Risk Management Strategy in Projects Inspired by the Systems Engineering Model

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ABSTRACT

This paper aims to demonstrate the use and benefits of a holistic, systemic and consistent risk management model starting from the deployment of the highest level uncertainties which surround a project, subordinating such uncertainties to a hierarchy by impact on the business, integrated solutions and operational actions of the project (in that order).

INTRODUCTION

It is recurring the great number of pseudo-risks identified and analyzed on several projects. The inadequate selection of risks hampers the capture of "authentic risks" which can effectively cause considerable impact on the goals of a given project. A significant factor that contributes negatively in this direction is the use of risk management as "crutch" for an inefficient project management. The lack of knowledge of basic concepts and foundations regarding "preventive intelligence" begins at the very top of organizations. This gap is not limited to the subject "risk", being also connected to a established "communication model", which often disregard apparently obvious small details which, in practice, are not as obvious as they appear to be.

The strategic business decisions, their deployment and communication, have a very high importance, long before a project is set up. The greater the distance between the strategic business decisions and the project, the higher will be the probability of emerging fragmented and isolated information created empirically by managers and project teams. This stems from the need of assuming or defining guiding information (when they do not exist) to build a minimal necessary boundary condition framework for the decision making throughout the project.

Business vision, value proposition, assumptions and constraints not properly communicated create interference and distortions within the communication and information exchange throughout the project's organizational structure. Many project managers believe that some business decisions are project risks, starting thus a failed identification of "pseudo-risks" for the project. Failed because it is no longer possible to change a strategic decision already made.

The risk is in the uncertainty and the uncertainty is in the future. Therefore true risks are related to imagined or estimated events within circumstances and conditions outlined, which can encompass a trend of potential impact to the project. Thus from this train of thought we can say that business risks already analyzed, with a decision made, including definitions and actions agreed towards the project are actually "facts", and no longer uncertainties in the future. It is appropriate to say that such a decision can jeopardize a project goal. It should be emphasized that the definition of "risk" is something quite different from the definition of facts which jeopardize the project. Of course, strategic decision-making happen (or should happen) before the validation of pacts and work agreements on a project. It should be noticed that before a decision is made it is possible to mentally build a scenario where a potential uncertain future event, after being judged and analyzed, generates a referential informational base that serves as foundation for future (post-decision) definitions, schedules and actions. Therefore, a decision at the strategic level, for example, unfolds as a constraint for the tactical or operational level (figure 1).

Figure 1: Decision levels in a traditional hierarchical structure.

The impact analysis of each decision made at the superior level can be deployed through different lines of reasoning, naturally inherent to a process established by the organization, formal or informal. For example:

A. It can be a guiding response considering only the "known", in other words, the scope of the project to be developed, devoid of analysis regarding the uncertainties which can cause a potential impact on the project (complete lack of strategy, see figure 2);

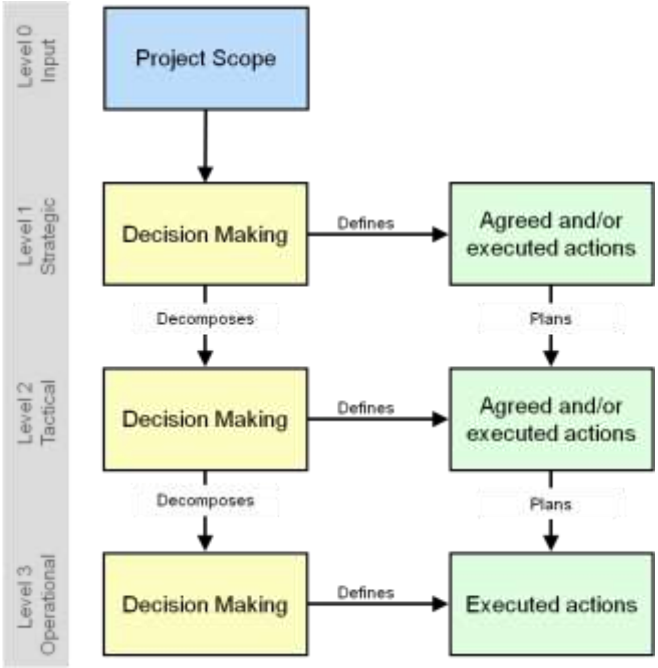

Figure 2: Decision's deployment without risk analysis.

