The Five Foes of Project Risk Management [1, 2]

Pascal Bohulu Mabelo

Abstract

Organisations involved in "risky" initiatives should implement risk treatments to reduce residual risks to levels acceptable to relevant stakeholders and ensure efficiency and effectiveness—to protect the organisation (or project) from potential losses or threats to its continued operations. Both the PMBoK (on Project Management) and ISO 31000 (on Risk Management) concur that Project Risk Management (PRM) should aim at increasing the "likelihood of success" in projects.

Like in the "Five Chinese Brothers" story (Appendix A) where the brothers work together to defeat justice, five inadvertences bedevil Project Risk Management. Though they do not necessarily work in the same order as the Five Chinese Brothers, they do a disservice to project delivery, mostly in Large Infrastructure Projects. Whereas the Chinese Brothers used each one's special aptitude to escape an execution sentence, these insidious "Five Foes" have so obstructed risk management efforts that PRM's significance and utility are increasingly questioned by executive management. No wonder, less and less attention and resources are devoted to its proper implementation in LIPs.

To the concerns raised in three previous articles (Mabelo, 2023a; Mabelo, 2023b; Mabelo, 2024) the author now adds two other issues that plague PRM and the delivery of Large Infrastructure Projects. Thus, five (three plus two) inadvertences in conventional PRM are unveiled as follows:

(1) *Ignoring "project life cycle" in PRM*
(2) *Ignoring the project-specific context*
(3) *Employing the PRM intermittently*
(4) *Throwing money at treating risks*
(5) *Implementing the PRM in a silo*

This paper essentially discusses these five flaws or inadvertences as the "Five Foes of Project Risk Management" that work insidiously to diminish the otherwise significant contributions of Risk Management in Large Infrastructure Projects (LIPs) and other industries—they bring woes!

Risk Management and Project Delivery

Organisations involved in "risky" initiatives such as large and complex projects should implement risk treatment measures. Projects inherently entail risks, stemming from their forward-looking nature encapsulated in the Latin word "*projectum*" (viz, *that which is thrown ahead*). Nobody can effectively (not to mention, accurately) predict the future in the current VUCA environment (i.e., Volatility/Vulnerability, Uncertainty, Complexity, Ambiguity). Therefore, the imperative of risk

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management, especially in Large Infrastructure Projects (LIPs), is to protect an organisation from potential losses or threats to its continued operation (Ang, 2023). Failure is not an option in LIPs.

Despite advances in the LIPs industry, Project Risk Management (PRM) is employed "*merely as one of the many knowledge areas*" of modern project management. However, the PMBoK (on Project Management) and ISO 31000 (on Risk Management) concur that the aim of Project Risk Management (PRM) should be none other than to increase the "*likelihood of success*" in projects:

(i) "The objectives of Project Risk Management are to increase the probability and impact of positive events and decrease the probability and impact of negative events in the project." (PMBoK, 2013)

(ii) "Risk Management increases the likelihood of an organisation [e.g., project] performing as planned by [1] identifying and [2] managing barriers to meeting objectives in advance [...]" (ISO 31000, 2018)

Owing to the VUCA nature of today's infrastructure projects, it is no longer a matter of *whether* project outcomes might stray from objectives, but rather the *extent and impact* of those deviations. Despite this realisation, inadequate Project Risk Management remains a persistent factor of project failure in diverse organisational landscapes—and it is getting worse (Clancy, 2014; Nevine, 2015).

Chronic delays and cost overruns on recent multi-billion projects, locally and abroad, attest to the high prevalence and severity of the issue (Flyvbjerg *et al.*, 2003; Nevine, 2015). A comparative review of the Chaos Report (Standish Group) from 1994 to 2009 reveals that there has been no major improvement in terms of project outcomes. Excluding the 1994 data of *successful* projects (16%), the remainder gives a standard deviation $\sigma = 3.5\%$, suggesting no significant improvement has been recorded during that period. Any apparent reductions in failure rate between 1998 and 2002 could be attributed to a heightened focus on project delivery due to the 1997/1998 Financial Crisis. Indeed, there was a surge in the rate of "challenged" projects over the same period (Mabelo, 2016). Interestingly, this *sluggishness* occurred between 1990 and 2010 while Earned Value, process-based methodologies, global certifications, and Agile practices were tenaciously promoted in the industry.

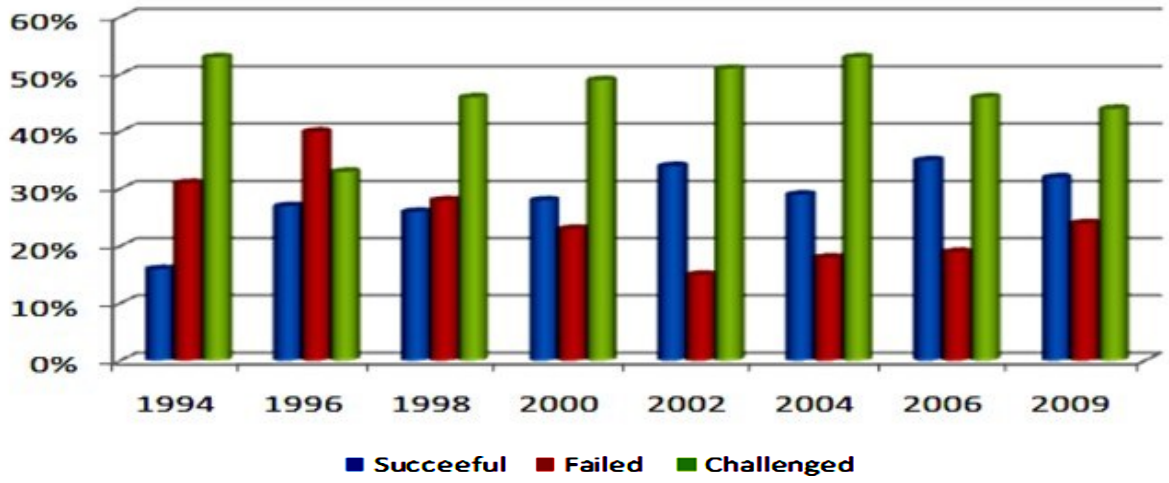

Figure 1 — Standish Findings on Project Outcomes: Comparison by Year (Mabelo, 2016)

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Furthermore, in a recent Project Risk Management survey by the author (Mabelo, 2023b), 45.5% of respondents observed that 10% to 50% of their projects have failed, while 54.5% (almost half) perceived it to be between 50% and 70%. Most organisations experience project failures; they only seem to diverge as to the number (how many) that are failing. This is quite a serious matter.

Moreover, project managers *brought into* Large Infrastructure Projects across Africa have delivered numerous megaprojects, but only a few have helped conquer our socio-economic woes. Indeed, one shall appreciate that infrastructure is a "technological system" *nested* in a "socio-economic system."

Therefore, it should *positively* affect the safety, quality of life, and even wealth of the community. It stands for such reasons that African countries (most are yet to develop) ought to gear themselves up to deliver Large Infrastructure Projects along the "WETWITS" themes, as one has coined it:

> "(1) Water systems; (2) Energy systems; (3) Transportation systems; (4) Waste treatment systems; (5) Information technology [IT] systems; (6) Telecommunication systems; and (7) Social facilities (e.g., police, hospitals, schools, shopping malls, parks)—Hence, the *thematic* acronym: WETWITS" (Mabelo, 2021) [*The author is not in support of military infrastructure*]

The Organization for Economic Cooperation and Development (OECD) maintains, "Infrastructure creates value when it contributes to addressing social needs or facilitates economic activity. Choices regarding infrastructure development must therefore be focused on user [and other stakeholders'] needs" (OECD, 2017). In the context of Large Infrastructure Projects, the organisation is the project team, and the objectives are, for example, job creation, provision of goods and services, increase in exports and reduction in imports, and sustained contributions to the country's economic growth:

> "Investments in modern infrastructure lay the foundations for economic development and growth. Building roads, bridges, power transmission lines and making other improvements create jobs. When [effectually] completed, these projects help a society increase its wealth and its citizens' standard of living." (U.S. DoS, 2012)

Two important messages are noted: (1) The works involved in delivering infrastructure result in job creation, e.g., the Daxing Airport (Beijing, China) created 40,000 direct jobs during construction; and (2) when completed, modern infrastructure projects increase the wealth (of the host-nation) and standard of living of citizens. No wonder such important "objectives" (e.g., jobs, reduced imports, GDP growth) should not be *deviated from* owing to risks not suitably managed or adequately treated.

> "Just as 'The body without the spirit is dead' ([Holy] Bible; James 2: 26), delivering Large Infrastructure Projects without Risk Management would only lead to complications, failure, and disillusionment. Think of socio-economic opportunities that will be delayed, or forfeited, to the peril of stakeholders." (Mabelo, 2024)

Implementing Project Risk Management (PRM) effectively entails allocating valuable resources, such as personnel, finances, and time. However, Large Infrastructure Projects (LIPs) often neglect PRM to the point of adopting inadequate frameworks, leading to poor/flawed Risk Management. Risk Management constitutes a tool of choice in ensuring investments in infrastructure delivery meet their objectives, providing expected benefits to relevant stakeholders. Yet, "The megaproject market is worth about $ 9 trillion each year, and globally big builds are in a mess. It is rare to have one completed on time and on budget" (Nevine, 2015). Since long-term projections called for an estimated US$ 57 trillion globally to build new and refurbished existing infrastructure between 2013 and 2030 (World Bank, 2014), investing and devoting *significant resources* to PRM is welcome.

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Despite the growing awareness of the importance of Risk Management across most industries, all the sophisticated tools and techniques, not to mention assistance available from professional bodies, Project Risk Management (PRM) still proves so ineffective that strings of failed projects keep growing longer by the day—robbing stakeholders of much awaited, life-changing benefits. This exposé builds on previous works (Mabelo, 2023a; Mabelo, 2023b; Mabelo, 2024) to unveil the "Five Foes" or common inadvertences undermining the efficacy of Project Risk Management (PRM) in ensuring the successful project delivery of LIPs. Conquering these foes will help achieve better project outcomes, reduce cost and schedule overruns, and increase stakeholder satisfaction.

The Five Foes of Project Risk Management

Poor or failure of Risk Management is a constant feature of project failures, even in well-established organisations. Traditional project management has proven inadequate in the face of increasing complexity in project scope and environment; only 26% of projects executed are deemed successful. Worse still, Flyvbjerg *et al.*, (2003) contend that project delivery outcome has not improved, but somewhat deteriorated, particularly in terms of cost overrun, over the last century (based on a survey covering megaprojects, also known as Large Infrastructure Projects, executed from 1910 to 2000).

According to a 2010 survey by the Independent Project Analysts (IPA) covering large chemical and thermal processing plants, 23 out of 31 completed projects (with a total Capex of $ 34 billion) were classified as *failures*—which represented 74% and was then worth $ 25 billion (Merrow, 2011). Further, a 2004 report published by the Business Technology Research Centre suggests that 90% of the executives surveyed stated they did not see project success improvements over the past 10 years. This *status quo* indicates something "structural" could be amiss with Risk Management processes.

No wonder, in many organisations, executive management questions the significance and *utility* of Project Risk Management (PRM), relegating it to an ad-hoc, optional extra, or nice-to-have practice; "*It makes no 'visible' contribution in the pursuance or fulfilment of the project goals and objectives*." Most executives and directors *brazenly* decline to discuss project risk matters escalated to them; "*Such shall be left to those engineers or blue-collar fellows to deal with—here we talk business*." It is however clear that what happens *in projects* will affect business in due course (Mabelo, 2021).

Still, this attitude and other fallacies may explain the lingering reluctance of executive management to devote significant resources to PRM efforts. However, theory and experience indicate (even so increasingly) that large and complex infrastructure projects would not do without an effective PRM regimen that "focuses not solely on risk avoidance and mitigation, but also on risk-taking as a means to value creation" (Deloitte, 2013)—a risk shield (not a buckler) is what is required. Thus, the author argues that a *consistently* poor "project outcome" indicates an anterior failure in Risk Management.

> "Bad or poor project outcomes, when persistent in a certain context, are generally a sign of a failure or a lack of Risk Management in Large Infrastructure Projects […] Should the applied PRM [regimen] fail, the project will eventually flounder or fail." (Mabelo, 2023a)

In three consecutive publications (already mentioned above), the author has respectively dissected three fundamental mistakes and/or inadvertences in Project Risk Management (PRM) as follows:

(1) *Ignoring "project life cycle" in PRM (see, Risk Management and Project Life Cycle [22])*
(2) *Ignoring the project-specific context (see, Risk Management and Project Context [23])*
(3) *Employing the PRM intermittently (see, Risk Management as an Immune System [24])*

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In addition to the above inadvertences, two further concerns are identified that often plague Project Risk Management and the delivery of Large Infrastructure Projects (LIPs). They are the following:

(4) *Throwing money at treating risks*
(5) *Implementing the PRM in a silo*

By consolidating these five inadvertences, this paper introduces the central topic of "Five Foes of Project Risk Management," while offering insights critical for augmenting the resilience of LIPs against inherent uncertainties. In the proverbial "Five Chinese Brothers," identical twins worked together to evade justice (Bishop & Wiese, 1996); similarly, the five identified PRM inadvertences are (individually or in pernicious combinations) inhibiting the contributions of Risk Management to the effective delivery of Large Infrastructure Projects and other complex capital initiatives.

