Risk Management and Project Context [1]

Pascal Bohulu Mabelo

Abstract

Implementing Project Risk Management (PRM) entails the allocation of valuable resources, such as personnel, finances, and time. However, Large Infrastructure Projects (LIPs) often neglect PRM or even adopt inadequate frameworks, leading to poor risk management. This detrimental situation is further exacerbated by haphazard Risk Identification practices. Many risk workshops devolve into hurried attempts to populate the Risk Register by conjuring up risk-items without a proper understanding of the "contextual factors surrounding the project at hand"—the context. Therefore, when incorrect or baseless risks are documented, the entire PRM process turns futile. This paper stresses the significance of understanding the project context for the successful PRM.

Risk Identification is Important

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, the brainstorming of threats and/or opportunities pertinent to the project at hand should flow from *objectives* and factors that may have a bearing thereto, not simply "*what could go wrong*".

The below Figure 1 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 should flow from "Base Risk Register" and/or "Specific Contingency". This was encouraging risk practitioners to source risk-items from *previous* identification exercises *as if* the project at hand has necessarily the same or similar objectives and had arisen from parallel circumstances—a rather *exceptional* case was being made a general rule.

Thus, it shall be appreciated that this *misstep* has been addressed in the 2018 version, by including "Scope, Context, Criteria" considerations before embarking on the Risk Identification exercise.

[1] How to cite this paper: Mabelo, P. B. (2023). Risk Management and Project Context; featured paper, *PM World Journal*, Vol. XII, Issue X, October.

This approach ensures risk-items are brainstormed in line with those specific concerns, as opposed to "*gleaning around*" in a haphazard manner and, therefore, proceeding with irrelevant risk-items.

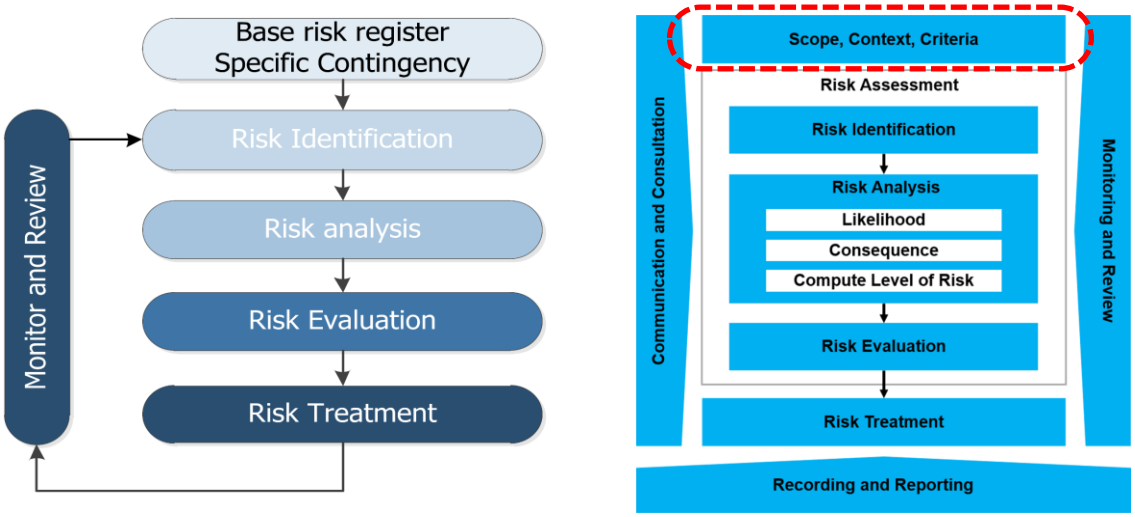

Figure 1 – ISO 31000: Risk Management Standard, 2009 Version versus 2018 Version

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.

Risk Identification and Project Context

Scott (2012) warns: "It doesn't help to solve the wrong problem"—Law No 2 of Effective Systems Engineering. Yet, Borza (2011) tells, "Too many times, individuals and teams jump into problem-solving activities without fully or properly defining what it is they really 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 (e.g., address a risk), one should first seek to understand it!

Unless the various project personnel *accurately* identify the threats and opportunities pertaining to 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 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)—what a waste of resources!

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 projects *for the better or for the 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 (Mabelo, 2023).

At the Conceptual (FEL-1) phase, before anything else, the "context" should be established to provide understanding and insights that ought 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.

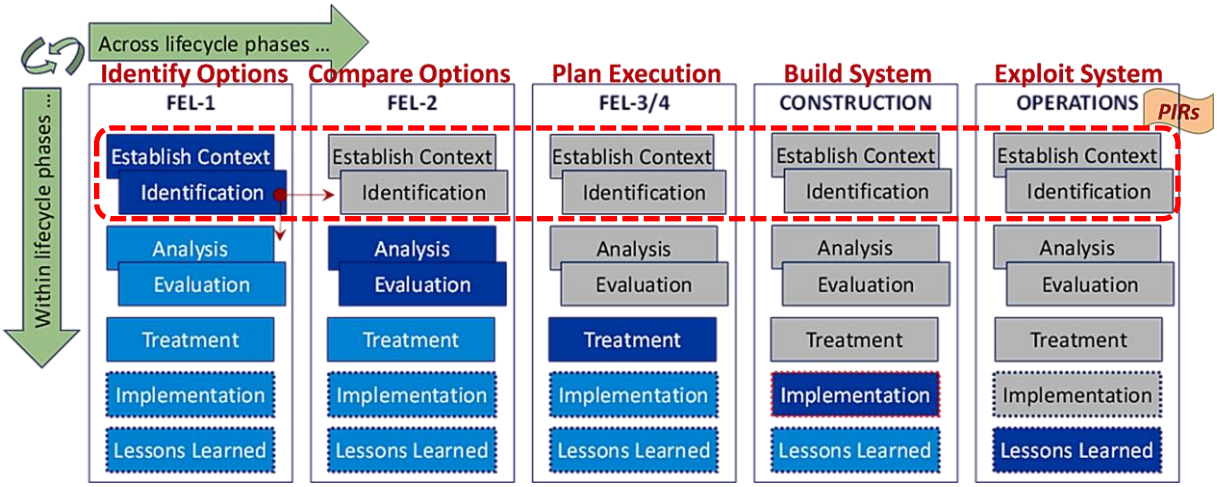

Figure 2 – Risk Process and Project Life Cycle (Mabelo, 2023)

The approach to Project Risk Management as per (Mabelo, 2023) requires that the Project Context stays up-to-date and valid—to prevent any manner of *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).