B. It can be a risk response considering its consequences on its own level, without the analysis of its impacts on subsequent levels, potentially and involuntarily jeopardizing the project's next level (see figure 3).

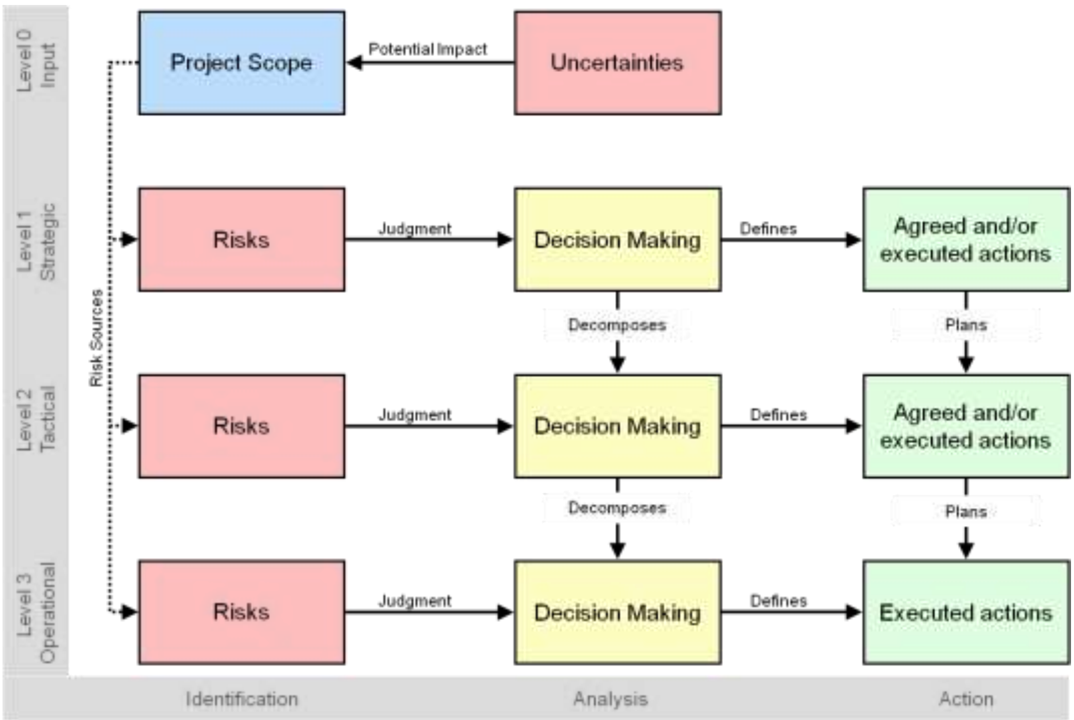

Figure 3: Decision's deployment with partial risk analysis.

C. It can be a planned risk response, which considers all the relevant consequences to its own level and to subsequent levels (framework that will be addressed in the "methodology" session).

The Systems Engineering Model applied to Decision Making

In 2014 a multidisciplinary team studied concepts, fundamentals and methods which could make easier the development of a process to identify and deploy the market needs into a functional architecture structured in levels (product, system, subsystems and components)to serve as the foundation to the establishment of requirements (also in levels) to further develop product solutions. In August 2014 there was a workshop led by Mr. Scott Jackson (System Engineering specialist) where he presented a requirements management process flow (figure 4) to the team. This process flow constituted the foundation to begin the studies, as it had shown a very simple logic yet robust. Such simplicity and robustness stimulated the study of the line of reasoning behind the process flow. This study was useful to discover that the same line of reasoning could be adapted to a flow of identification, analysis and response to risks by levels (strategic, tactic and operational) of a project organizational structure (figure 5).