The ensuing sections discuss these "foes" to highlight their negative implications (or "woes") and suggest effective remedies to the predicaments they inflict on large and complex projects. Yet, the lookalikes "Chinese Brothers" do not necessarily turn up in the order they did in the original story.

The First Foe of PRM—Ignoring "Project Life Cycle" in PRM

There comes "*the Chinese Brother who could indefinitely extend his members*" …

Everyone who has ever worked on a project will agree with its book definition that "*a project has a definitive start and finish"* and tasks/activities, deliverables, and attitudes evolve with the life cycle. The author (Mabelo, 2023a) contends that one of the pernicious causes of ineffective application of PRM could stem from its processes not being reconciled to project life cycle methodologies—it ought to become an integral part of every phase, process group, and aspect of managing the project.

> "A risk management strategy that is not carefully structured [i.e., reconciled to the life cycle] and monitored is a double-edged sword: if it goes wrong, it can drag a firm [or a large and complex project] down even more quickly than the underlying risk." (Crouhy et al., 2006)

A major *drawback* of common Risk Management standards (e.g., ISO 31000, AS/NZS 4360) is their leaving it to delivery organisations to incorporate the elements of the PRM processes into their project delivery framework. Unfortunately, our current experience is that most organisations fail to articulate "*how much*" of Risk Management should be applied at a *specific* phase of the life cycle. As a result, project risk practitioners apply it only at the onset (e.g., to produce a Risk Register) or to *regurgitate* risk-related activities at certain points—focusing on construction-type risks, however.

"A well-documented Project Lifecycle Model enables us to apply Systems Thinking to creating, planning, […], and managing the project through all of its phases, and to evaluating both the success and the value of both the project and results that the project has produced" (Archibald et al, 2012). The PMBoK (2013) states that "The definition given by the PMBoK Guide of a project life cycle is a *series of phases that represent the evolution of a product, from concept through delivery, maturity, and to retirement* […] it provides more control over the project and greater clarity with respect to the project deliverables." It also suggests that such a life cycle should consider Operations:

> "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) [*Underlining added for emphasis*]

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Indeed, by mentioning "[…] *the project should take the current life-cycle phase of the product into consideration*," PMBoK encourages the reader to take an "operational" outlook of the life cycle. One major implication of this perspective is that project teams should consider how the "product" shall be operated, maintained, and finally retired. Projects are exposed to risks throughout their life cycle, not just at the Initiation or Concept phase—The Chinese Brother shall "*extend his members!*"

> "The purpose of the Risk Management Process is to identify, analyze, treat and monitor the risks continuously. The Risk Management Process is a continuous process for systematically addressing risk throughout the [entire] life cycle of a system product or service. It can be applied to risks related to the acquisition, development, maintenance or operation of a system […]" (ISO/IEC 15288, 2015)

It makes sense that project risks should be managed throughout the life cycle, *from womb to tomb*. However, ISO 31000 Risk Standard submits, "This Framework is not intended to prescribe a management system, but rather to assist the organisation in integrating risk management into its overall management system." As noted earlier, ISO 31000 leaves it to the organisation to incorporate the components of the PRM processes into their (lifecycle-based) project delivery framework. Unfortunately, this critical adjustment is not always adequately pursued. Thus, project teams might apply PRM processes just once, at Initiation—or else, they repeat the same processes until Closeout.

Not only is the remainder (or some other interesting parts) of the life cycle not managed *risk-wise* but most identified risk items (and proposed treatment measures) will revolve around Construction. Not only are the identified threats and opportunities ignored in ensuing decision-making processes, but no clear, management-approved framework might even be made available to the project team as to *why, what, when, where, by who/with whom, and how* risk considerations shall serve as "input" into other project activities. Project delivery methodologies should indicate "*how*" the Project Risk realm (e.g., Identify and Control Risks) intersects with areas/processes such as Project Documents, Project Management Plan, Integrated Change Control, or Monitoring and Control over the life cycle.

The undue focus on Construction/Execution risks is narrow-minded and often proves misleading. The author was once told, "*I only manage construction risks because at least I can measure them*;" but the whole thing was supposed to be about "managing," not merely measuring or calculating. One recalls the proverbial drunk man who had lost his keys twelve yards away from a lamppost but went searching there—because *there* was light. The *where* we look for solutions (i.e., risk items) often precludes effective solutions to problems (i.e., risk treatment), Ackoff (1978) would admonish.

The current and widely prevalent practice encourages "*dealing with project risks merely at the beginning of the project*." The team will attend a Risk Workshop and produce some "sacred" Risk Register that is often signed off, laminated, and framed on the wall of the project office, as one would hang a trophy. Nothing much is done further, except to exhibit it to auditors upon request.

The Risk Register alone does not indicate at what points in the life cycle a particular risk would manifest (i.e., changing its status from *green* to *amber* or, worse still, from *amber* to *red*). This is problematic since most project teams are thus misled to treat any "red" risk as if its status will remain the same throughout the entire project—or at least to a point where it is treated. This approach results in the wastage of resources (e.g., undue management focus) even during periods where such risks were not manifest or relevant. For instance, contingency monies that are no longer to be spent should be returned to the owner's treasury; keeping them liquid (in a non-interest-bearing account) may result in ROI or ROCE deterioration since they form a big portion of Total Capital at Risk. Thus,

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appropriate and effective assessment steps, including developing and documenting methods and techniques to identify, then analyse, and evaluate pertinent risks, will be defined and implemented:

(i) Risk Identification—i.e., sources of risk, areas of great impacts, and causes and consequences
(ii) Risk Analysis—i.e., evaluation of existing controls, factors shaping consequences, or likelihood
(iii) Risk Evaluation—i.e., comparison of risk profiles to criteria, decisions to treat or accept risks

Processes such as 'Monitoring and Control' and 'Communication' are commonly added to the "core assessment" steps to enhance their 'Implementation' and to ensure successful outcomes. Several frameworks are readily available to risk practitioners—some standardised, some bespoke. Figure 2 (below) depicts the core elements of ISO 31000 as a risk management framework. One could notice "improvements" accommodated between the 2009 and 2018 versions of the same.

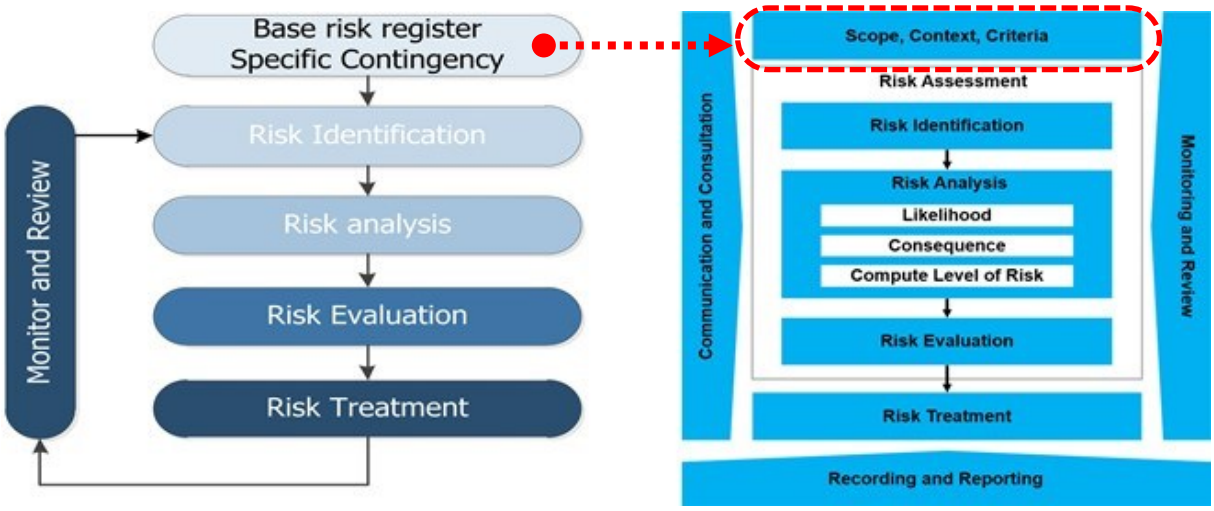

Figure 2 — ISO 31000 Standard: Risk Management, 2009 versus 2018 Versions

It is common cause that ISO 31000 is the "most-known" risk management standard; however, considering the Eleven Principles of Risk Management (ISO 31000, 2018), AS/NZS 4360 could be the "most suitable" framework for infrastructure projects. It best meets the following principles:

(i) Explicitly address any uncertainty—i.e., facilitate a deep understanding of the project context
(ii) Be systematic and structured—i.e., include discrete steps and their "to-and-from" interactions
(iii) Be transparent and all-inclusive—i.e., cover all phases/processes of the project delivery cycle
(iv) Be continually monitored and improved upon—i.e., promote constant Monitor and Control

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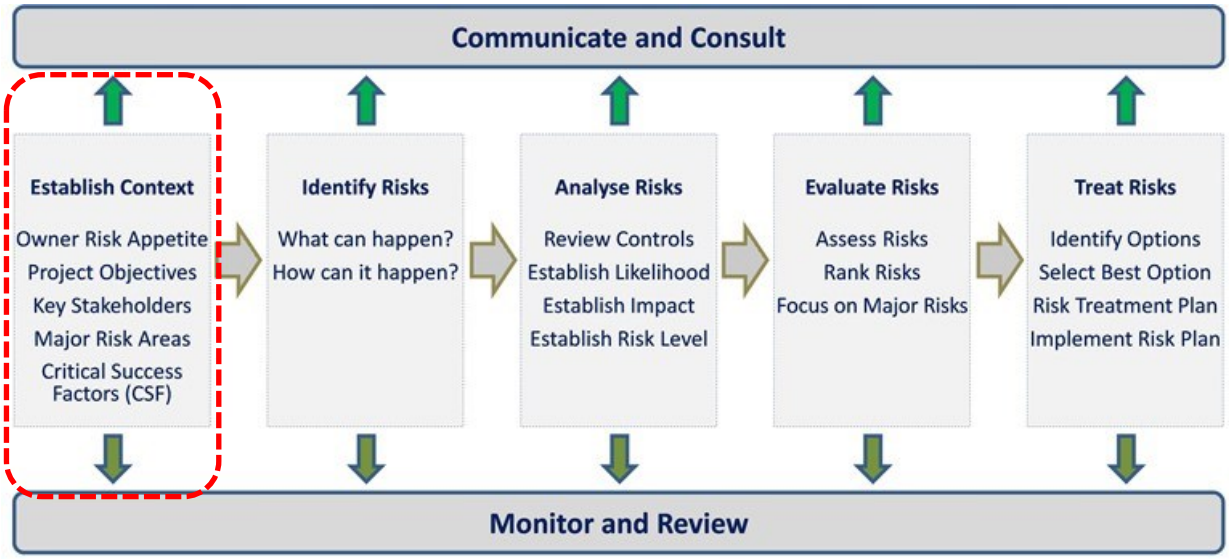

Figure 3 — AS/NZS 4360: Risk Management Standard (2018)

Due to the above considerations and practical experience, the author will propose AS/NZS 4360 Standard as the "preferred" framework for managing risk in large, complex infrastructure projects.

While projects should begin with the end in mind by putting empathy in operations (Scott, 2012; Mabelo, 2020) in terms of the Problem Statement or Primary Requirement, the "focus" of Risk Management will evolve from 'strategic' to 'technical' to "operational" to "environmental" risks.

The "Operational Environment" where the system (the product of the project) shall eventually live (i.e., deployed to operate) usually includes other systems. Such systems often end up "competing," "collaborating," or "sustaining/being sustained" by the newly deployed system, *for better or worse*. Therefore, opportunities and threats that emanate from such an environment should be identified —an earlier publication (Mabelo, 2022) argued the basis of considering Operations in the life cycle.

