriented outcomes"—in other words, projects are successful when delivered on-time, and on-budget, and to quality specifications; the traditional Iron Triangle so dear to project managers.

However, ISO 21500 makes it clear that organisation issues also matter, not just the Iron Triangle:

> "The project environment may impact project performance and success. The project team should consider the following: […] Factors within the organizational boundary such as strategy [i.e., objectives thereof], technology [i.e., operations], project management maturity and availability of resources, organizational culture and structure." (ISO 21500, 2012)

Therefore, a holistic definition of success should consider both business and delivery dimensions. The author has previously discussed a Project Failure Grid with two gauging axes (Mabelo, 2021); to the *traditional* Delivery Performance axis (i.e., on-time, on-budget, to-specifications) he would add the Business Improvement axis (i.e., improved operations, strategic goals), both ranging from "low" to "high". This Project Failure Grid indicates four quadrants pertaining to project outcomes:

1. Total Success—quadrant whereby both delivery and business targets are satisfactorily met
2. Delivery Failure—quadrant whereby delivery targets are missed, but business targets met
3. Business Failure—quadrant whereby delivery targets are met, but business targets missed
4. Catastrophe—quadrant whereby the project has failed on both delivery and business axes; (should) have been aborted/canned, with nothing achieved to show for the resources spent

Considering that "A factor present in every successful project and absent in every unsuccessful project is sufficient attention to requirements" (Suzanne and James Robertson, 1999), the above-mentioned Project Failure Grid also suggests that the quality (i.e., correctness, completeness, and consistency) of project requirements would determine the likely outcomes of projects as follows:

(i) "Wrong Requirements" (viz, of good quality, but irrelevant) largely affect Business Targets

(ii) "Poor Requirements" (viz, very relevant, but of low quality) largely affect Delivery Targets

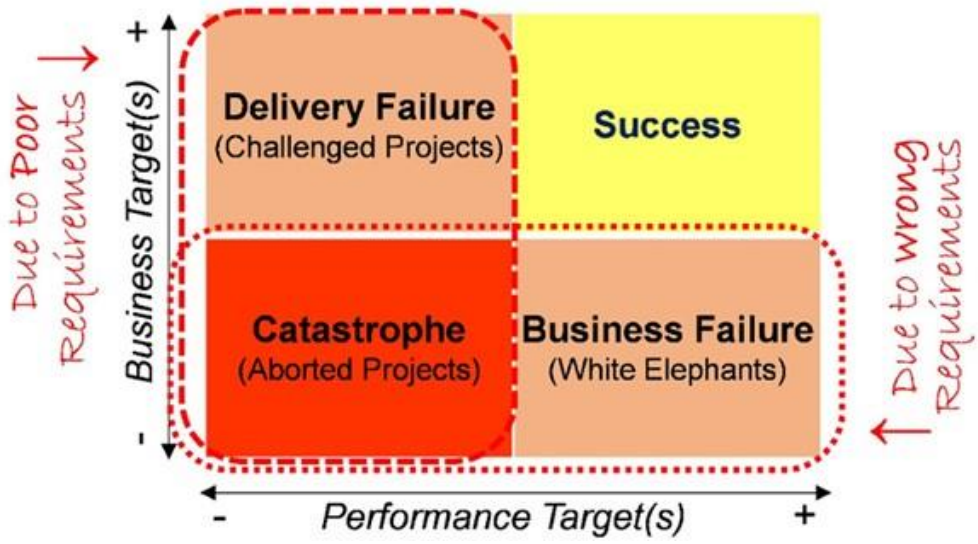


Figure 3 – Requirements and Project Failure Grid (Mabelo, 2016; Mabelo 2021)

The above Figure 3 introduces the notion of a double-dimension definition of project success or failure. In addition to the Iron Triangle, the project team ought to consider the business-targets, or organisational objectives such as increased sales/revenue, higher customer satisfaction, improved safety, upgraded quality, superior ROI or ROCE, reduced carbon-footprint, enhanced reputation.