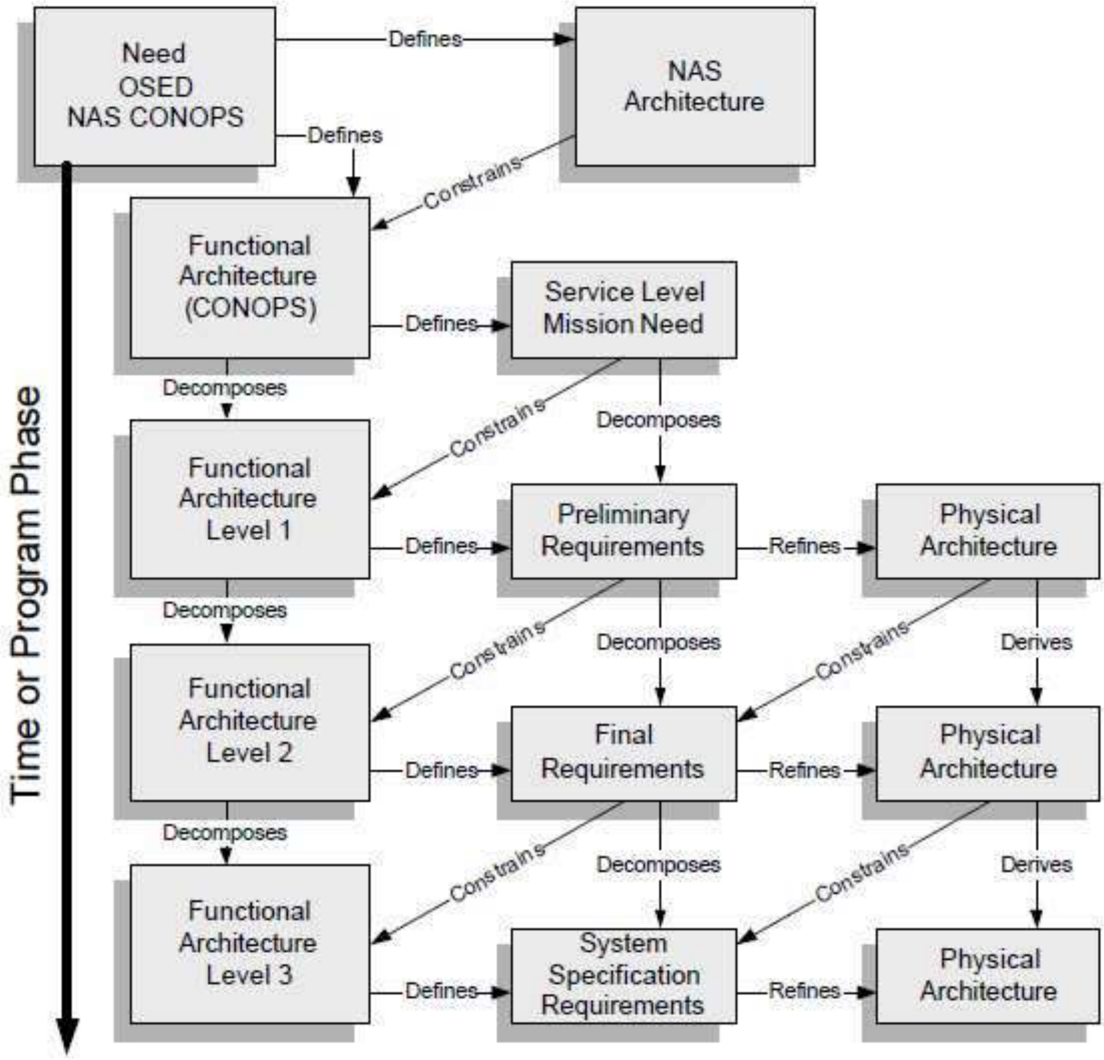

Figure 4: Requirements Management Process Flow (NAS, Systems Engineering MAnual).