Figure 4 — Shift of Risk Management Emphasis Over Project Life Cycle

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The Risk Manager ("Risk Diva," in this case) should be "*changing hats*" accordingly, not failing to identify and address transition and operational risks (Okoh et al, 2016)—the *weightiest* hat, always! Another view of "focus shifting" could reflect an evolution from broader to specific risks as follows:

Institutional	To >>	Market-Related	To >>	Completion
Social Acceptance Risks		Supply Risks		Technical/Design Risks
Regulatory Risks		Market Risks		Construction Risk
Sovereign Risks		Financial Risks		Operational Risks

Figure 5 — Project Risk Management Focus Shifting (Adapted: Miller & Lessard, 2001)

The main reason why 'social/strategic' (or else, 'institutional') risk-focus should bestride FEL-1 (Concept Phase) and FEL-2 (Pre-Feasibility Phase) is that during these early phases, the project ought to be dealing with considerations of strategy, acceptability, and overall financial affordability. Likewise, the 'financial/technical' (or else, 'market-related') risk focus should straddle FEL-2 (Pre-Feasibility Phase) and FEL-3 (Feasibility Phase) because, during these phases, the project ought to be dealing with considerations of technical feasibility and overall financial sustainability. Thereafter, the focus should shift to "Completion/Handover" of the system to operations, while still considering any issues/challenges of strategy, finance, or technical design that might jeopardise the project.

The author proposes a PRM approach that combines the elements of the Standard (AS/NZS 4360 or any other) with the "holistic" life cycle (ISO 15288: System Life Cycle Processes, 2015) to submit a framework that will guide risk practitioners involved in LIPs in applying the right "focus" to risk considerations from one phase to the next. Rather than fixating the focus on construction risks, the recommended PRM approach entails a *moving focus* that shifts from 'social/strategic' risks to 'Financial' risks to 'technical' risks to 'operational' risks, and to 'environmental' risks.

The shift in emphasis is not *mutually exclusive*. It indicates that while every type of risk ought to be considered throughout the life cycle, the focus on a specific type should be heightened to reflect the considerations (e.g., strategic alignment, readiness) pertinent to the project at any point in time. Moreover, as per the principle of "Progressive Elaboration," this PRM approach will accommodate both the horizontal or "longitudinal" perspective (i.e., across life cycle phases) and the vertical or "transversal" perspective (i.e., within life cycle phases)—both in this phase and in phases to come!

The proposed PRM approach combines elements of the Risk Standard (AS/NZS 4360 or another) with the "holistic" life cycle (refer to ISO 15288: System Life Cycle) to provide a framework that guides risk practitioners involved in LIPs in applying the right *focus* to risk considerations from one phase to the next. In so doing, the project team shall avoid the traps of *regurgitating* the same process (e.g., risk workshop to produce a Risk Register) over and over, when it is not done once at the onset.

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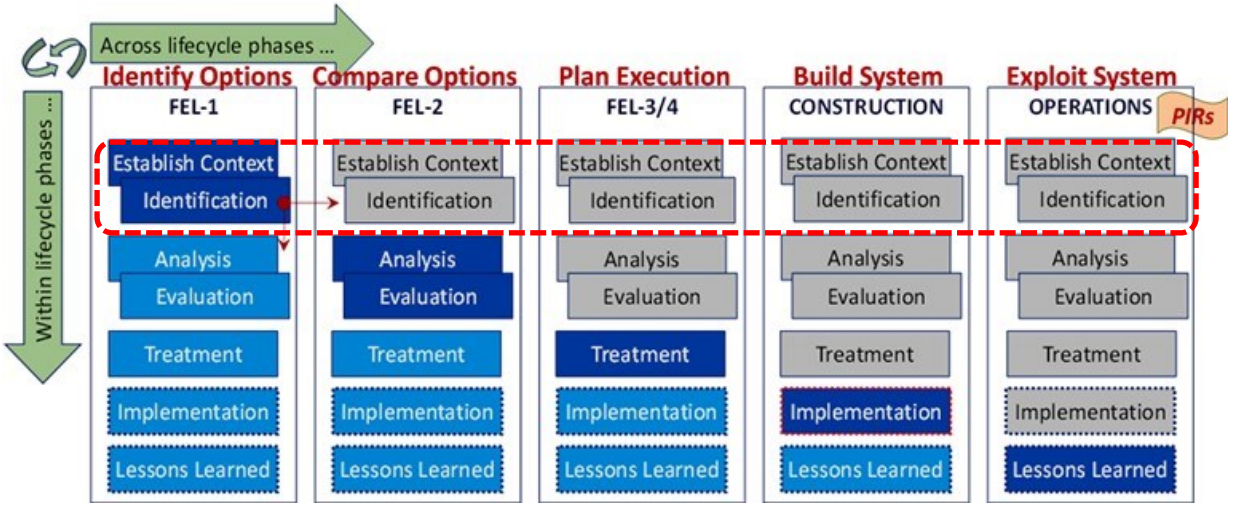

Figure 6 — Risk Process and Project Life Cycle (Mabelo, 2023a)

Following the life cycle principle of "Progressive Elaboration," the focal PRM step should move from Identification to Analysis/Evaluation to Treatment to Implementation and, *ultimately*, to Lessons Learned. For instance, PRM at FEL-1 shall cover the full scope for the current phase, and Risk Identification for later phases—to address any *exceptional* items from those phases. A case in point, "loan approval" is a major risk to manifest at Feasibility (FEL-3) when a bankable business case will be ready for the bank manager's perusal; yet it should be identified at Concept (FEL-1). The prudent Risk Manager would advise the project to assess such a risk and approach prospective banks at that early stage to gauge their chances of securing the vital loan in due course.

Further, "Establish Context/Identification" aids in Option Identification (FEL-1), just as "Analysis" of life cycle risks supports "optioneering" (FEL-2) and "Treatment" informs Execution Planning (FEL-3/4). When reviewing risk items at FEL-2 (Pre-Feasibility), the focus should be on that phase (i.e., FEL-2 types of risks). However, FEL-1 risk processes (which focussed *primarily* on "Establish Context" and "Identification") should be reviewed and, at the same time, risk elements about the subsequent phases (from FEL-3 to PIR) are duly assessed at a high level (for exceptional elements).

In so doing, this approach will accommodate both the horizontal or "longitudinal" perspective (i.e., across life cycle phases) and the vertical or "transversal" perspective (i.e., within life cycle phases). Surely, juxtaposing the project life cycle with 'AS/NZS 4360 (Risk Management Standard) has provided a massive yet practical, feasible "improvement" to the Project Risk Management practice.

However, the above "life cycle" improvement might not be the only potential contribution to PRM. Many other Systems Thinking principles, concepts, and practices could also assist to that effect.

> "Current approaches to [project] risk management have been built over time from a large body of knowledge, but fail to address some of the common [and systemic] characteristics of risks, such as unpredictability [i.e., VUCA] and interconnectedness [...]" (Barber, 2002)

Indeed, three critical elements of Systems Thinking can be added to the PRM approach as follows:

(i) Interactions among risk items—i.e., opportunities and threats engender and affect each other
(ii) External interactions—i.e., PRM activities can affect, be affected by the project environment
(iii) Feedback loops—i.e., effecting risk treatments and responses thereto affect project outcome

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A structured and methodical implementation of these provisions has resulted in a "systems-based," even *enhanced* rendition of 'AS/NZS 4360: Risk Management Standard' (2018) as shown below:

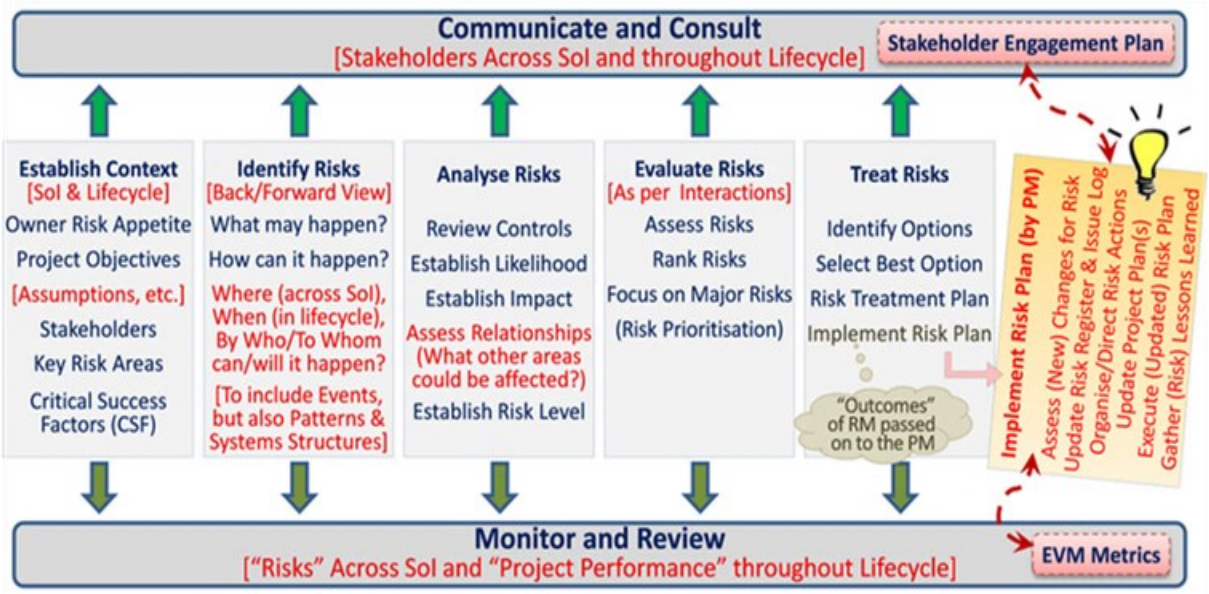

Figure 7 – Proposed Revisions to AS/NZS 4360: Risk Management Standard (2018)

The main improvements (as proposed by the author) consist of elevating the "Implementation" section of the Risk Treatment Plan to a *fully-fledged* PRM process step—at the same level as any other steps (i.e., Establish Context, Identify Risks, Analyse Risks, Evaluate Risks, or Treat Risks).

Further, a point is herein made that "life cycle considerations" are not the only Systems Thinking aspect that could enhance Project Risk Management in LIPs. Considerations of "connectedness" and "feedback loops" were also discussed and a model as to how they should be incorporated into the AS/NZS 4360 Standard was proposed. Of note is the *elevation* of the Risk Implementation Plan (RIP) as a fully-fledged PRM process step, while its outputs are to be reconciled and fused into the "overall" Project Execution Plan (PEP) under the responsibility of the Project Manager. As part of Monitoring and Control, the said RIP will also talk to both EVM and Engagement Plans.

The principles and processes denoted in ISO 31000 and (enhanced) AS/NZS 4360 provide a robust system that allows entities to design and implement repeatable, proactive, and strategic programmes. Again, the ultimate onus to execute the Risk Implementation Plan (RIP) should rest on the Project Manager, as the *Chief Conductor* (as in orchestra), and not the Project Risk Manager as a *facilitator*.

The outline of RIP should reflect activities such as: "Assess (New) Changes for Risk," "Update Risk Register and/or Issue Log," "Organise/Direct Risk Actions," "Update Project Plan(s)," "Execute (Updated) Risk Plan," and "Gather (Risk) Lessons Learned"—which must *liaise* with Earned Value Management (EVM) and the Stakeholder Engagement Plan in terms of overall project performance. Moreover, the Risk Register should now reflect both a "listing" and an "assessment" that considers the (strong, moderate, or nil) *connectedness* among risk items to provide a "network-based" ranking.

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The Second Foe of PRM—Ignoring the Project-Specific Context

There comes "*the Chinese Brother whose neck was iron-strong*" …

Many risk workshops devolve into hurried attempts to populate the Risk Register by conjuring up risk items without a proper understanding of "*contextual factors surrounding the project at hand*"—the context. Therefore, when incorrect or baseless risks are documented, the PRM process becomes futile. This section stresses the significance of understanding the project context for effective PRM.

While most project risk practitioners would indulge in "analysing" risk items, revelling in fancy spreadsheets and convoluted Monte-Carlo simulations, the main aim of Risk Management shall not be forgotten. It must be about "*effecting and monitoring risk treatments*" to prevent (or counteract) any conditions or events (or turns of events) that could impair the achievement of project objectives. Such risk items ought to have been duly identified *in the first place*; analysing and treating wrong or false risks can only prove futile, if not descend into a "*chasing of the wind*"—a waste of resources!

> "The purpose […] is to identify risks to the maximum extent that is practicable. The fact that some risks are unknowable or emergent requires the […] process to be iterative." (PMI, 2017)

Moreover, the common but misguided practice of convening workshops and urging the attendees to "*come up with risk items*" would often result in enumerating the same risks as were mentioned in previous projects—and, in some cases, in impelling the participants to *verbalise* their hidden fears. ISO 31000 (2018) defines risk as "*the effect of uncertainty on objectives*"; as a result, risks ought to be identified in terms of project objectives—and *contextual* factors that may affect such objectives. Therefore, brainstorming of threats and/or opportunities on the project under consideration should flow from *objectives* and factors that may have a bearing thereto, not simply "*what could go wrong*."

Figure 2 (above) depicts the essential elements of ISO 31000 as a Risk Management framework; a key "improvement" was accommodated between the 2009 and 2018 versions of the same standard. The 2009 version suggested that Risk Identification must flow from "Base Risk Register" and/or "Specific Contingency". This would encourage risk practitioners to source risk items from *previous* identification exercises *as if* the project at hand necessarily has the same or similar objectives and had arisen from parallel circumstances—a rather *exceptional* case was being made a general rule.