Establishing the Project Context

Each project is inherently "unique", making "*a comprehensive grasp of its context*" essential for ensuring successful delivery. Thus, "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. In fact, Daniëlla van Well-Stam (who has 28 years of PRM practice in infrastructure projects) argues, "Quantitative Analysis is not an exact science. The analysis often relies on expert estimates, and the outcome should be viewed with this in mind […]" (van Well-Stam et al, 2007). This quote bears out the need for "interpretation" of risk outcomes—and coming from such an expert, it sure means a lot.

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 project objectives are the pivotal parameters within which the project context should be defined. Hence, in line with the "Desired Future Scenario", the specific goals or objectives to consider are:

- Strategic fit of the intended project—and other socio-economic outcomes (e.g., job creation)
- Technical performance, as per the Concept of Operations (ConOps) and other Requirements
- Schedule, cost and/or quality targets
- Regulatory and/or legal compliance
- Health and safety standards
- Market-share and growth
- Profitability and margins
- Reputation and branding
- Customer satisfaction

Such aspects should be defined in a "S.M.A.R.T" fashion (Specific-Measurable-Aligned-Realistic-Timebound) (University of Adelaide, 2017). No doubt, incorporating these factors and aspects provides clarity and direction in discussing *uncertainties* and identifying risks in projects. However, further "contextual" factors and considerations would be required to complete the "Big Picture"; it is about "identifying and managing all the many sources of uncertainty" (Ward & Chapman, 2003). Otherwise, PRM will descend into the proverbial "*Six blind men and the elephant*"; the blind men (i.e., a risk team with little/no project insights) failed to fathom what the "*elephant of riskiness*" was.

> "When presented with an engineering design [or any *complex* project-delivery] problem, the system engineer's [and the risk manager's] *first* task is to truly understand the problem in its totality; this means understanding the "context" in which the problem is set." (Mabelo, 2021)

The *holistic* outlook of the "Establish Project Context" step is crucial to implementing an effective PRM and seeks to provide a comprehensive appreciation of all the factors that may have an influence on the ability of an organisation to achieve its intended outcomes. It is particularly important that the scope is clearly defined so that the subsequent activities of the Risk Management process stay within required boundaries. Recent PRM standards tend to expand the *sphere* of the Project Context.

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

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

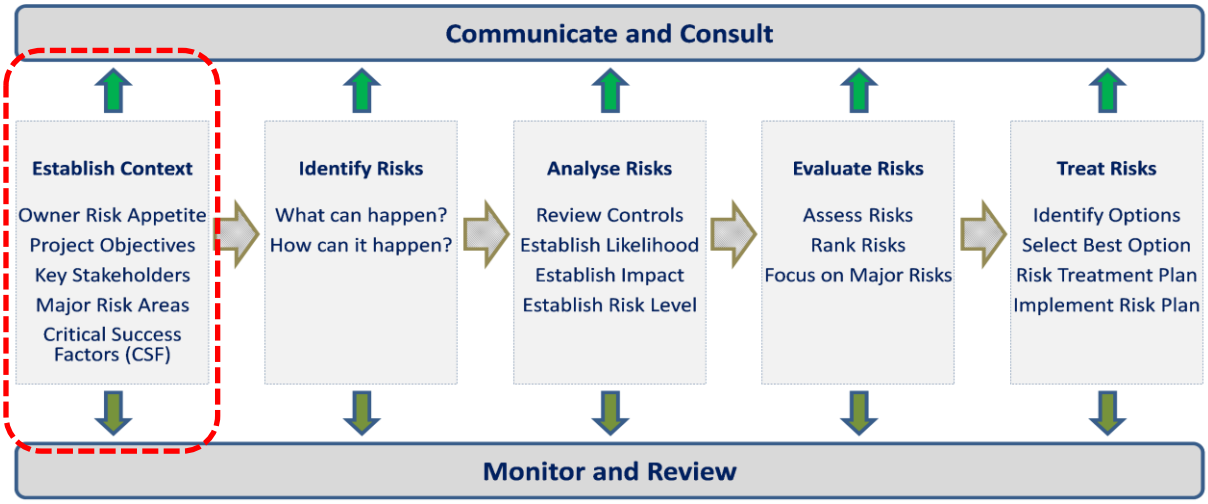

Figure 3 – AS/NZS 4360: Risk Management Standard (2018)

> "The project, which is a network formed by various stakeholders and their interactions, has the characteristics of a social network. The success of the project stems not only from the optimum plan, efficient allocation of resources, and utilization of control functions but also from a high-performance team, where the project participants [i.e., relevant stakeholders] communicate, exchange information, cooperate, etc. to complete the whole [mega] project efficiently and effectively […] Megaprojects social networks are highly complex because of the large number of participants involved and great impact on society." (Xie et al, 2019)

Indeed, involving relevant stakeholders at key points in the life cycle builds acceptance and can generate constructive solutions. Failure to identify and include the stakeholders may lead to failure in the acceptance of the proposal and its strategy by management, customers, staff, regulators, and the community. Therefore, Stakeholder Analysis (i.e., understanding the stances of stakeholders and the complexity of their relationships) is important for most activities of Project Risk Management:

> "The most important issue in project management is for the project manager to get project staff, beneficiaries, and other stakeholders to develop a common understanding, agreement, and commitment to a project's objectives. A shared perception about objectives, agreement that the project is worth doing, and the commitment to make it happen does not happen automatically. It takes effort and involves a considerable amount of communication [i.e., effective stakeholder engagements]." (Youker et al, 2001) [*Underlining added for emphasis*]

> "The delivery of megaprojects [e.g., 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)

Stakeholder Analysis must have started at an early stage of the project. At the very least, external and internal stakeholders to be "analysed" include government and its agencies, funders, corporate board, staff, customers/users, competitors, and the community at large—and their interconnections.

> "When a bank [or any organisation] assesses the risk of its investment portfolio, it should not only look at the risk of individual exposures but also account for correlations of the exposures [or "interconnectedness"—thus, one should look at a *network* of project risks]." (Lehar, 2005)

Moreover, as Figure 4 implies, in addition to the particulars indicated in the 'AS/NZS 4360 Standard' (e.g., goals and objectives, stakeholders), an appreciation of "capabilities" is required in conducting a SWOT (Strengths-Weaknesses-Opportunities-Threats) Analysis that defines the organisation's "internal environment". Likewise, its "external environment", as well as its competitors, shall be discussed as part of a PESTEL (Political-Economical-Social-Technological-Environmental-Legal) Analysis that defines the *how* and *to what extend* external factors are likely to impact *uncertainties* surrounding the project. Of particular interest in the latter analysis are the interactions between the competing, collaborating, and sustaining systems or projects, and how they relate to the new system. By definition, (a) a sustaining-system is needed to sustain (or enable or support) the intended system; (b) a collaborating-system shall join forces (or synergise) with the new system; and (c) a competing-system vies for resources or space with the deployed system (INCOSE SEH, 2015; Mabelo, 2020b).