For a change, the project team is equipped with relevant business considerations to maintain a lucid dialogue at the PIR enquiry, not merely insist on "*their having completed within the Iron Triangle"*. Elsewise, even the 65% of industrial projects (up to 75% in some sectors) with budgets larger than $1 billion in 2010 U.S. dollars that failed to meet business objectives (Merrow, 2011) might still be argued as successful—just because such were completed on-budget, on-time, and to-specifications.

Project teams generally know about the business case, yet they do not seem to appreciate that such a business case has committed to delivering *benefits* to the organisation in line with the strategy being pursued, which gave rise to the project. They often leave it for the sponsor to worry about. Of course, since the sponsor serves as the "*hinge between the project and the business realms*", he is primarily responsible for ensuring that projects outputs are duly converted into organisational capabilities. However, the project manager ought to appreciate and assist the sponsor in this role:

> "Capabilities are exploited in order to achieve outcomes […] you have to make some changes in 'business as usual' in order to enable outcomes […] those outcomes and benefits are what enable you to achieve transformational corporate objectives […] but [you] also recognise that they may lead to dis-benefits [despite *positive* outcomes]." (Ferguson, 2014)

A project delivers a specific *output* (e.g., product, asset, service, result), which in turn may require combining with other projects (i.e., in a programme) to afford a *capability*. Indeed, a capability is a completed set of outputs required to deliver an *outcome* (e.g., service capacity, desired function, operational attributes) that enables an entity to exploit specific opportunities. Hence, a strategic benefit is a measurable improvement resulting from an *outcome* that is perceived as beneficial to stakeholders (e.g., operations team, customers) and contributes to one or more strategic objectives:

- Therefore, the business case for a particular project should take care to list and describe the *outputs*, *capabilities* (including from inter-dependent projects) and *benefits* to be delivered, as well as when and to what extent such would translate in *solid* operational improvements
- While project *outputs* (e.g., physical artefacts) could and should be verified and validated (refer to V&V) both during System Development and Closeout, attainment of *capabilities* and realisation of *benefits* cannot be ascertained (through Verification and Validation) until at some point during Operations—except in those specific cases where a model is available
- The business case should undergo a Verification and Validation (i.e., review of *capabilities* and *benefits* to be attained) both during project delivery and at Post-Implementation-Review

The expected benefits of a product or solution (e.g., powerplant, hospital) to the organisation shall be defined in the business case. Therefore, Solution Evaluation involves planning the works that determine how to measure (i.e., aspects and processes) these benefits by defining the following:

- How the Solution will be evaluated, as well as the evaluation criteria and acceptance levels
- Evaluation techniques to be used (e.g., inspection, testing, modelling, special methods/tools)
- Quantitative (i.e., key measurements) and qualitative evaluation activities to be performed
- When, how often, by who (i.e., responsibility, approval) that evaluation will be carried out
- Approaches and/or methods of information analysis and of reporting/ratification of results

A new system may exhibit desired and/or undesired, as well as serendipitous emergent properties. Thus, it is imperative for any business to determine whether a "deployed" solution has achieved the desired business results. Therefore, Solution Evaluation should be performed *before and after* a solution has been implemented, and using techniques such as surveys, focus groups, exploratory testing, expected versus actual comparisons, outcomes measurements, and financial evaluations (BABoK, 2015; PMI, 2015). Then again, management theories suggest people behave according to what they are measured on: "Tell me how you measure me and I will tell you how I will behave. If you measure me in an illogical way […] do not complain about illogical behavior" (Goldratt, 1990).

Conclusions

The PMBoK appreciates that "Projects can [and should] intersect with operations at various points during the product life cycle" and, thus, it notes: "At each point, deliverables and knowledge are transferred between the project and operations for implementation of the delivered work. This implementation occurs through a transfer of project resources to operations toward the end of the project, or through a transfer of operational resources to the project at the start" (PMBoK, 2013).