Should risk items be identified *out-of-context*, the subsequent processes of Risk Analysis, Risk Evaluation, and Risk Treatment (as convoluted or intricate as they might get) would turn futile and misleading. They would not provide the right "intelligence" (as the intended "immune system") or yield the right effects to protect the project from complications and failure. The project would suffer.

Unless the various project personnel *accurately* identify the threats and opportunities on the project, all the efforts to steer their undertaking towards success might be in vain. But more importantly, unless the project team *pertinently* understand the Project Context, chances are high they will find themselves dealing with *wrong* risks (i.e., risk items not significant to their project) or *false* risks (i.e., risk items that would never materialise during their project)—again, what a waste of resources!

Scott (2012) warns: "It doesn't help to solve the wrong problem"—Law No. 2 of Effective Systems Engineering. Yet, Borza (2011) says, "Too many times, individuals and teams jump into problem-solving activities without fully or properly defining what it is they need to solve, or what factors or interactions within the problem area [i.e., context] will create complications [i.e., risks]". Before attempting to change something (address a risk), one should *in the first place* seek to understand it!

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Confining "sources" of risks in LIPs to Construction leads to a "*narrow risk-landscaping*" syndrome and should be avoided by *first* establishing the Project Context where risks will be identified, and against whose background their assessments will be interpreted during the ensuing Risk Analysis, Risk Evaluation, Risk Treatment, and Risk Control. Sources of risks are categories of possible risk events (e.g., in requirements, design, operations, stakeholder actions, economy, environment, legal; in short, from both *inside-out* and *outside-in*) that may affect the said project *for the better or worse*.

For this reason, the author has already proposed a Risk Process that reflects the strong link between the "Establish Context" and the "Identify Risks" steps over the project life cycle (Figure 6, above). At the Conceptual (FEL-1) phase, before anything else, the right "context" should be established to provide understanding and insights needed to guide the ensuing identification of pertinent risks.

It follows that "Establish Context" must always precede "Identify Risks" to prevent any instances of risk items being identified *out-of-context*, which shall prove disastrous as already alluded to. Accordingly, in later phases of the project, though "identification" is no longer in focus, "Establish Context" and "Identify Risks" shall still be reviewed together to *re-set the scene* before proceeding. This approach ensures risk items are brainstormed in line with those specific concerns, rather than "*gleaning around*" in a haphazard manner and, as a result, proceeding with irrelevant risk items.

The recommended approach to Project Risk Management (Mabelo, 2023a) requires that the Project Context stays up-to-date and valid—to prevent some *misdirected* risk assessment exercises. Indeed, one "must understand how to quantify the trade-offs of risk against the potential returns. The failure to understand the essential nature of risk can have devastating consequences" (Crouhy et al, 2006).

Each project is inherently "unique," making the "*comprehensive grasp of its context*" indispensable to successful delivery. No wonder, "Establish Project Context" is the *first* step of the PRM Process.

> "Establishing the context is concerned with understanding the background of the organization and its risks, scoping the risk management activities being undertaken and developing a structure for the risk management tasks to follow." (AS/NZS 4360 Standard — HB 436: 2004)

As a PRM step, "Establishing the Context" shall focus on understanding the project's background. It involves perceiving both explicit and implicit *uncertainties* in the project's environment. This step provides a foundation for *interpreting* risk items and scoping subsequent Risk Management tasks. Understanding the "context" aids in interpreting any aspects of risk items that may arise during the Identification, Analysis, Evaluation, and Treatment processes—it provides the "framing" for PRM.

Hence, in line with 'AS/NZS 4360—HB 436: 2004', this PRM step serves the following purposes:

(a) To clarify the owner's risk appetite and their organisational objectives, as and when applicable
(b) To identify the environment in which those objectives should be pursued through the project
(c) To ascertain the set of criteria against which the identified risks will be measured and assessed
(d) To define key elements for structuring the Risk Identification and Risk Assessment processes
(e) To specify the main scope, scale, and objectives for Risk Management; namely, the boundary conditions and outcomes required, at both project and corporate levels (i.e., *Lines-of-Defence*)

The AS/NZS 4360: Risk Management Standard (2018) points to the following factors and aspects:

- Owner's Risk Appetite
- Project Objectives
- Key Stakeholders

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- Major Risks Areas
- Critical Success Factors (CSFs)

Explicitly, information held and actions by project stakeholders could constitute a "source of risk;" e.g., any withheld information or actions taken (or lack thereof) on the project can introduce risks. One practical implication of this study is that understanding the project context would enable the project management team to deal with the root causes rather than the symptoms of the risk events.

Since "*events with likely positive effects*" (i.e., opportunities) and "*events with potentially negative effects*" (i.e., threats) on "objectives" could arise from those *internal* and *external* environments, the deeper the understanding and appreciation of such environments, the more insights or acumen would the project team be armed with during the ensuing Risk Identification exercise, and at the subsequent Risk Analysis (especially, during the "computer-modelling" for Quantitative Risk Analysis), Risk Assessment, and Risk Treatment. The deeper you *understand* risk, the better you will calculate it; the current indulgence of "*calculating risks one does not even understand*" should be frowned upon!

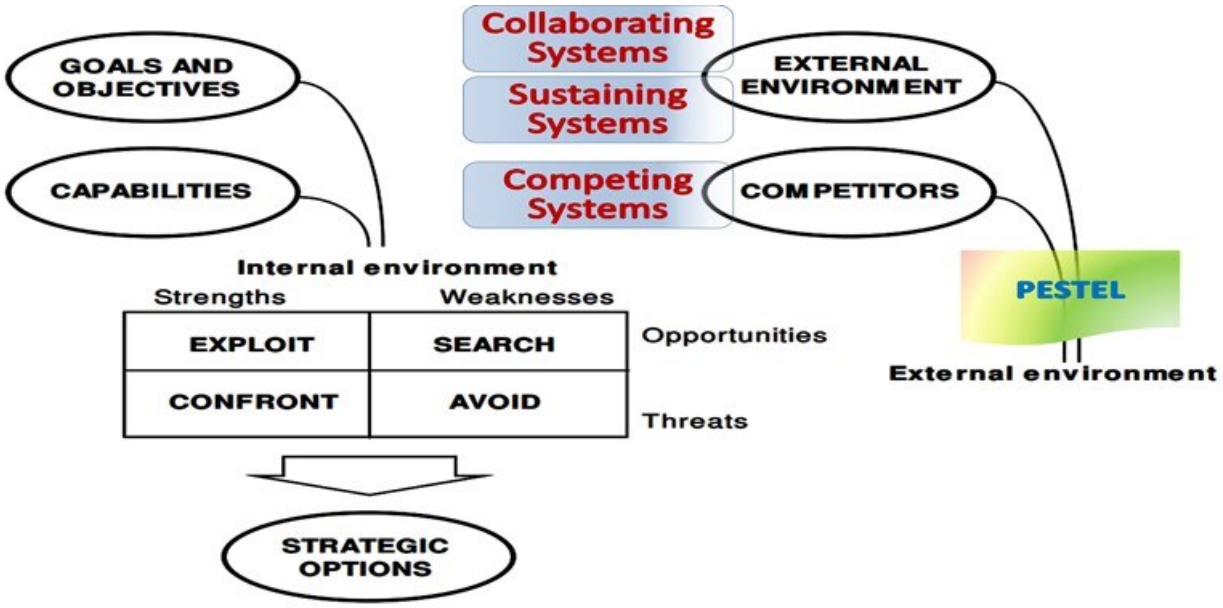

Figure 8 – SWOT and PESTEL Analysis Frameworks (adapted: Rowe et al, 1989)

Figure 8 essentially suggests that while most "strengths and weaknesses" originate from the *internal* environment, "opportunities and threats" usually emanate from the *external* environment—and the "strategy" of Risk Treatment mostly depends on their gravity, dynamic interactions, and alignment. ("*No rules are universal*," except this one: all rules require *grasping the context* wherein they apply.) Thus, Risk Identification and any ensuing risk assessment processes right through to Risk Treatment, and Monitoring and Control steps would not make sense except in such a "Context." Indeed, from *there* would emanate the 'social/strategic' (or 'institutional') risks, 'Financial' (or 'market-related') risks, 'technical' (or 'completion') risks, 'operational' risks, and 'environmental' risks noted above. Ignoring any of these *areas of influence* renders Risk Management blind; this can result in flawed appraisals and stubborn adherence to hopeless strategies—This Chinese Brother will "*rub his neck*."

Context is important. It defines "*the set of circumstances or conditions*" surrounding a particular event, situation, or piece of information, as well as a complex project. It also includes relevant details

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such as the time, place, environment, background information, and any other factors that support the understanding or *accurate interpretation* of something (e.g., risk scenarios in complex projects).

"In a dynamic and competitive world, companies cannot manage either strategic or tactical risks by adopting a passive stance. They need to develop the mindset and tools to explore the many dimensions of [project] risks associated with each activity and opportunity so they can balance these against the more obvious signs of reward. This is […] something we practice ourselves" (Crouhy et al, 2006).

> "Construction [and other large and complex] projects are faced with a challenge that must not be underestimated. These projects [e.g., LIPs] are increasingly becoming highly competitive, more complex, and difficult to manage. They become problems that are difficult to solve using traditional approaches." (Maqsood et al, 2009) [*Underlining added for emphasis*]

The author has argued in a prior article (Mabelo, 2023a) that Project Risk Management (PRM) in Large Infrastructure Projects shall benefit from adopting Systems Thinking principles and concepts. In as much as the increasing complexity of Large Infrastructure Projects today requires a substantial contribution of Systems Thinking and Systems Engineering to ensure successful (system) delivery, Risk Management ought to *similarly* benefit from the concepts, principles and practices arising from "*the world of systems*" to advance and promote PRM as a useful "immune system" in LIPs delivery.

The preceding discussions extend the notion of Project Context to include the *internal* and *external* environments; nevertheless, their rendition only reflects a *snapshot* of the "Big Picture" perspective. It fails to ask: At what *system stratum* are risks manifesting? How might such risks *evolve*? Thus, in line with Systems Thinking, a more *holistic* approach to PRM would require additional perspectives. These Systems Thinking outlooks and their risk implications are recapped in the following sections:

(i) The *depth* of risk behaviours—as per the Iceberg Model
(ii) The *evolution* over the system life cycle—as per the TAWOO model
(iii) The *layer* of System Hierarchy—as per the HKMM (or HKM^2) Framework

To establish a *holistic* Project Context and, *ipso facto*, to enhance the ensuing steps that PRM entails, the author recommends a few Systems Thinking principles and tools, in addition to what 'AS/NZS 4360: Risk Management' (2018) has put forward. For instance, exploring the *internal* environment (using a SWOT Analysis) and the *external* environment (through a PESTEL Analysis) provides a broader, expanded *snapshot* of the understanding of the "*circumstances surrounding the project*." However, to reflect the "dynamic" nature of risks that arise from the increasing complexity of Large Infrastructure Projects, as well as to accommodate both the *structural* and *temporal* perspectives to the PRM, the Iceberg Model, TAWOO Model, and the HKMM Framework are also incorporated.

Further discussions detailing the workings (and their relevance to Project Risk Management) of the Iceberg Model, the TAWOO Model, and the HKMM Framework are reflected in a previous article (Mabelo, 2023b). The *holistic* "Project Context" is incomplete until these aspects are incorporated. In so doing, not only would the "context" allow an exploration of *uncertainties* beyond the usual "events/condition" outlooks (even to discuss trends and patterns, systemic structures, and mental models), but such an exploration will also address system hierarchy and system maturity over both the project and system life cycles—from system's conception to obsolescence to retirement. Opportunities and threats (and their "*interconnectedness*") shall be identified across these realms to *enhance* Risk Identification and, by inference, contribute to the *responsiveness* of the PRM process.

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The considerations and models thus far elaborated, in their totality, offer the theoretical background for practical applications of the *holistic* Project Context to support an *enhanced* Risk Identification step. Hopefully, gone will soon be the days when project personnel would waltz *unprepared* into a risk workshop and yet be expected to "*think up*" risks about projects they hardly know *a thing* about.

In Figures 3, 6, and 7, the 'AS/NZS 4360: Risk Management Standard' (2018)—which the author considers most apt for mitigating risks in Large Infrastructure Projects (Mabelo, 2023a)—advocates commencing with the "Establish the Context" as the initial assessment step. Adopting this "context-based" approach to PRM allows for "*an insightful understanding of the circumstances surrounding the project at hand*" before embarking on the crucial Risk Identification process, and subsequent Risk Management steps. By so doing, project practitioners are shielded from identifying risk items *out-of-context*, which time and again leads to identifying "wrong" and/or "false" risks—maiming or rendering impotent the entire Project Risk Management (PRM) effort in large and complex projects.