One practical implication of this study is that understanding of 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, as well as at the ensuing Risk Analysis (e.g., during the "computer-modelling" for Quantitative Risk Analysis), Risk Assessment, and Risk Treatment. The deeper you *understand* a risk, the better you will calculate it; the current indulgence of "*calculating risks one does not even understand*" ought to be frown upon!

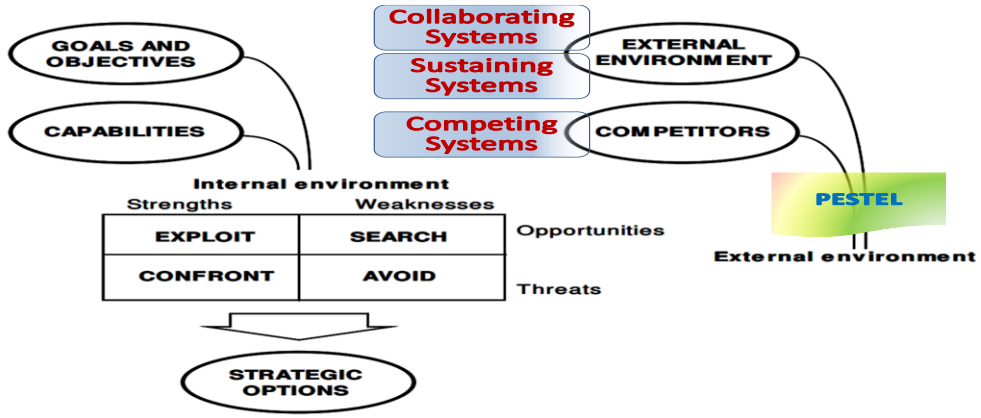

Figure 4 – SWOT and PESTEL Analysis Frameworks (adapted: Rowe et al, 1989)

Figure 4 essentially suggests that while most "strengths and weaknesses" originate from the *internal* environment, "opportunities and threats" oftentimes emanate from the *external* environment—and the Risk Treatment strategy mostly depends on their "gravity", dynamic interactions, and alignment. Thus, any Risk Identification and the subsequent Risk Assessment processes right through to Risk Treatment as well as Monitoring and Control steps would not make sense except in such a "context". Indeed, from *there* would emanate "social/strategic" (elsewise, "institutional") risks, "Financial" (elsewise, "market-related") risks, "technical" (elsewise, "completion") risks, "operational" risks, and "environmental" risks. Ignoring any of these *areas of influence* renders Risk Management blind.

Incorporating Structural and Temporal Perspectives

"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). The author has argued in a prior article (Mabelo, 2023) that Project Risk Management (PRM) in Large Infrastructure Projects shall benefit from adopting Systems Thinking principles and concepts.

The foregoing discussions extend the notion of Project Context to include both *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* over time? Thus, in line with Systems Thinking, a more *holistic* approach would require additional perspectives. These Systems Thinking outlooks and their risk implications are discussed 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

(i) The Iceberg Model:

Systems Thinking maintains that, "Because 'systemic structures' generate 'patterns' and 'events'—but are very difficult to see—we can imagine these three levels as a kind of iceberg, of which 'events' are only the tip. Because we only see the tip of the iceberg, the 'events', we often let those drive our [PRM] decision-making. However, the 'events' [i.e., incidences faced in daily operations] are the results of deeper 'patterns' [i.e., memories of events over time and their trends] and 'systemic structures' [i.e., ways in which a system's components (or sub-systems) are arranged]" (Kim, 1999). Consequently, a smart PRM ought to address "systemic structures"—and even "mental models", as designing a system/product should conform to, but can also *influence* the prevalent "mental models".

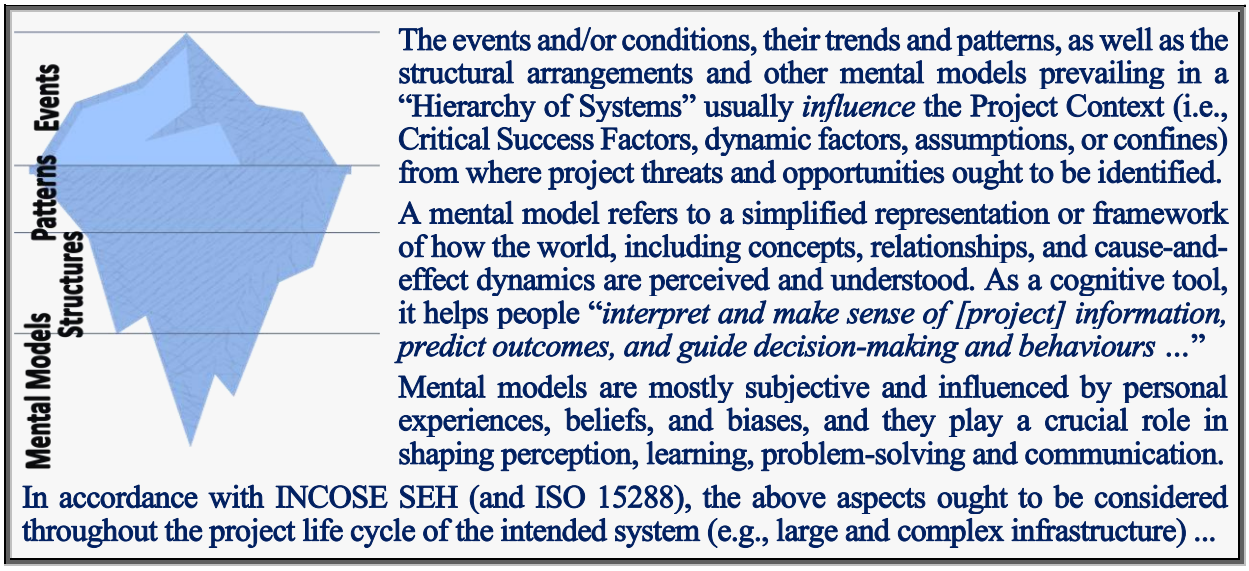

Figure 5 – Iceberg Model Showing Different Depths of Systems Behaviour

The application of the Iceberg Model to PRM entails a *deepening* of the notion of Project Context by expanding the "*spheres of uncertainties*" beyond the usual "events and/or conditions" to include their "trends and patterns", the "systemic structures" causing them, and "mental models" involved. It defines "*new frontiers*" by identifying and/or treating risks beyond "events/conditions" outlooks; e.g., the event-based flood risks may be treated by tackling "*claypits and poor drainage*" in the area, or by "*public condemnation*" of people occupying lands whose topography is improper for building.