However, the PMBoK is thus far conspicuously silent on Post-Implementation Reviews (PIRs). Even when it suggests "*post-implementation analysis, evaluation, and lessons learned*" as a way of evaluating decision-making (i.e., the impact thereof) and mentions "*post-implementation risks*" the PMBoK Standard remains silent on practicing the same approach at the overall-project level.

While Systems Engineering experts profusely discuss system-level Verification and Validation, they confine their attention to Closeout, not overtly bothered about Post-Implementation Reviews:

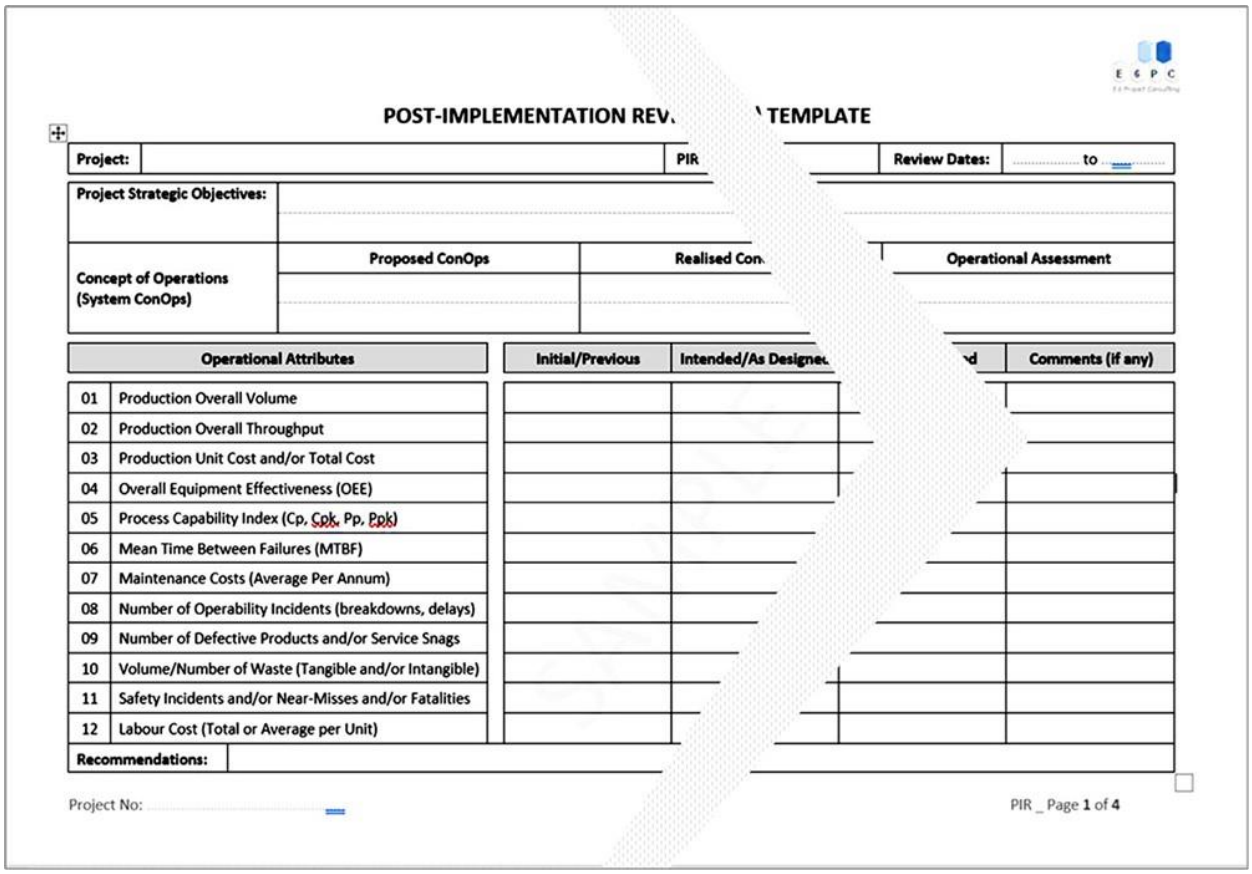
> "Preparing for system-level tests to determine that the system performance requirements are met and that the system is ready for operational evaluation is more than a normal extension of the integration test process […] System performance tests go well beyond this goal and measure how the system as a whole responds to its specified inputs and whether its [test] performance meets the requirements established at the outset of its development." (Kossiakoff et al, 2011)