Seeing that "Establish Context" as a Risk Management assessment step provides the *understanding* that supports the *interpretation and appreciation* of the outcomes of any ensuing processes, and the *validation* of the proposed Risk Treatment measures, a *holistic* outlook of the Project Context is required. The author argues that any blind spots in the "context" will reflect in and cripple the PRM; treating both wrong (i.e., irrelevant) and false (i.e., inapplicable) risks is *detrimental* to the project.

The Third Foe of PRM—Employing the PRM intermittently

There comes "*the Chinese Brother who could not burn with fire*" …

Organisations involved in "risky" initiatives (e.g., projects) should implement risk treatments to reduce residual risks to levels acceptable to stakeholders and ensure efficiency and effectiveness —to protect an organisation from potential losses or threats to its continued operation (Ang, 2023).

To many organisations, Risk Management is like a "buckler" one will only raise when the situation around the project gets "risky," not something that should always remain activated. As a result, the entire concept of Risk Management is typically employed only at the project's outset or, more commonly, when setbacks or impending massive cost and schedule overruns threaten the project. The author contends that Risk Management should serve as the "immune system" for the project, not only when a threat lurks around—not like the near-blind man who only puts on his pair of glasses afterwards, to figure out how to come out of a ditch he could not see and has fallen in it.

Every organisation, as a living entity or organism, whether complex or otherwise, would face hostile circumstances. Large Infrastructure Projects, due to their nature as technological systems *nested* in socio-economic environments, are prone to adverse circumstances—more so than smaller projects. Treating Large Infrastructure Projects as *isolated* from their environment is quite widespread in the industry; however, this stance will scarcely allow them to evolve to success in such an environment.

> "All organisms are connected in a complex web of relationships. Although many of these are benign, not all are, and everything alive devotes significant resources to identifying and neutralizing threats from other species. From bacteria through to primates, the presence of some kind of effective immune system has gone hand in hand with evolutionary success." (Nicholson, 2016)

Failing to "*devote significant resources*" to establishing and/or nurturing an "immune system" may prove fatal to project delivery (e.g., in LIPs); a good place to take care of this need is through PRM. The author has alluded to Risk Management functioning as the "immune system" for large projects.

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> "Project Risk Management (PRM) constitutes the 'immune system' [for the complex project] that provides the 'intelligence' to detect and protect the large project against anything (or lack thereof) that may prevent or diminish the achievement of objectives. Should the applied PRM [regimen] fail, the project will *eventually* flounder or fail." (Mabelo, 2023a)

The relevance of likening risk management in project delivery to an "immune system" is detailed in the ensuing sections. However, it is prudent to explore this novel concept before expounding on it —So, what is the "immune system," what are its aims, and how does it function in living organisms?

In a nutshell, the "immune system" is an intricate biological defence network that safeguards the (living) body by identifying, neutralising, and remembering threats, such as pathogens and foreign substances, to maintain health and combat illness—"wellbeing-seeking" and "reparative" outlooks.

> "The immune system is a complex network of organs, cells and proteins that defends the body against infection, whilst protecting the body's own cells. The immune system keeps a record of every germ (microbe) it has ever defeated so it can recognize and destroy the microbe quickly if it enters the body again. Abnormalities of the immune system can lead to allergic diseases, immunodeficiencies and autoimmune disorders." (Better Health Channel, 2024)

The effectiveness of an immune system lies in its capacity to interpret changes in the environment and respond suitably thereto—the "intelligence." An effective immune system entails four critical attributes—i.e., discrimination, flexibility, infection management, and memory—to address distinct challenges encountered during the organism's life cycle. With an effective, "immunity-based" PRM, project teams *overcome* risks and get stronger and less *fragile*; they no longer dread but tackle risks.

The preceding elaboration of the four characteristics of an efficient immune system, when examined from a *remedial* outlook (i.e., addressing pathologies in project delivery performance) shall support the adoption of a PRM entailing three "Lines of Defence," consistent with a generic immune system. The idea is to ensure (as it applies to mammals) that no part of the project *is cut off* from immunity.

> "The problems that the mammalian immune system solves are not restricted to higher animals; they are faced by all forms of life and are ignored by none […] It is a fundamental property of immunity that no part of our body is cut off from its surveillance. For this reason, although the immune system may seem a less substantial thing than an organ such as the heart or the liver, in aggregate, immunity consumes enormous resources, producing the large number of cells that it depends on for successful functioning." (Nicholson, 2016) [*Underlining added*]

The medical field asserts that the mammalian immune system (unlike in the plant world) works in three distinct stages; namely, (i) Surface Barrier, (ii) Innate Response, and (iii) Adaptive Response:

(i) Surface Barrier:
The body uses surface barriers—physical, chemical, and biological defences—to fend off invading pathogens. Systems like respiratory, digestive, urinary, and reproductive use bodily fluids (e.g., saliva or tears) to block germs. Also, skin and mucous membranes, housing the body's normal flora, create competition for nutrients and space, forming biological barriers.

(ii) Innate Response:
Upon breaching surface defences (e.g., through skin wounds), pathogens face the immediate but *nonspecific* response of the innate immune system. Inflammation starts as macrophages ingest the pathogen and attract more immune cells releasing cytokines—which widen blood vessels and boost blood flow, as neutrophils kill pathogens via enzymes or oxidative bursts.

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(iii) Adaptive Response:
If the innate response falters, the adaptive immune system will take effect, target the invader, and create a "memory" for future encounters. White blood cells, derived from bone marrow, play pivotal roles. Antigen-presenting cells, like dendritic cells, present pathogen fragments in lymph nodes to matching T-cells or B-cells, ensuring "specificity." These cells expand, forming memory cells for future encounters, while antibodies shield against reinfections.

The ultimate purpose of the aforementioned "Lines of Defence" (LoDs) is to ensure that any relevant risk item relevant to the project at hand is addressed by an effective provision of the adopted Risk Management regimen in place in the organisation involved in project delivery, albeit as the owner. However, this provision only satisfies the structural perspective (i.e., covering every component) of the Project Risk Management (PRM) requirements. Such an "immunity shield" should comply with the temporal perspective, and its requirements; hence, it shall apply throughout the project life cycle.

An effective PRM (working as an immune system) should be able to pinpoint any areas of the project that need therapy or surgery—a dysfunctional PRM (without an immune system) would leave you wondering as to what could be miscarrying, failing, or causing the entire project delivery to flounder. To prevent such an unfortunate predicament, an effective Risk Management regimen should prove efficacious and include, of necessity (viz, *sine qua non*), three "Lines of Defence" (LoDs) as follows:

- 1st Line of Defence—a domain of "project delivery", by project managers and other vendors;
- 2nd Line of Defence—a domain of "project governance", by project directors and sponsors;
- 3rd Line of Defence—a domain of "project strategy", by executives and independent advisors.

These Lines of Defence (LoDs) are graphically represented in Figure 9 (below), in a manner that reflects the relevant actors, their levels of Risk Management concerns, and their "systemic" focus. Therefore, any Risk Management regimen modelled on such a *naturally* excellent system would prove effective "*in protecting a project from potential losses or threats to its continued operation*."

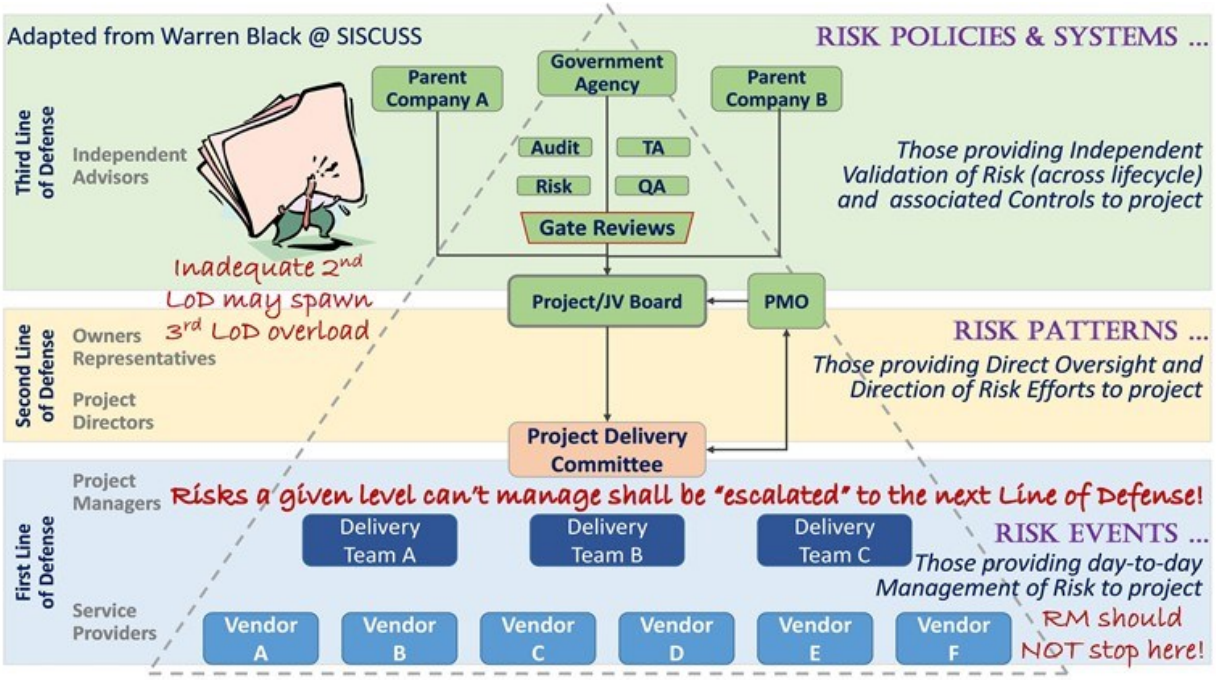

Figure 9 — Three Lines of Defence and Project Risk Management (Adapted: Black, 2014)

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These three "Lines of Defence" correspond *bijectionally* to the three stages of the immune system. Thus, the First Line of Defence corresponds to the "Surface Barrier," the Second Line of Defence to the "Innate Response," and the Third Line of Defence to the "Adaptive Response"—one-to-one. Therefore, in keeping with the principle of the *bijective* correspondence between the three stages of the immune system and the three Lines of Defence (LoDs) of effective Risk Management, the PRM implications to the delivery of Large Infrastructure Projects (LIPs) could be summarised as follows:

(i) PRM First Line of Defence (viz, Surface Barrier):
The PRM should also include mechanisms that function as barriers to risks to protect the project from events (or chains of events) and conditions that might hinder or diminish project success. This is where project team members and other vendors employ day-to-day Risk Management; e.g., once-off instances such as a supplier running late, unanticipated price-hike on materials, and presidential tax rebates before elections could discretely or jointly affect project objectives.

Personnel operating at this level must have been trained in RM, say, "*to nip risks in the bud*" and not allow them entry or accommodate their "accumulation" into the project environment. Nevertheless, risk items that proved stubborn at this level must be escalated to the Second Line.

(ii) PRM Second Line of Defence (viz, Innate Response):
The PRM should include mechanisms that assess patterns and trends of adverse circumstances (i.e., events, chains of events, and conditions) across project delivery to provide oversight and direction of the Risk Management efforts. Any recurrent and long-range risk items across the project environment should be reviewed and synthesised at this level to propose remedies. For instance, risks that keep manifesting (or are likely to do so) like a supplier who is often late, frequent floodings that delay production, or recurring export opportunities shall be treated here.

However, current experience will suggest that many, if not most project delivery organisations suffer from a failure or lack of the crucial Second Line of Defence. Consequently, issues at this level (e.g., frequent theft of tools) will be discussed at the board level, where they do not belong. Only risk *states of affairs* that call for a strategic adjustment shall be escalated to the Third Line.

(iii) PRM Third Line of Defence (viz, Adaptive Response):
The PRM should, more importantly, include mechanisms and processes that seek to influence or change the environment, whether internal or external, for the organisation involved in project delivery to bear or elude adverse circumstances (i.e., events, chains of events, and conditions). Such adverse circumstances could arise from "systemic arrangements" (i.e., the way things are), as well as from prevailing "mental models" (i.e., the way people are, or ought to be, thinking). Any *happenings* that could alter how the business is (should be) operating are addressed here.

The idea is to "reposition" the environments, be they internal or external, in a way that secures the pursuance and/or fulfilment of the project objectives and goals—to ensure project success. The Third Line of Defence leverages policies and management systems (or changes thereto) to reposition the business ecosystem based on feedback from independent controls and validation. In this Third Line of Defence, the "memory" attribute of the immune system comes to the fore; not only lessons learned are compiled from feedback, but policies also impose "mental models."

In addition to risks arising from their market interests and operational activities ("run-the-business"), organisations find themselves impelled to manage risks regarding projects ("change-the-business"). The prevalent lopsided attention to strategic and operational risks alone has left many organisations

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bleeding on the project side. This attitude on the part of executive management is counterproductive: what happens in projects (unmitigated threats or missed opportunities) will soon affect the business.