Brief presentation of Systems Engineering philosophy

Systems Engineering is an interdisciplinary field of engineering whose focus is to better design and manage the development of complex engineering systems (including the system's lifecycle). Subjects such as requirements management (validation & verification), reliability, logistics, team coordination, maintainability and many other disciplines necessary to a proper development of systems and solutions, become tougher when it comes to big or complex projects. The systems engineering discipline deals with processes, optimization methods and tools for risk management in such projects. It integrates socio-technical disciplines such as product development engineering, industrial engineering, software engineering, organizational studies and project management. The systems engineering discipline ensures that every necessary aspect within a project or system are considered and integrated holistically.

Methodology

Inspired by the philosophy of systems engineering (SE), specifically by the requirements management process flow, a method (framework) was developed and named "Risk Strainer" (figure 5). The goal is to establish two types of analysis in its architecture. First to serve as a "filter" to segregate and define what is really a risk and what is not, through the following steps:

- Analyze which future uncertain event (A) matters, as it may bring potential impact on any of the project objectives (B).
- Identify to which risk source this particular risk is related (e.g. government, suppliers, market, technology, etc)

Second, to serve as a filter to identify the level in which the risk must be managed, through the following steps:

- Rate at which level the identified risk must be addressed: at the strategic level (1), tactical (4) or operational (7);
- Identify which process flow the risk analysis shall follow. Here are some examples:
    - Example 1: A risk can be identified at the strategic level (1), be analyzed at the strategic level (2) with actions performed only at the strategic level (3).
    - Example 2: A risk can be identified at the strategic level (1), be analyzed at the strategic level (2) with agreed actions at the tactical level (6) to actions taken at the operational level (9).
    - Example 3: A risk can be identified at the strategic level (1), be analyzed at the strategic level (2) with unfolding further decisions made at the tactical level (5) and operational level (8), with actions performed at the operational level (9).
    - Note: In some cases of risks that "flow" through the process of Example 3, it is possible that decisions made at the steps (2) and (5) generate secondary risks at the tactical level (4) and/or operational level (7), as it was said in the beginning of this article, a decision made at a higher level becomes a constraint to the lower level (figure 1).