(ii) The TAWOO Model:

It is said that "A system is a combination of *interacting* elements [e.g., sub-systems, assemblies, parts] organized to achieve one or more stated purposes [i.e., objectives]" (INCOSE SEH, 2015). At every stage of the design process of Large Infrastructure Projects, engineers and risk practitioners ought to incorporate a *holistic* approach by considering the adjacent levels—for the "purpose" of a system is discerned at the level above, while its "underlying mechanisms" reside at the level below.

For instance, when designing a power plant, the team ought to carefully consider its *interconnections* with the power grid and coal availability or supply. Any risks to the power grid and to the coal supply regime (i.e., level above or Meta-level) should be considered. Equally, risks pertaining to the generators, turbines, and boilers (i.e., the level below) would be considered. Further, they should explore *how* and *to what extent* such adjacent sub-systems might *evolve* over time, just as the Meta-system itself evolves as per the TAWOO (See Figure 6); risks could indeed *emerge* from this realm. Figure 7 depicts the *Risk Context According to System Hierarchy*, with its meta- and sub- systems. While the plant aims to increase/stabilise power generation, that "objective" could prove contingent upon the quality/quantity of coal supply; further, electricity demand/shortage and coal supply curves may vary over time. Those issues shall be considered in discussing the risks of building such a plant.

Likewise, the operability/reliability and the technical-maturity profile (i.e., new/innovative versus obsolescent components—as per the TAWOO) of the power plant's components (sub-systems) such as 'conveyor belt', 'generators', and 'boilers' might affect the *overall* performance of the "system" in terms of availability of spare parts, as well as operations and maintenance support, Mean-Time-Between-Failures (MTBF), and disposal timelines, when applicable. Hence, any *systemic* solutions to be provided and, thus, project risks to be addressed ought to accommodate such considerations.

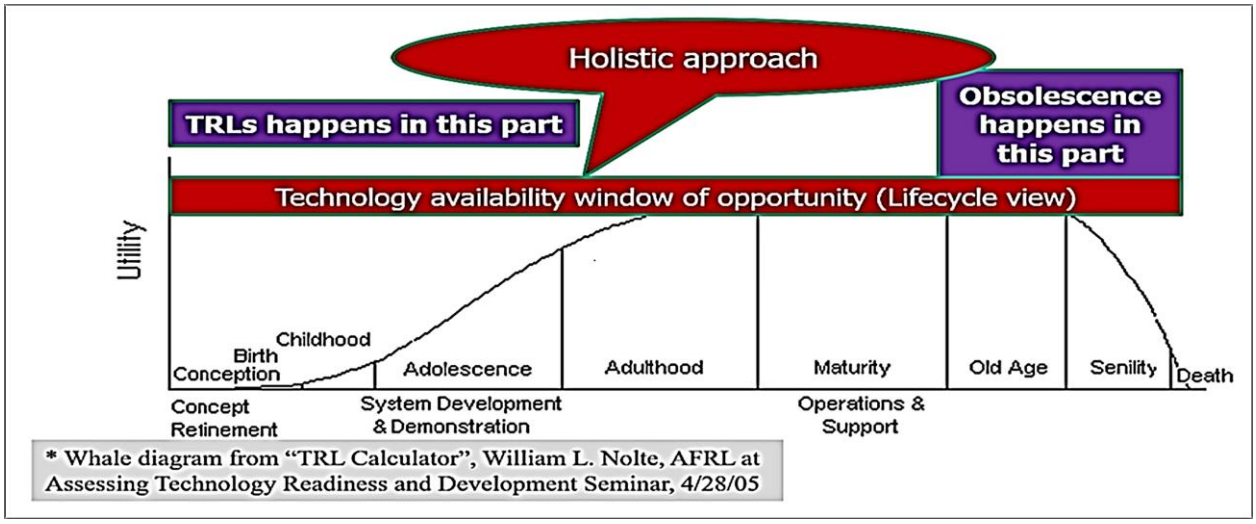

Figure 6 – TAWOO Diagram, as Superimposed on the Whale Diagram (Source: Kasser, 2020)

The installed and/or envisaged "system-components" (e.g., legacy-assemblies, spare-parts) at both Meta-Level and Sub-Systems level often create TAWOO-based opportunities (e.g., better/cheaper components *availing* as commercial-off-the-shelf) or threats (e.g., extinction of know-how, spare-parts in obsolescence) due to their age/state on the TAWOO Diagram—turning into "risk-sources".

(iii) The HKMM or HKM²Framework:

The foregoing TAWOO discussion assumed a "Three-Level Hierarchy" as shown in Figure 7 below:

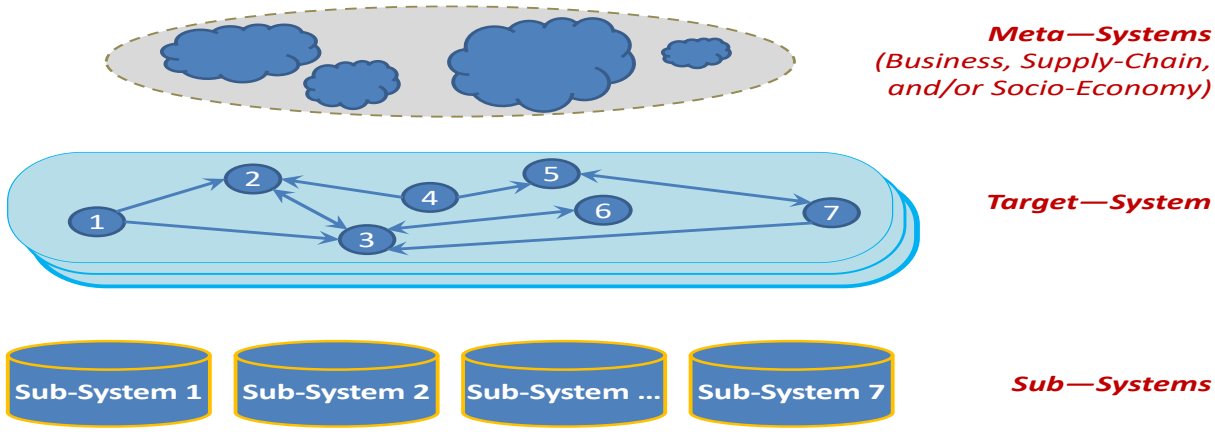

Figure 7 – Risk Context According to "Three-Level" System Hierarchy

The above System Hierarchy portrays the infrastructure-system at hand as the "Target System", whereas the "Meta-System" represents anything from the "business" to "supply-chain" to "socio-economic" realms and to "regional" and "global" environments. This System Hierarchy aligns itself to the HKMM or HKM² Framework; just like with the TAWOO, risks could *emerge* from this realm.