> "[…] (2) Escalations and inflation costs, due to increases in prices of goods and/or services in the general economy, and particularly in the construction and related industries […] (4) Opportunity costs due to other investments being delayed, interests forfeited or loss of goodwill, and more importantly, loss of potential clients/customers by the time the facility is eventually complete [following schedule overruns]. These financial repercussions are debilitating to the economics of projects, the business, and the country's overall economy. They might even destroy 'value' in the projections of the Net Present Value (NPV), Income Statement, and Balance Sheet. For these reasons, the project manager (and the project board) must know when to stop—i.e., to abort the project and cut their losses." (Mabelo, 2021)

> "As we look back over the past 23 years at IPA customers [involved in projects] that have disappeared, all but one of them grossly overspent for their capital assets." (Merrow, 2011)

Increasingly, organisations are learning *at their expense* that every sphere of the hierarchy should be involved in managing project risks. Some of such risks are in fact in the province of executive managers. Think of these risks: sovereign, regulatory, policy/strategic, social acceptance, market, financial, and supply risks—what actions can the project manager take to address such challenges?

It is no wonder that Project Risk Management, even when considering the essence of Figure 1 above, shall be construed as "*everybody's business*". Some (e.g., project team) will handle it at the project level, others (e.g., executives and directors) will tackle it at business or strategic levels—everybody.

> "Risk Management is no longer confined solely to risk management specialists. Stakeholders ranging from employees to investors [as well as executive management] must understand how to quantify the trade-offs of risk against the potential returns. The failure to understand the essential nature of risk can have devastating consequences [on projects]." (Crouhy et al, 2006)

> "There can't be a meaningful dialogue about risk and risk management if only one party to the conversation understands the [risk] significance of what is being said." (Crouhy et al, 2006)

Two more points must be made here: (i) As much as executive management will stretch themselves to play a PRM role, project managers, in turn, shall also endeavour to grasp strategic and operational risks that have a bearing on project goals and plans; and (ii) While everybody should get involved in Risk Management, there shall still be a Project Risk Manager appointed to facilitate these efforts. Indeed, the common practice of expecting a lone ranger and under-resourced Project Risk Manager to provide/sustain risk management efforts across most projects is neither practical nor reasonable.

> "Thus, the *proper* role of the 'Project Risk Manager', whether from inside or outside the organisation, is not to manage risks *for projects*, but to encourage [or teach] and facilitate the management of risks by project personnel themselves—and any other external stakeholders, as appropriate. Hence, the 'Project Risk Manager' [or perhaps a team] should provide relevant stakeholders with information, knowledge, understanding, and motivation that can enable them to manage project risks more effectively than they would otherwise." (Mabelo, 2023b)

Furthermore, seeing that such a facilitation role will generally be played across the whole hierarchy, through all Lines of Defence, the assigned Project Risk Manager will need knowledge and expertise beyond the project delivery domain to encompass business, strategic, and operational aspects. Or else, the entire Risk Management regimen will turn dysfunctional to the peril of their organisation.

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The significance of the "immunity shield" model of PRM lies in its ongoing and continual features and, more importantly, in its systemic and all-inclusive framework. It does not exclude any phases or parts of the project or even the broader organisation from the immunity it provides. Therefore, this model makes PRM "*everybody's business*"—from project teams to the executives. This provision alone should make PRM "fireproof" and cause one of the Chinese Brothers to smile.

However, as happens in real life, even the most effective *regimen* would fall short of expectations. So far, an argument has been made about the necessity and benefits of an effective immune system. What then happens to organisms or projects in the unfortunate event of a defective immune system? An underdeveloped or crippled immune system causes pathologies to both organisms and projects.

> "Rarely, but regularly, individuals are born without an effective immune system […] Such children have a very limited life expectancy. Without immunity, they are repeatedly attacked by the organisms that afflict all of us […] Less dangerous, but still severe, are mutations that cripple a particular arm of the immune response […] Patients with deficiencies in their natural killer cells are highly susceptible to herpesvirus infections [i.e., a disease which causes painful red spots to appear on the skin]. Patients who have macrophages that cannot digest the bacteria that they eat, develop recurrent abscesses that are difficult to treat." (Nicholson, 2016)

The mammalian immune system, it is argued, plays a crucial role in maintaining overall health by recognising and eliminating foreign invaders and distinguishing them from the body's healthy cells. Projects with a dysfunctional PRM (i.e., with a defective immune system) will tend to suffer from "*recurrent abscesses that are difficult to treat*"—worse yet, suffer "*a very limited life expectancy*."

Examples abound of Large Infrastructure Projects that suffered massive overruns due to recurrent risks they could not address (i.e., identify or manage) and many others that were merely terminated. Such deficiencies ranging from immunosuppression (crippled immunity) to autoinflammation (due to mutated immunity) to autoimmunity (attacks on healthy cells) to allergies (inappropriate immune response) are introduced in Table 1 below—it also describes their equivalent PRM manifestations.

One of the reasons PRM or Risk Management in general is not taken seriously could be summarised by this controversial but widespread statement, "*Risk Management doesn't work on large projects*." Ironically, it is within those large and complex projects that Risk Management is needed the most; still, if its significance is being questioned by management, no wonder they resent investing in it.

The reality, however, is that Project Risk Management is relevant to Large Infrastructure Projects —this paper does a decent job of establishing the rationale and requirements of an effective PRM. Rather than "*spray-paint everything in black*," one should point out and discuss its few pathologies. Thus, it shall be said *aloud* that Project Risk Management works, even in large and complex projects. Of course, like in every other discipline of projects, it only works well when *effectively* employed. It would be unfair to expect great results from PRM where, as is the case in many industries today:

(a) Resources are not *significantly* devoted to managing risk (e.g., "one-man-show" syndrome);
(b) Risk Management is *limited* to projects—at times, *isolated* from other management spheres;
(c) Ineptitudes (due to fractional process, lack of skills, fallacies, etc) are not *timeously* addressed.

The author makes a strong case for the critical departure from the current and widespread sporadic approach to Risk Management to an ongoing one that positions the PRM as an "immune system." A Project Risk Management regimen that fails to constitute an effective immune system would allow infections and other pathologies (i.e., risk scenarios) to cause maladies in and around projects.

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These common shortcomings would usually manifest as pathologies to the PRM system as follows:

Immunity Pathologies	Manifestations in Organisms	Manifestations in PRM
Frequent Infections *[Will affect any LoD]*	A compromised immune system fails to provide adequate defence against infections due to its reduced ability to protect the body from pathogens; thus allowing "opportunistic" infections.	An *inadequate* PRM regimen will fail to protect projects against risks arising from its environment—'*anything that could go wrong would just go wrong*'. Thus, project teams will be locked into a never-ending cycle of fire-fighting.
Delayed Wound Healing *[Will affect 1st LoD]*	A dysfunctional immune system can result in delayed wound healing and prolonged recovery times, causing a high(er) risk of infections and other health complications, e.g., gangrene.	A *dysfunctional* PRM regimen would expose projects to escalating impacts of risks whose treatments were not proactively executed. Management of risk, if reactive, diverts attention from delivery to replanning, curative works.
Allergies and Asthma *[Will affect any LoD]*	An immune system that "overreacts" to harmless substances has a high(er) risk of triggering allergic responses (e.g., frequent sneezing) and asthma.	An *over-sensitive* PRM overreacts to wrong (i.e., irrelevant) and false (i.e., inapplicable) risks, calling '*knee-jerk*' solutions and, thus, reducing resources available to address/treat actual risks.
Autoimmune Diseases *[Will affect 2nd, 3rd LoD]*	An immune system whose design or programming has mutated (i.e., turned flawed due to failure in its regulation) will lead to attacks on and damage to the body's healthy tissues and organs.	An *inconsistent* or *sporadic* PRM (i.e., not properly structured or monitored) has fractional processes often working against itself, dragging projects down even faster than their underlying risks. Such PRM will harm, rather than help.
Chronic Fatigue *[Will affect 1st LoD]*	A "malfunctioning" immune system (not properly supported or balanced) leads to chronic fatigue syndrome, causing reduced productivity levels, impaired daily functioning, higher vulnerability to health issues, etc.	An *overcomplicated* PRM will usually burden project delivery, causing most project teams to spend more effort on managing risks (albeit necessary) than on actual deliverables; the proverbial, '*Nitor in adversum*' [Latin]— Striving for furniture instead of the building …
Mood Disorders *[Will affect any LoD]*	In an immune system, dysregulation can impact neurotransmitter function and spark/exacerbate mood disorders such as depression, anxiety, and even mental problems in some cases.	A *constrained* PRM, i.e., limited to the project realm and without linkages to other organisational spheres such as governance and strategy, would lead to organisational trauma and conflicts between project teams and executives.
Cancer Susceptibility *[Will affect any LoD]*	A compromised immune system may lack the checks and balances needed to identify and eliminate abnormal or excessive cells, resulting in a higher susceptibility to developing cancer.	A *crippled* PRM that fails to identify or treat risks will allow errors, leading to rework or other inadvertences (e.g., scope creep, diseconomy of scale) that engender costs or schedule overruns.

Table 1 — Immune System Pathologies and Equivalent PRM Manifestations (Non-exhaustive List)

This table provides a practical guide for diagnosing PRM pathologies in LIPs; should the adopted PRM exhibit any such abnormalities, therapy or surgery will be required to avoid project failures. (Our remedies shall depend on the maladies detected and, thus, will be discussed on a case-by-case.)

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An effective PRM manages risk exposures in various parts of the organisation to efficiently pursue its strategic goals, by considering *interactions* among multiple risks instead of focusing on a single risk item. Thus, the overlap between the "run-the-business" risks and the "change-the-business" risks (i.e., project risks) at the second or third lines of defence is a welcome development in PRM. This way, the PRM regimen will grow stronger (via *hormesis*) each time a certain risk is overcome. Companies that separate the two risk streams may encounter *strategic dissonance* in their projects.

For example, an evaluation of a key state-owned company's 300 billion Rand capital programme revealed that complexity posed the most significant risk, followed by internal approval processes, planning, and start delays. While project personnel (1st LoD) could manage day-to-day complexities and start delays, these challenges emerged *consistently* across diverse projects in various divisions, qualifying them as systemic issues falling under the purview of the corporate 2nd LoD. As internal approvals and planning were also managed at the corporate level, they, too, fell within the 2nd LoD's remit. Given the programme's scale and poor overall performance, these issues warranted escalation to the 3rd LoD. Sadly, while the "corporate office" had a risk management department for "run-the-business" risks, there were no equivalent structures for "change-the-business" risks (viz., projects). Thus, critical capital project concerns requiring attention at the 2nd and/or 3rd LoDs were discarded, leading to severe consequences—the company faced insolvency barely years after this programme.

To enhance the practical implications of this concept, the author has offered a guide (see Table 1) intended to equip PRM practitioners and other consultants in diagnosing any potential issues affecting their adopted PRM regimen. The aim is to maintain a PRM regimen that pinpoints any project aspects that could be miscarrying, failing, or causing the entire project delivery to flounder. Further, the aforesaid real-world example of an ineffective PRM regimen and its outcomes has confirmed the relevance (e.g., benefits, requirements) and applicability of the proposed PRM model.

The Fourth Foe of PRM—Throwing Money at Treating Risks

There comes "*the Chinese Brother who could swallow up the sea*" …

A fundamental aspect of risk management, as outlined in the ISO 31000 and the AS/NZS 4360 risk management standards, is the Risk Treatment phase (i.e., *develop and implement risk treatments to reduce residual risks to levels acceptable to most stakeholders*). PRM literature proposes several generic actions for treating identified threats and opportunities—which are summarised as follows:

Causative Actions for Opportunities		Preventive Actions for Threats	
Exploit	Making the opportunity definitely happen – Eliminate uncertainty (from source of risk)	**Avoid**	Consider another project solution / Eliminate the threat (from source or make it to not matter)
Share	Risk-sharing partnerships, joint-ventures, etc. – Allocating responsibility to a third party	**Transfer**	Give it away contractually or through SLAs to someone more capable – May entail a *premium*
Enhance	Modifies "size" of opportunity – Strengthen the cause or increasing the probability	**Mitigate**	Reduce the probability by taking early action – Do something! You will need a specific plan
Accept (No action taken) or **Contingency** (Provision of scope, resources, budget, time for use only *if specific "events" occur*)			

Table 2 — Project Risk Treatment Actions for Threats and Opportunities

Alas, across the Large Infrastructure Projects (LIPs) industry, many risk practitioners are inclined to prioritise "contingency" actions rather than apply more proactive risk treatment measures, those based on effective design, practices, policies, or contracts. This propensity is concerning, seeing the effectiveness and *fitness* of such proactive approaches in addressing threats and opportunities.

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Consider a hypothetical scenario involving a factory that handles hazardous waste, posing risks to workers and adjacent communities. In addressing these risks, rather than merely "*throwing cash*" (via contingency) at the problem, the following risk treatment strategies could indeed be explored:

1. Design-based Risk Treatment: Modifying the initial design of facilities, such as waste storage areas, to mitigate threats and capitalise on opportunities; for instance, by ensuring that the design of the waste room includes features to insulate the surrounding environment from potential harm.