No wonder most project teams are not excited about, committed to Post-Implementation Reviews. While some project teams duly verify and validate the project business case (e.g., check accuracy; confirm alignment with strategy and stakeholder expectations) during planning stages, they do not apply the same stance *ex-post*—with the system *in operations* to ascertain the "true" project results. For example, Mr. DB who compiled most project business cases in a large organisation was asked whether he could think of any infrastructure project that delivered benefits as per its business case. He went quiet for a while, and then sighed: "*Yeah … none*". The real trouble is that he had never thought of validating a business case until the query came up; was he perhaps scared of the truth?

No project shall be deemed successful unless a PIR has duly established attainment of objectives. Providing a PIR-based "feedback-loop" is essential in effecting leverage and/or improvements to the performance of large and complex systems such as in modern infrastructure (Meadows, 2009). Conducting effective Post-Implementation Reviews affords significant benefits to both project and operations teams in terms of Verification and Validation (i.e., extent to which objectives have been reached) and of Lessons-Learned (i.e., what might have gone wrong or needs improvements). Nevertheless, given the perennial mistrust and resentment between project and operations teams, the greatest benefit is in reconciling, stopping the *unholy war* between project and operations teams. This change in organisational culture would enhance not just project delivery, but the whole business.

Annexure

The pane below (Figure 4) provides an excerpt of the E6PC template for PIR in industrial projects; additional sheets and associated information are concealed herein owing to copyright stipulations.



POST-IMPLEMENTATION REV. ' TEMPLATE

Project:		PIR		Review Dates:	to
Project Strategic Objectives:					
Concept of Operations (System ConOps)	Proposed ConOps		Realised Con.	Operational Assessment	

	Operational Attributes	Initial/Previous	Intended/As Designe.	d	Comments (If any)
01	Production Overall Volume				
02	Production Overall Throughput				
03	Production Unit Cost and/or Total Cost				
04	Overall Equipment Effectiveness (OEE)				
05	Process Capability Index (Cp, Cpk, Pp, Ppk)				
06	Mean Time Between Failures (MTBF)				
07	Maintenance Costs (Average Per Annum)				
08	Number of Operability Incidents (breakdowns, delays)				
09	Number of Defective Products and/or Service Snags				
10	Volume/Number of Waste (Tangible and/or Intangible)				
11	Safety Incidents and/or Near-Misses and/or Fatalities				
12	Labour Cost (Total or Average per Unit)				
Recommendations:					

Project No: .....

PIR _ Page 1 of 4

Figure 4 – PIR Template, One-Page Excerpt (Adapted from E 6 Project Consulting, © 2022)

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Additional Readings

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Pascal Bohulu Mabelo, *MBA, MSc (Industrial), BSc (Civil), Pr Eng, Pr CPM, Pr. PMSA, PMP*, has more than 25 years of professional experience and possesses a wide range of technical and managerial skills pertaining to large and complex infrastructure projects. He has worked in large infrastructure projects as a design engineer, project/programme manager, project consultant and project management executive. Pascal was honoured to serve as the national chairman of Project Management South Africa (PMSA), the leading Project Management professional association in Southern Africa.

Pascal has published the book: "*Managing Engineering Processes in Large Infrastructure Projects*" (2021); he has also published, "*How to Manage Project Stakeholders—Effective Strategies for Large Infrastructure Projects*" (2020) and "*Operational Readiness—How to Achieve Successful System Deployment*" (2020). He assiduously promotes the application of Systems Thinking and/or Systems Engineering principles and concept to unravel complexity in Large Infrastructure Projects (LIPs) in order to address their persistent risks of failure and their massive, even pernicious, cost and schedule overruns.

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