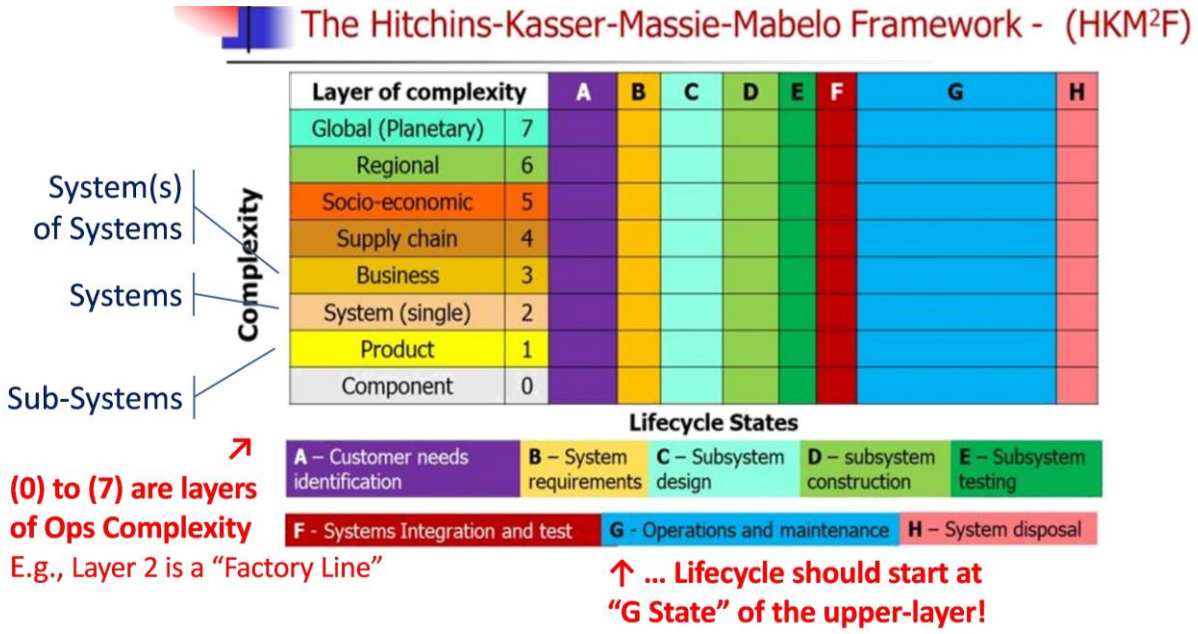

Figure 8 – HKMM Framework (Layers of Operational Complexity) and System Hierarchy

Depending on the "layer" of the system at hand, the HKMM Framework shall provide a guide as to which "Meta-System" and/or "Sub-Systems" to include in establishing the "context" of the project. In the rare case of a *well-functioning* hierarchy (i.e., where all issues and risks in higher layers are "consolidated" in the 'one-level up' sphere), it would make sense to only explore the 'one-level up' system; however, in most cases, such an exploration should rather include every other above-system. Similarly, it is either the 'one-level down' system, or else any below-systems that will be included.

Further, since no 'one-level down' system is defined or *elaborated* at the Conceptual (FEL-1) phase, sub-systems (or assemblies/components) shall be determined from a "Generic Conceptual Model" of the system at hand; but, from FEL-2 onwards, they would derive from the System Design process. For example, generic sub-systems for an integrated "metro-transit-system" may entail the following: ticket-system, bus-system, and train-system—thus, opportunities and threats would arise from there.

Essentially, should a *constellation* of opportunities and threats within the Meta-System materialise, "disruptions" (i.e., issues/problems, open possibilities) would be *bestowed* unto the Target-System. Similarly, strengths or weaknesses existing across Sub-Systems (or in their interactions) may result in "capabilities" and/or "vulnerabilities" that would determine the "resilience" of the Target-System.

Therefore, the *enhanced* Risk Identification process should incorporate the following items as well:

(i) Any opportunities and/or threats from the Meta-System (e.g., global health system and ensued Covid-19 lockdown) that caused *disruptions* (e.g., global shipping crisis) to the socio-economic ecosystem (e.g., port operations), but also *higher prospects* for online services and for cargoes.
(ii) Any capabilities and/or vulnerabilities that may affect the overall resilience of the system, which will be addressed by replacing/updating existing sub-systems (e.g., "foldaway" cranes at ports).

Clearly, by exploring opportunities and threats from both 'above/upper' and 'below/lower' systems, projects would further depart from the stance of focusing on the *Construction-Horizon* and its risks.

Industry Validation

The practicality of considerations and models explored thus far needed to be tested with the industry. A survey was conducted to gather information and insights about the current and *desired* levels of application and effectiveness of Risk Management across the Large Infrastructure Projects industry.

Surveys are generally appropriate for measuring the impact of social and psychological phenomena. Although interviews usually produce a higher response rate and are a more formalised, systematic, and extended version of a conversation aimed at finding rich and descriptive data, they are prone to the "*halo effect*" since the respondent may feel obligated to please the interviewer. For this reason, the author has relied solely on the survey—hoping to still attain a *sufficiently* representative sample.

It must be noted that the LIPs sector is quite a specialised industry, with a limited number of actors. Therefore, an "online questionnaire" was used to gather information by asking a range of individuals (project personnel) the same questions concerning PRM-related characteristics, attributes, practices, or opinions. The PRM questionnaire was devised as an *instrument* to collect data on aspects such as demographics, Risk Management practices, and awareness and applications of Systems Thinking.

The collected data and feedback from the surveyed organisations were analysed to generate valuable insights and knowledge that helped in establishing "*the significance of understanding the project context*" for the successful PRM, as far as Large Infrastructure Projects (LIPs) are concerned. It was hoped that the outcomes of this survey will not only add to the integrity and credence of this study

but, more importantly, encourage project and risk practitioners to adopt and implement its findings in developing and improving their Project Risk Management frameworks, processes, and practices.

While the author's articulations (as supported by the information and insights collected from current literature) have led to the proposed approach to establishing a *holistic* Project Context, the data collected via the survey have helped in determining both the *desirability* and *status quo* of PRM practices across the SnA region. Further, given the *qualitative* nature of responses and dealing with *insubstantial measurements* (i.e., concepts, ideas, opinions, or other intangible entities) a Five-Scale Likert was used and a Conbach's Alpha Test was applied thereafter to verify its results for reliability.