2. Practice-based Risk Treatment: Implementing Standard Operating Procedures (SOP) aimed to reduce negative impacts and curtail the probability of hazardous incidents; for example, by setting protocols for pre-treating waste before storage and conducting regular hazardousness assessments.

3. Policy-based Risk Treatment: Enforcing operational rules and restrictions through policies to limit risks and mitigate likely harm or failure, for instance, by implementing policies that prohibit or curb onsite waste storage or human settlement within a specified radius to protect communities.

4. Contract-based Risk Treatment: Entering into agreements with third parties and, as a result, transferring threats or sharing opportunities—thereby enhancing risk management capabilities. This could be done, for example, by securing contracts with a toxic waste recycling company to safely remove hazardous waste from the premises and, thus, earn revenue whilst mitigating harm.

In many project environments, the predominant focus on "*contingency tracking*" overshadows the more proactive approach of addressing threats and capitalising on opportunities through strategic measures such as design improvements, enhanced practices, contractual agreements, and policy implementations. This undue reliance on contingency often leads to unintended consequences and inefficiencies in risk management practices. This is tantamount to "*just throwing cash at risks."* The author has reviewed a Risk Management Plan for a multi-billion project that reads as follows:

> "This document outlines the risk management processes of risk management planning, identification, analysis, evaluation, treatment, risk monitoring, communication, consultation and [cash?] contingency tracking for the [*name concealed*] project." [Underlining added]

Still, "contingency allocation and tracking" is not straightforward, despite the allure of fancy tools like Monte Carlo simulations; their *accuracy* often proves misleading. The value of proactive risk treatment approaches must be recognised. Relying solely on convoluted software, but neglecting proactive strategies, can render risk management efforts *fruitless* and jeopardise project outcomes.

Allocating excessive contingency amounts usually fails to address threats effectively. In addition, it entails potential misuse of funds, such as bailing out blunders or funding non-essential activities (viz, gifts to clients). Further, holding contingency funds *liquid* can affect the organisation's Return on Capital Employed (ROCE), prompting scrutiny from the CFO and other financial stakeholders.

Moreover, this common, *one-size-fits-all* approach to Project Risk Management fails to account for the distinct characteristics of different risk domains. While 'technological' risks usually follow a normal distribution curve, most 'socio-economic' risks (e.g., pandemics, tsunamis, riots) tend to be "*rare yet impactful*" events (viz, tail distributions) that fall outside the realm of conventional statistical models. For instance, risk items are often ranked using techniques like Tornado Graphs, with a notable emphasis on cost uncertainties and allocation of contingency amounts. However, this approach may misread *uncountable* risks such as revolutions, unrest or coups, and many other socio-economic factors such as bank crashes, inflation and price hikes, shortage of commodities, power grid collapses, and company bankruptcies warranting attention and risk treatment efforts.

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A common pitfall in Project Risk Management is the failure to differentiate between randomness characterised by normal distributions and the extreme and unpredictable "tail distribution" events. Statistical methods like Monte Carlo simulations are fit for modelling "averages," deviations, and probabilities of normal distributions; they may not adequately address "rare yet impactful" events typical of "tail distributions" such as Black Swans or *unknown—unknowns* (Taleb & Blyth, 2011). Therefore, it is imperative to tailor risk management strategies to the specific nature of each risk domain, recognising the unique challenges and opportunities they present. By adopting a more nuanced approach that segregates technological and socio-economic considerations, organisations can enhance their resilience to a wide range of risks and improve the *overall* project outcomes.

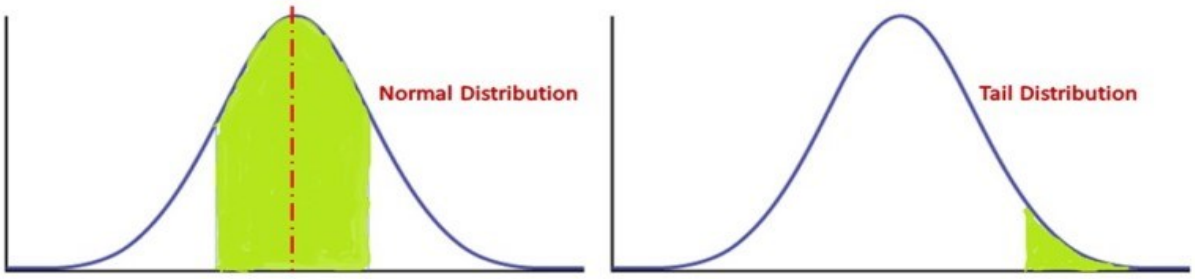

Figure 10 — Bell Curve: Normal (technological risks) vs Tail (Socio-economic risks) Distributions

The variability or randomness in strength and sizes of precast concrete road barriers is "normal," with *historical* data points that fall near an "*average*" or "*mean*" value, with a standard deviation. But what about the challenge of assigning a contingency to socio-economic events like "*lightning struck the 'engineering team' during a site visit*"? Unlike routine uncertainties, such events defy traditional probabilistic modelling and require a more nuanced approach to risk assessment. Still, many risk practitioners run Monte Carlo simulations of normal and exceptional events *together*, ignoring the unique features of "tail-distributed" risks—the result is a *glossy* "statistical muddle." For instance, in a Project Risk Plan, such risks as "*Disruptions to operations*" were included in Monte Carlo simulations. Yet, the diverse range of potential disruptions to operations, from veld fires to civil unrest to COVID-19 to logistics disruptions, each exhibit a "tail distribution" pattern. Such "*rare but potentially tragic*" events cannot be modelled *correctly* by ordinary methods alone.

In another multi-billion project, risk items were ranked according to a Tornado Graph with cost uncertainties assigned to each. Crime (e.g., vandalising of project assets), community riots, labour unrest, et cetera, were allocated contingency amounts to be tracked—ironically, "*business risks*" were utterly left out. The Chinese Brother has *swallowed up* other risk treatment actions to favour "Contingency Tracking"—as most folks would do. However, since such events are rare (i.e., tail distribution, small numbers), one would wonder what *historical* data (for something that has never occurred, or not so in a long time) were used as statistical input for those Monte Carlo simulations.

Risk managers need to recognise the limitations of traditional statistical approaches when dealing with "tail distribution" events common to socio-economic environments in which LIPs are nested. Instead of only relying on averages, modes, and probabilities they should adopt a more nuanced, scenario-based approach that effectively assesses and mitigates those "rare but high-impact" risks. By integrating conventional modelling techniques (e.g., Monte Carlo simulations) and specialised risk assessments (i.e., tail distributions, law of small numbers, scenarios) project teams can devise robust risk management strategies that account for the full spectrum of uncertainties, from routine deviations (due to randomness) to exceptional/rare or *unknown* events with massive consequences.

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The Fifth Foe of PRM—Implementing the PRM in a Silo

There comes "*the Chinese Brother who could hold his breath indefinitely*" …

Project Risk Management is often implemented as a separate process, to comply with the standard. However, the Project Management Body of Knowledge (PMBoK) covers Risk Management, Scope Management (which includes Earned Value Management for tracking progress against the plan) and other knowledge areas. For example, since Earned Value Management (EVM) assesses and controls cost and schedule performances, it should be *interconnected* to Project Risk Management (PRM)—the said project performances set the constraints in which the project objectives should be achieved.

Aligning Earned Value Management (EVM) and Project Risk Management (PRM) can significantly enhance project performance and mitigate risks. Interpreting EVM and PRM inputs and outputs *synergistically* (i.e., leveraging similarities and differences) should lead to two major implications:

(1) Informed Thresholds: EVM's cost and schedule control thresholds should be informed by PRM and project-specific context. Instead of specifying arbitrary thresholds (leading to puzzling EVM data), PRM provides insights into acceptable variations that align with project objectives. For example, while some projects entertain cost variances of up to 20%, others, particularly during the Construction phase, may require stricter limits (e.g., +10% and -5% from the baseline). Thus, a failure to consider these contextual factors could bring unnecessary risks and challenges to the project life cycle—and invite the Chinese Brother, the *breath-holding* one, to this *puzzling party*.

    The PMBoK stresses the importance of aligning EVM variance thresholds to project objectives; "Crossing the threshold should trigger some action, such as generating an exception report" (PMBoK, 2013). PRM input is crucial in informing these thresholds by considering the project's unique context, life cycle phase, and risk tolerance levels. For instance, a software development project may allow higher cost variances during the prototyping phase but require tighter control in implementation. By aligning EVM thresholds to PRM insights project managers can balance flexibility and accountability and ensure *deviations* from the baseline are managed effectively.

(2) Accurate Project Status: Interpreting outcomes of EVM and PRM *in unison* provides a more accurate assessment of the project's status. Project managers will gain a broad understanding of performance trends and potential risks by combining *backwards-looking* data (from EVM) with *forward-looking* insights (from PRM). This holistic approach allows proactive decision-making and timely interventions to steer a project towards success—thus, no *breath-holding* is needed!

    Integrating EVM and PRM information enables project practitioners to assess the performance of a particular project comprehensively. EVM provides valuable insights into cost and schedule suitable variances, while PRM anticipates and mitigates potential risks that could impact project outcomes. By combining these perspectives, project managers gain a nuanced understanding of the project's trajectory and can proactively address emerging issues. For example, should EVM indicate a cost overrun, PRM will identify the underlying risks, such as supply chain disruptions or scope changes, thus allowing project practitioners to implement corrective actions promptly.

It follows that aligning EVM and PRM enhances project governance, improves decision-making, and strengthens risk management practices. By leveraging synergies between these two disciplines, project managers can navigate uncertainties more effectively and better the odds of project success. It is a pity most project practitioners still interpret EVM and PRM separately, with a "silo" mentality —not to mention those who do not consider EVM in their capital projects, arguing it does not work.

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Figure 11 provides a practical illustration of how Earned Value Management (EVM) and Project Risk Management (PRM) can *interact* to establish and monitor cost and schedule thresholds, thereby evaluating overall project performance. This symbiotic "coupling" is essential to project success. It should be noted that provisions for *aleatoric* risks are to be incorporated into the "Integrated Work Breakdown Structure" (I-WBS), stressing the importance of addressing uncertainties from the onset.

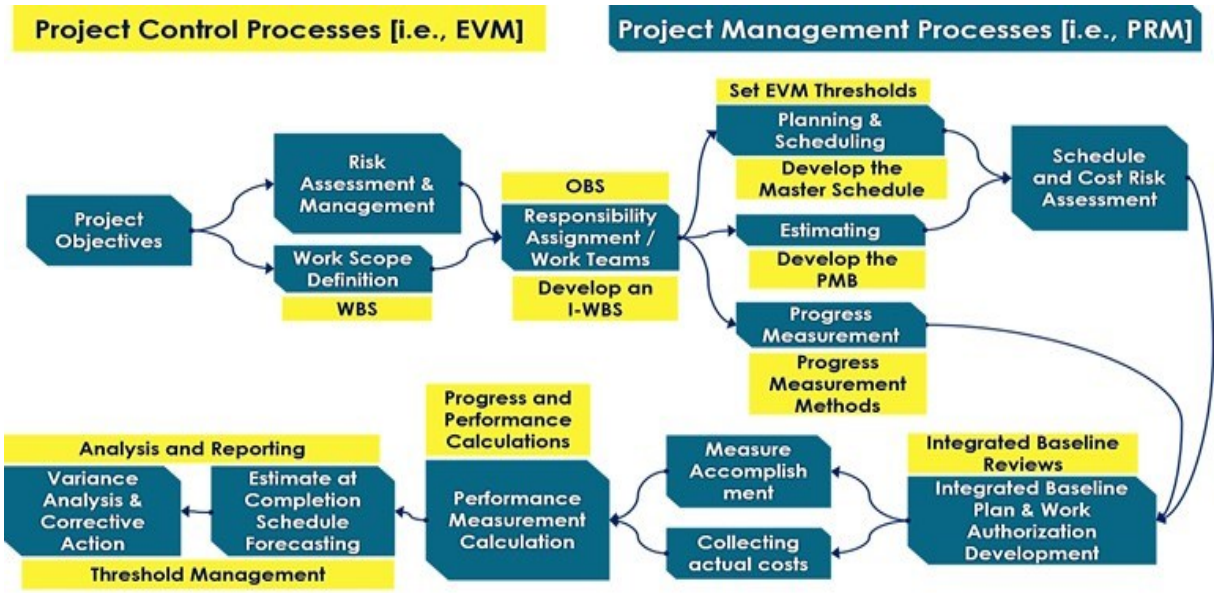

Figure 11 — EVM and PRM Interactions to Set and Track Thresholds (Adapted: ANSI/EIA 748)

In many megaprojects failure often stems from ineffective *communication* or insufficient *integration* between EVM and PRM. Whenever these disciplines are treated in isolation, like a man watching only half of his TV screen *alternatively*, the full story of "project performance" will remain untold. To prevent this "misstep," project and risk managers must concurrently interpret EVM, which gives *backwards-looking* data, and PRM, which provides *forward-looking* insights. By synthesising these perspectives, project managers shall gain a comprehensive understanding of the project's actual status and future trajectory, enabling them to make informed decisions and prevent potential failures.