The Likert Scale is a 'simple-to-construct' kind of tool that usually produces an 'easy-to-read-and-complete' and 'highly-reliable' scale—despite its "central tendency bias" (in odd-numbered scales). Further, since this study mainly sought to "*illustrate the significance of understanding the project context as precondition for a successful PRM process*", the term "entity" was used interchangeably to mean a "Project/Programme Manager", or a "Risk Manager", or "Project Team Member", or even other personnel such as "Project Executive", "Project Consultant", and "PM Coach/Trainer".

The questionnaire, therefore, asked questions seeking to determine the *prevalence* of Project Risk Management and Systems Thinking's principles and practices in the various organisations surveyed. The General Information section gathered information to establish the profile of the respondents and their organisations by relying on "quantitative" data from preset discriminatory values, informed by the size and scope of LIPs in the Southern African (SnA) region. The other sections, from (2) to (6), being of a "qualitative" nature and dealing with insubstantial measurements entailed a "code" set in line with the Five-Scale Likert (ranging from "*Strongly Disagree*" to "*Strongly Agree*") as follows:

Figure 9 – Proposed Five-Scale Likert Continuum

The design of the questionnaire has given careful attention to its appearance (e.g., visual appeal), structure, section ordering and, most importantly, interpretability of statements—which is key to the Likert Method applied. Further careful attention was given to the issue of reliability and validity; when these issues are properly addressed, "measurement error" is generally reduced to its minimum.

For that purpose, a Cronbach's Alpha Coefficient has served as an "ex-post" test (i.e., after data collection) to confirm the reliability of the Likert-coded questionnaire; an Alpha score of 0.80 or higher shall indicate good reliability. In principle, the Cronbach's Alpha Coefficient should have served to pilot-test the reliability of a questionnaire before its broader distribution. However, given the selective population of the LIPs industry in the proposed region, and to avoid further reducing the ensuing purposive sample, this investigation has proceeded onto the industry survey and has only applied the Cronbach's Alpha test thereafter to verify its reliability on an *after-the-fact* basis. Therefore, a Cronbach's Alpha score of below 0.80 could have entailed discarding the whole survey.

Having posted the questionnaire on a portal for easy access, a survey tool (SurveyMonkey) was used to forward an online link to participants via email, LinkedIn, etc., with the convenience of automatic gathering and archiving of data. Table 2 (below) shows a sample survey questionnaire containing

'Project Risk Management' and 'Systems Thinking' question-items—focusing on Project Context. These carefully selected survey questions (52 in total) are listed in six distinct categories as follows:

(1) [Q_{01} to Q_{10}] General Information, to inform the demographics pertaining to surveyed entities
(2) [Q_{11} to Q_{19}] Project Risk Management regimen, as adopted by and applied in the organisation
(3) [Q_{20} to Q_{28}] Key principles and concepts applicable to the *Holistic* Project Risk Management
(4) [Q_{29} to Q_{37}] Characteristics of the *Enhanced* Project Risk Identification, as applicable to LIPs
(5) [Q_{38} to Q_{46}] Necessity and requirements of Project Context—for successful Risk Management
(6) [Q_{47} to Q_{52}] Awareness of Systems Thinking and its applications in Project Risk Management

In closing, three other questions were added to gauge its pertinence from the participants' viewpoint:

[Q_{53}] On a scale of 0 (low) to 100 (high) how "insightful" did you find this survey?
[Q_{54}] Would you like to receive a copy of the paper (if any) arising from this survey?
[Q_{55}] Would you recommend this survey to a colleague, or friend, or research fellow?

To confirm the validity of this survey from both its "content" and the participants' responses, it is worth noting that its Cronbach's Alpha scored ± 0.99, which is significantly above the required 0.80. Further, 86% of participants have found this survey "insightful" on a scale above 65 [i.e., Q_{53}], while 82% of respondents would recommend it to a colleague or to research fellow [i.e., Q_{55}], and 91% would like to receive a copy of the ensuing paper [i.e., Q_{54}]. These general sentiments, when read in conjunction with the Cronbach's Alpha Coefficient score, clearly endorse the validity of this survey.

Table 1 (below) provides a summary of the *heterogeneous* demographics of the survey as follows:

Number of organisations that responded to this survey: 13	% of entities delivering < 50 projects: 82%
% of multi-billion Rand projects: 64.6% (but 36.4% < R200 mil)	% of entities in "infrastructure" projects: 73%
Granularity of projects delivered: Ranging from 'mega' (multi-billion) to 'big' to 'small'—but 30% to 70% 'small'	
% of (perceived) project failures: 45.5% of respondents perceive that 10% to 50% of their projects have "failed" 54.5% of respondents perceive that 50% to 70% of their projects have "failed"	
Perceived level of PM Maturity: Only 36.4% of entities are perceived to have reached above 'Level 3' of maturity	
% of organisations where "strategy-project" link is obvious: Only 55% are confident of any "project strategic link"	
% of organisations with "documented" PM Methodology: Only 63% are confident of a documented methodology	

Table 1 – Summary Demographics of Survey Respondents

Project Risk Management (PRM) Survey
1. What is your industry or sector
2. Industry/Field of capital projects
3. Capacity/Function of "entity" surveyed
4. Portfolio of capital projects — Value of current biggest project
5. Portfolio of capital projects — Percentage of "failed" projects
6. Portfolio of capital projects — Approx. number of projects in portfolio
7. Portfolio of capital projects — Granularity of projects in portfolio
8. Your Organisation PM Maturity (as you perceive it) is at Level
9. Your Organisation has a clear, well-documented strategic 'goals' and most projects are — linked to such
10. Your Organisation has a clear, documented Framework/Policy on Project Delivery (e.g., PM Methodology)
11. Project Risk Management (PRM) is a 'core', critical delivery process
12. Such a PRM is documented, approved across the organisation
13. Approved PRM is integrated to Project Life Cycle Methodology
14. Approved PRM is applied on large projects in your organisation
15. Most project personnel are exposed to, trained in such a PRM
16. Project Managers are actively involved in every PRM processes
17. Approved PRM is based on ISO 30000 or AS/NZS 4360 standard
18. Approved PRM is regularly reviewed for improvement
19. Approved PRM is effective, proves satisfactory in most projects
20. Approved PRM has distinct steps, is aligned to project life cycle
21. Approved PRM has a different 'focus' for each project phase
22. Approved PRM considers both threats and opportunities
23. Approved PRM serves as ‘immune system’ to prevent project failure
24. Approved PRM also considers interactions between stakeholders
25. Approved PRM considers connectedness among various risk-items
26. Approved PRM is integrated to Enterprise Risk Management
27. Approved PRM is integrated to applicable Corporate Governance
28. Approved PRM is integrated to Project Execution Plan (PEP)
29. Approved PRM includes a specific Risk Identification step/process
30. Approved PRM documents risks onto a standardised Risk Register
31. Risk Register is normally populated once, at Project Initiation
32. Risks are identified in line with the main project objectives/goals
33. Risks are identified from a list or 'sources' defined by Project Board
34. Once identified, a risk remains relevant from one project to the next
35. Identified risks can only affect budget, schedule, and quality
36. Identified projects are as good as addressed, no action required
37. Every risk must be calculated using spreadsheets or simulations
38. “Projects are projects”—the so-called ‘context’ does not matter at all
39. Project outcome is affected by its internal/external environment
40. Failure to understand the context may cripple the PRM process
41. Socio-economic factors will always affect project outcomes
42. Uncertainties around the parts of a system can never create risks to the project
43. Risks are event-based and shall be treated by dealing with events
44. High-complexity projects require a broader exploration of context
45. Project managers must not care about uncertainties at the company level
46. Changes in the project environment often affect project outcome
47. Project activities and products may change the project environment
48. Interactions between risk-items may create new, additional risks
49. The way systems are structured could influence turns of events
50. A minor risk-event may cause major risk-impact and vice-versa
51. Risks created or ignored in early phases manifest at later stages
52. High-complexity projects require a broader context exploration

Table 2 – Sample Questions from Project Risk Management Survey

Only 13 organisations participating in the survey would indicate a *neglect* of PRM in the SnA region. Many organisations might not see the benefits of implementing robust Risk Management processes; however, Table 1 exposes a *prevalent* issue: chronic project failures in most surveyed organisations. This has broad implications on operations and strategy—a nexus 55% of respondents seem to know.

Further, a systematic and systemic analysis of responses has revealed many other *insightful* points:

1. ***Common Practice of PRM:***
   1.1. A statistical analysis revealed that only 54.5% of respondents believe that PRM is a 'core' process within their organisation—regrettably, some half rather treat it as an optional extra.
   1.2. Out of the survey participants, only 72.7% agree that risks are identified in line with the main project objectives or goals (as per the definition of risk, "*effect of uncertainty on objectives*").
   1.3. An overwhelming 90.9% of respondents agree that project outcomes are influenced by both internal and external environments, emphasising a need to explore the entire Project Context.

2. ***Project Complexity and Context:***
   2.1. Statistical evidence suggests a positive correlation (indicating a Correlation Coefficient: $r = 0.75$, and $p < 0.01$) between 'project complexity' and the depth of the 'context exploration'. Hence, the *higher* the complexity of the project, the *broader* its context should be explored.
   2.2. 90.9% of respondents acknowledge the substantial impact of socio-economic factors and environmental variables on project outcomes; a *holistic* Project Context shall consider such.
   2.3. In the survey, 81.8% of respondents stress the importance of considering both internal and external project environments for effective PRM, particularly in large and complex projects.

3. ***Corporate Governance and PRM:***
   3.1. A statistical analysis of survey responses highlights that 65% of participants advocate for incorporating systemic perspectives into PRM methodologies within Corporate Governance.
   3.2. In the survey, a compelling 90.9% of participants recognise that risks created and/or ignored in early project phases often manifest during later stages, such as construction or operations.

4. ***Integration and Documentation:***
   4.1. Statistical evidence shows that 60% of participants agree that PRM should align with their organisation's documented strategy, emphasising the role of projects in "strategy execution".
   4.2. Only half (45.5%) of respondents agreed that PRM is adequately documented and approved across their organisation, indicating a need for improved standardisation of PRM processes.
   4.3. Statistical data shows that 72.7% of respondents believe Risk Registers should be updated to reflect *environmental* factors (or changes) that may affect project outcomes and vice versa.
   4.4. A significant majority (81.8%) advocates for Enterprise Risk Management to integrate risks from large projects, considering both threats and opportunities—and their *interconnections*.

5. ***Misconceptions and Awareness:***
   5.1. Statistical evidence demonstrates that 54.5% of respondents hold misconceptions about the "static" nature of risks, believing they (should) remain the same from one project to the next.
   5.2. 77.8% of participants believe that every risk must be calculated using spreadsheets and/or simulations, highlighting a widespread misconception (i.e., an *obsession* to "calculate" risk).
   5.3. All respondents do recognise that changes in the environment often affect project outcomes.

6. ***Establishing an Effective PRM:***
   6.1. An analysis indicates that 72.7% of respondents recognise the importance of varying PRM focus at different project life cycle phases, while considering both threats and opportunities.

6.2. Statistical evidence also shows that 54.5% of respondents agree that PRM should consider *interactions* between relevant stakeholders and *connectedness* among the various risk-items.
6.3. However, 27.3% of participants think "*project managers must not care about uncertainties at company-level*", revealing some divergent opinions and contradicting many earlier points.

7. PRM Framework and Training:

7.1. The majority (72.7%) of participants are not even trained in PRM; they would need a training that is tailored to specific project goals and addresses *uncertainties* in relevant environments.
7.2. The survey data indicates 45.5% of participants believe effective PRM should serve as the "immune system" of any project, especially by addressing "*minor risks that cause major impacts*" (i.e., non-linearity) in LIPs—the grasp of this *novel* concept should be propagated.

In summary, statistical analysis of the survey data confirms the need for *improvements* in how PRM is perceived or applied in projects. It stresses the importance of "context-awareness" and of aligning PRM with project complexity, integrating it into Corporate Governance and PM methodologies, and of providing a *holistic* training to project personnel—for addressing misconceptions and increasing awareness of the "dynamic" and non-linear nature of risks is crucial for effective Risk Management.

The outcome of this PRM survey has confirmed that current practices in the LIPs industry across the SnA region are lacking in terms of *holistic* Project Context and *enhanced* Risk Identification assessments. Further, the survey has indeed revealed that such *systemic* aspects are highly desired across the LIPs sector—which suggests a strong possibility of an early adoption, just as it was hoped.

Information and insights gathered have assisted in establishing "*the significance of understanding the project context*" for the successful PRM, as far as Large Infrastructure Projects are concerned. "The power of context" suggests that understanding and analysing the context in which events (and change of events) take place is essential to *fully* comprehend why certain actions are taken, decisions are made, and outcomes occur. It stresses the idea that events (and risk thereof) as well as other underlying patterns/trends, structures, and mental models cannot be *fully* understood in isolation. Every area of *uncertainty* in projects ought to be explored *in-unison*, providing a *holistic* perspective.