By leveraging both EVM and PRM information, project managers can accurately assess the project's "*Where-We-Are*" (its status) and, thus, anticipate "*Where-To-Go*" (its end predictions). This holistic approach empowers project managers in proactively addressing emerging challenges and optimise project outcomes. Moreover, integrating EVM and PRM enables project managers to evaluate the likelihood of achieving project goals/objectives within the constraints of cost and time targets, and quality requirements, thereby enhancing project oversight, and increasing the probability of success.

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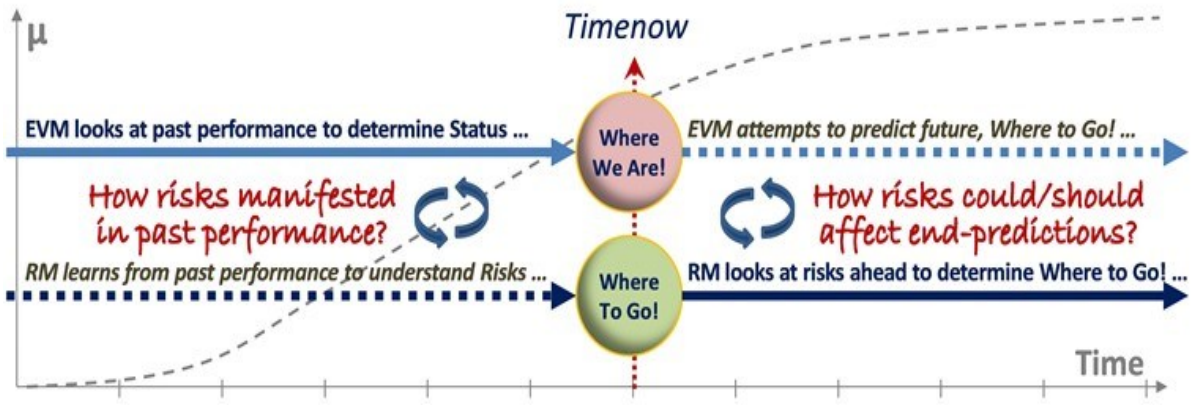

Figure 12 — EVM and PRM Interactions to Establish 'Lessons Learned' and 'End Predictions'

Combining the *retrospective* data from Earned Value Management (EVM) with the accumulated insights from Project Risk Management (PRM) at the *Timenow* enables project managers to discern how project risks have materialised in the past. Similarly, integrating the *forward-looking* data from PRM with the "end projections" derived from EVM enables project managers to anticipate how risks might impact cost and schedule performances and, thus, inform the overall project outcome.

For instance, say, Polokwane is located some 270 km from Pretoria and Bela-Bela is about halfway between the two towns. In a scenario where it took somebody two hours of driving to reach Bela-Bela coming from Pretoria, at that point, EVM would suggest that it will take them a further 2 hours of driving to reach Polokwane. However, considering they wasted half an hour at an *unanticipated* police roadblock on the way to Bela-Bela, the drive has only taken an hour and a half. Thus, it might only take another hour and a half drive to Polokwane. Unfortunately, if they are now warned there could be two other police roadblocks beyond Bela-Bela (via PRM report), arrival time to Polokwane should *de facto* add two more half-hours of police stops—arrival is *expected* in two and a half hours.

From this Polokwane trip scenario, combining these two perspectives gives a better *expectation* of the project results (e.g., cost or schedule performance, burn rate, and outcome—success or failure). Applying this method to large and complex projects prevents "*holding one's breath for too long*." Indeed, combining EVM (*backwards-looking*) with PRM (*forward-looking*) would generally afford:

(i) A more accurate assessment of the project's "performance status"
(ii) An informed decision on the next "course of action"

This fusion of EVM (*backwards-looking*) with PRM (*forward-looking*) facilitates a more accurate assessment of project performance regarding cost, schedule, and burn rate. Moreover, it empowers project managers to make informed, insightful decisions regarding risk response strategies and plan adjustments; thus, preempting potential setbacks and optimising project outcomes (to avoid failure).

While EVM plays a crucial role in enhancing PRM, it is not the only discipline capable of doing so. Symbiotic interactions between PRM and other project management disciplines, such as Safety Management (e.g., HAZOP Studies), Stakeholder Management, Social and Legal Compliance, and Requirements Management, shall further bolster project resilience and success. By integrating these *eclectic* perspectives, project practitioners can mitigate risks, address challenges, and ensure the attainment of project objectives in Large Infrastructure Projects (LIPs) or other complex initiatives. Sadly, project teams do not consider this notion relevant to large and complex projects at their peril.

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Integrating PRM and Stakeholder Management usually reveals risks that often remain undetected until the project falls into complications and failure; one talks about "*significant relationship risks.*" And similar situations also arise from a failure to consider "requirement risks" in a complex project.

> "The delivery of megaprojects [i.e., LIPs] involves various stakeholders and usually requires interregional and multi-agent cooperation. These [key] stakeholders play different roles and undertake different responsibilities and obligations, forming a complex social network […] The social attributes of megaprojects, as a result, lead to significant relationship risks, which is the product of the dynamic interaction between [influential] stakeholders." (Xie et al, 2019)

> "A factor present in every successful project and absent in every unsuccessful project is sufficient attention to requirements [and the risks thereof]." (Robertson & Robertson, 2005)

Why should the Project Team still "*hold their breath forever*" while status can be gauged accurately? Nothing in the PMBoK says we should always treat the Ten Knowledge Areas separately, in silos.

Conclusion

The PMBoK (on Project Management) and ISO 31000 (on Risk Management) concur that the aim of Project Risk Management (PRM) should be none other than to increase the "*likelihood of success*" in projects by [1] identifying and [2] managing barriers to meeting objectives in advance. However, owing to the VUCA nature of today's infrastructure projects, it is no longer a matter of *whether* project outcomes might stray from objectives, but rather the *extent and impact* of those deviations. Delivering any Large Infrastructure Projects (LIPs) without effective risk management only leads to complications, failures, and disillusionment; think of socio-economic benefits that will be delayed or forfeited to the stakeholders' peril. For LIPs to thrive, the "Five Foes" of PRM must be conquered.

Hence, since most PRM standards leave it to organisations to incorporate components of the PRM processes into their (lifecycle-based) project delivery framework, the project life cycle methodology should accommodate PRM as an *integral* part of every phase, process group, and aspect of managing projects. If not, PRM processes would be employed only once (at the onset, to create a Risk Register) or, worse still, *regurgitated* at each phase, despite every project phase necessitating a different focus.

Further, the pertinence of threats and opportunities depends on the project context (i.e., a proper understanding of "*contextual factors surrounding the project at hand*"). Any attempts to identify risks without consideration of the context shall result in wrong or false risks. Analysing and treating wrong or false risks can prove futile and descend into a "*chasing of the wind*"—a waste of resources! Therefore, brainstorming of threats and/or opportunities on the project under consideration should flow from *objectives* and factors that may have a bearing thereto, not simply "*what could go wrong*."

Still, to many organisations, PRM is like a "buckler" one will only raise when the situation around the project gets "risky," not something that should always remain activated. The author contends that PRM should serve as the "immune system" for the project, not just when a threat lurks around. In keeping with the principle of the *bijective* correspondence between the three stages of the immune system and the three Lines of Defence (LoDs) of effective risk management, the First Line of Defence corresponds to the "Surface Barrier," the Second Line of Defence to the "Innate Response," and the Third Line of Defence to the "Adaptive Response"—PRM applies across the organisation.

Then again, the risk treatment process is about reducing residual risks to levels acceptable to relevant stakeholders and ensuring efficiency and effectiveness. Therefore, the tendency to throw money at

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treating risks (via a "contingency") is not necessarily the wisest way of managing risk or finances. Other risk treatment actions (i.e., adequate designs, operating procedures, contracts, and policies) often prove more effective. Moreover, exceptional (rare yet impactful) risks must not be treated like normal distributions—they have no *meaningful* mean, maximum, or standard deviation. A *nuanced* approach is needed to apply scenario analysis and stress testing to manage such risks effectively.

Ultimately, yet another "foe" to defeat is the propensity to implement PRM in a silo, separate from any other project management disciplines. No clauses in the PMBoK say we ought always to treat the Ten Knowledge Areas apart from each other. For instance, insights from combining the *forward-looking* PRM and *backwards-looking* EVM (Earned Value Management) in a *synergetic* approach provide a more *accurate* assessment of the project's performance status, trends, and impending risks.

The story has it that the "Five Chinese Brothers," after escaping the *execution* sentence, stayed away from mischief and, with their mother, "*all lived together happily for many years*." Conversely, it is hoped Project Risk Management (PRM) will not only survive its pernicious predicaments but also prove greatly effective once the insidious "Five Foes" are *fittingly* conquered, as noted in this paper.

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Appendix A: The Story of the Five Chinese Brothers

"The Five Chinese Brothers" is a beloved children's bedtime book (by Claire Huchet Bishop, with illustrations by Kurt Wiese, first published in 1938 and reprinted in 1996). The story is a *re-telling* of a traditional Chinese folktale, characterised by its engaging plot and the theme of familial unity (viz, brothers' solidarity and willingness to help each other highlight the strength of family bonds) and cleverness (viz, the story highlights the value of using one's wits to overcome seemingly insurmountable challenges)—and unfairness (viz, the story *subtly* critiques the townspeople's rush to judgment and condemnation, and highlights the importance of understanding and compassion). Whether the five brothers were *heroes* or *villains* has remained a controversy to this day, however.

The book is a "classic" traditional tale, with an engaging narrative and charming illustrations, that continues to be a popular and enduring story of wit and escape, beloved by generations of readers. The account begins with the *unveiling* or introduction of the "Five Chinese Brothers" who, despite being identical in appearance (i.e., lookalikes), each has a distinct aptitude or supernatural power:

(1) The First Brother: He has the extraordinary ability to swallow the sea
(2) The Second Brother: His neck is as strong as iron, making him invulnerable to decapitation
(3) The Third Brother: He can stretch his legs to incredible lengths
(4) The Fourth Brother: He is immune to fire and cannot be burned
(5) The Fifth Brother: He can hold his breath indefinitely

In the story, the First Brother in seemingly good faith uses his ability to "*swallow up the sea*" to help a young boy catch fish from the exposed seabed. Despite the First Brother's warning to return before he releases the water, the boy stays too long on the dry seabed, collecting more fish than he needs. Sadly, unable to hold the sea any longer, the First Brother releases it, and the boy drowns.

The townspeople hold the First Brother responsible for the boy's undeserved and untimely death. He is arrested, tried, and sentenced to public execution; however, he thinks of an escape plan. Before each execution attempt, the First Brother requests to return home to bid his family farewell. Together, the brothers devise a plan to use their unique abilities to survive the execution attempts:

(a) *Execution by beheading:*
The Second Brother (with the iron neck) takes the place of the First Brother; hence, when the executioner tries to behead him, the blade breaks on his iron-strong neck—he survives!

(b) *Execution by drowning:*
The Third Brother (who stretches his legs) replaces the Second Brother. Thrown into the sea, he extends his legs to stand on the ocean floor, with his head above water—he survives!

(c) *Execution by burning:*
The Fourth Brother (the one immune to fire) gladly takes the place of the Third Brother. When forced into a fiery oven, he emerges unharmed, with no single burns—he survives!

(d) *Execution by suffocation:*
The Fifth Brother (who could hold his breath indefinitely) substitutes the Fourth Brother. He is tied up and locked up in a smoke-filled room, but he does not suffocate—he survives!

After each failed execution, the irritated townsfolk conclude the brothers are *invincible* and release the First Brother. The "Five Brothers" return home safely, parading their unity and unique talents. Having survived the execution, with their mother, they "*all lived together happily for many years*."

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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 on 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*" (Cambridge, 2021); he has also published, "*How to Manage Project Stakeholders—Effective Strategies for Large Infrastructure Projects*" (Routledge, 2020) and "*Operational Readiness—How to Achieve Successful System Deployment*" (Routledge, 2020). Through various publications, journal articles, and conference presentations, he assiduously promotes the application of Systems Thinking and/or Systems Engineering principles, concepts, and practices to unravel complexity in Large Infrastructure Projects (LIPs) to address their persistent risks of failure and their massive, even pernicious, cost and schedule overruns. His other papers can be viewed at https://pmworldlibrary.net/authors/pascal-bohulu-mabelo/

Pascal is currently a Director and Principal Consultant at E 6 Project Consulting or E6PC; for comments, further information, and clarifications he may be contacted at Consult@e6pc.com.

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