> "Uncertainty management is not just about managing perceived threats, opportunities and their implications. It is about identifying and managing all the many sources of uncertainty which give rise to and shape our perceptions of threats and opportunities. It implies exploring and understanding the origins of project uncertainty before seeking to manage it, with no preconceptions [by project personnel] about what is desirable or undesirable […] Key concerns are understanding where and why uncertainty is important in a given project context, and where it is not." (Ward & Chapman, 2003) [*Underlining added for emphasis*]

Therefore, somebody needs to lead the determination of the pertinent boundaries, and orchestrate an adequate exploration, of the "*Project Context*"—this approach is a significant change in emphasis compared with other PRM methods that focus only on *likelihood and impact* of events or conditions. It would transpire from this analysis of responses that the "Project Manager" and any other relevant stakeholders in both internal and external environments ought to *actively* partake in PRM processes.

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

Conclusion

Context is important. It defines "*the set of circumstances or conditions*" that surrounds a particular event, situation, or piece of information, as well as a complex project. It also includes relevant details such as the time, place, environment, background information, and any other factors that help in understanding or *accurately* interpreting something (e.g., risk scenario of any complex project). The considerations and models elaborated thus far, in their totality, afford 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 where project personnel would waltz *unprepared* into a risk workshop and yet be expected to "*think up*" risks regarding projects they hardly know *a thing* about.

The 'AS/NZS 4360: Risk Management Standard' (2018)—which the author considers most apt for mitigating risks in Large Infrastructure Projects (Mabelo, 2023)—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 other subsequent Risk Management steps. By so doing, project personnel are shielded from identifying risk-items *out-of-context*, which often leads to identifying wrong and/or false risks—maiming or rendering impotent the entire PRM.

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, as well as the *validation* of 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.

> "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 by author for emphasis*]

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.

To establish a *holistic* Project Context and, *ipso facto*, to enhance the ensuing steps that PRM entails, many Systems Thinking principles and tools are herein recommended, 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 arises 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, the TAWOO Model and the HKMM Framework are also incorporated.

In so doing, not only would the "context" allow an exploration of *uncertainties* beyond the usual "events/condition" outlooks (to even 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 not only *enhance* Risk Identification, but also contribute to the *responsiveness* of the PRM process.

References

01 AS/NZS 4360 Standard — HB 436: 2004. Standards Australia/Standards New Zealand. (2004). Risk Management Guidelines: Companion to AS/NZS 4360:2004. Sydney, Australia: Standards Australia/Wellington, New Zealand: Standards New Zealand.

02 AS/NZS 4360 — Standards Australia/Standards New Zealand. (2018). AS/NZS 4360: Risk management. Sydney, Australia: Standards Australia.

03 Borza, J., 2011. FAST Diagrams: The Foundation for Creating Effective Function Models. In: Trizon Detroit 2011. [online] Available at: <https://www.aitriz.org/documents/TRIZCON/Proceedings/2011-06_FAST-Diagrams-The-Foundation-for-Creating-Effective-Function-Models.pdf> [Accessed: 30 May 2020].

04 Crouhy, M., Mark, R. and Galai, D., 2006. *The essentials of risk management*. New York, NY: McGraw-Hill.

05 INCOSE SEH — International Council on Systems Engineering (INCOSE). (2015). INCOSE systems engineering handbook: A guide for system life cycle processes and activities (4th ed.). Hoboken, NJ: Wiley.

06 ISO 15288 — ISO/IEC/IEEE international standard - systems and software engineering – system life cycle processes (2015) Institute of Electrical & Electronics Engineers (IEEE).

07 ISO 31000 — International Organization for Standardization (ISO). (2018). ISO 31000:2018 Risk management – Guidelines (3rd ed.). Geneva, Switzerland: ISO., 2018

08 Kasser, J. E. (2020). Systems Engineering - A Systemic and Systematic Methodology for Solving Complex Problems. CRC Press.

09 Kim, D., 1999. Introduction To Systems Thinking. Pegasus communications, Inc.

10 Lehar, A. (2005). Measuring systemic risk: A risk management approach. Journal of Banking and Finance, 29(10), 2577-2603. ISSN 0378-4266.

11 Mabelo, P. B., 2020b. Operational Readiness. 1st ed. London: Routledge.

12 Mabelo, P. B. (2023). Risk Management and Project Life Cycle; featured paper, PM World Journal, Vol. XII, Issue VI, June. https://pmworldlibrary.net/wp-content/uploads/2023/09/pmwj130-Jun2023-Mabelo-Risk-Management-and-Project-Lifecycle-2.pdf

13 Maqsood, T.; Finegan, A. D., Walker, D. H. T, 2003. A Soft Approach to Solving Hard Problems in Construction Project Management. In Second International Conference on Construction in the 21st Century. Hong Kong, 10-11 December 2003. Sustainability and Innovation Management and Technology. pp. 313-314.

14 PMI (2017). Practice standard for project risk management. Project Management Institute.

15 Scott, Z., 2012. 9 Laws of Effective Systems Engineering. White Paper. Vitech Corporation.

16 University of Adelaide. (2017). Risk Management for Projects: Setting the context and objectives, Dr John Sing [Video]. Retrieved from University of Adelaide YouTube channel: <https://youtu.be/bZdcA1KRPy4> [Accessed: 21 June 2023]

17 van Well-Stam, D., Lindenaar, F., van Kinderen, A., & van den Bunt, B. (2007). Project Risk Management. Kogan Page.

18 Ward, S., & Chapman, C. (2003). Transforming project risk management into project uncertainty management. International Journal of Project Management, 21(2003), 97-105

19 Xie, L., Han, T., & Skitmore, M. (2019). Governance of Relationship Risks in Megaprojects: A Social Network Analysis. Advances in Civil Engineering, 2019, 1426139.

20 Youker, R., & Brown, J., 2001 (revised). Defining the hierarchy of project objectives. In: IPMA Conference in Slovenia, 1998. [online] Available at: http://www.ipma-usa.org/articles/m_hierobjs.pdf [Accessed: 18 October 2019].

About the Author

Pascal Bohulu Mabelo

Johannesburg, South Africa

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

Pascal has published the book: "*Managing Engineering Processes in Large Infrastructure Projects*" (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 other publications and journal-articles, he assiduously promotes the application of Systems Thinking and/or Systems Engineering principles, concepts, and practices to unravel complexity in Large Infrastructure Projects (LIPs) in order to address their persistent risks of failure and their massive, even pernicious, cost and schedule overruns.

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