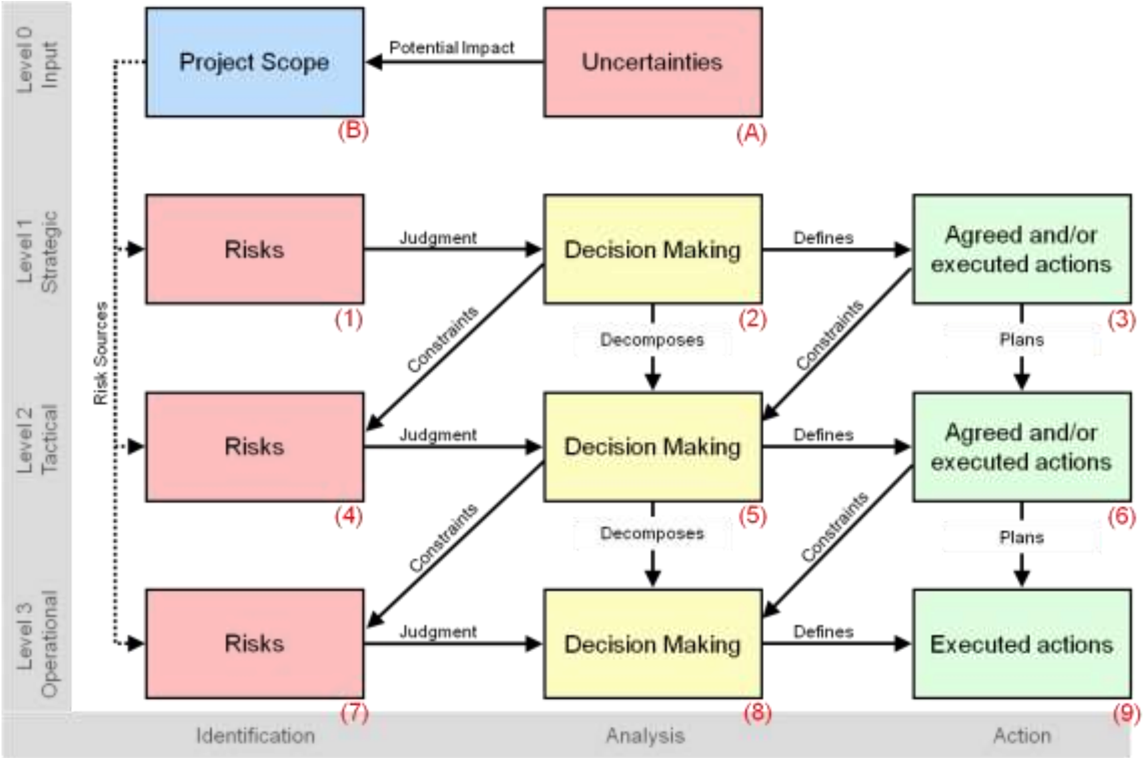

Figure 5: Process flow for dealing with risks in projects.

Applying the method in a product development project

To validate the method in a real project environment, two professionals were trained in concepts and fundamentals of risk management and instructed in the use of the method "risk strainer". Then a product development project and of great importance to the organization was chosen for application of the method. The following steps were followed:

1. Identification of risks already registered in the project database;
2. Collection of a statistical sample of risks already validated by the project management team (sample equivalent to approximately 25% of the bank)
3. Thorough evaluation performed by the two qualified evaluators, to qualify the "risk level" (strategic, tactical, operational) and identify its proper process flow.
4. The evaluation was structured in a panel using post-its (TM), where each "risk" was identified with an ID number, as shown in figure 6 (picture), and separated into six classes:
    - **Authentic risks:** Potential future uncertain events (figure 6, right side of "framework risk strainer")
    - **Condition inherent to the process:** Established condition or activity in a particular process, predicted in the process flow, regardless of its complexity;
    - **Process gaps:** Process steps of any given process already used and tested by the work teams (existence of experience in the process flow), where there are information from the past with identification of improvements or problems,

although these improvements or problems haven't yet been incorporate or corrected in the process, thus causing repetition of the same events in scheduled project activities;

- **Problems:** Present impediments, which hinder some activities or deliverables to be completed. Consequence of process gaps or risks that already occurred (where not identified in advance or their countermeasures weren't effective);
- **Procrastinated decisions:** Decision that was not made in time by any project authority, then causing an impediment to the project's task continuity.
- **Incomplete or ambiguous information:** The possible risk was not clearly defined and registered in the databank , thus making it impossible to complete the analysis.

Figure 6: Application of the method in a product development project.

Results

The initial proposal of the project analysis had as main goals:

- To validate the method "risk strainer"

- To qualify the evaluators (complementary action to the technical mentoring in the project management field);
- To confirm the evaluation and validation of risks already registered in the project databank (diagnosis);
- Identify to which level each risk belongs and which process flow it should follow.

All the goals above were achieved and demonstrated by the evaluators, therefore rising the following results (summary in figure 7):

- 70 (seventy) "risks" registered in the project databank were evaluated (equivalent to approximately 25% of the total databank);
- 11% of these "risks" were confirmed by the evaluators as authentic risks (8 risks);
- 28% of "risks" were identified by the evaluators as events or conditions inherent to the work process (19 items);
- 21% of "risks" were identified by the evaluators as process gaps (15 items);
- 23% of "risks" were identified by the evaluators as problems (16 items);
- 6% of "risks" were identified by the evaluators as procrastinated decisions (4 items);
- 4% of "risks" were identified by the evaluators as incomplete or ambiguous information (3 items);
- 7% of "risks" were identified by the evaluators as closed risks in the databank, therefore these items were not analyzed (5 items);

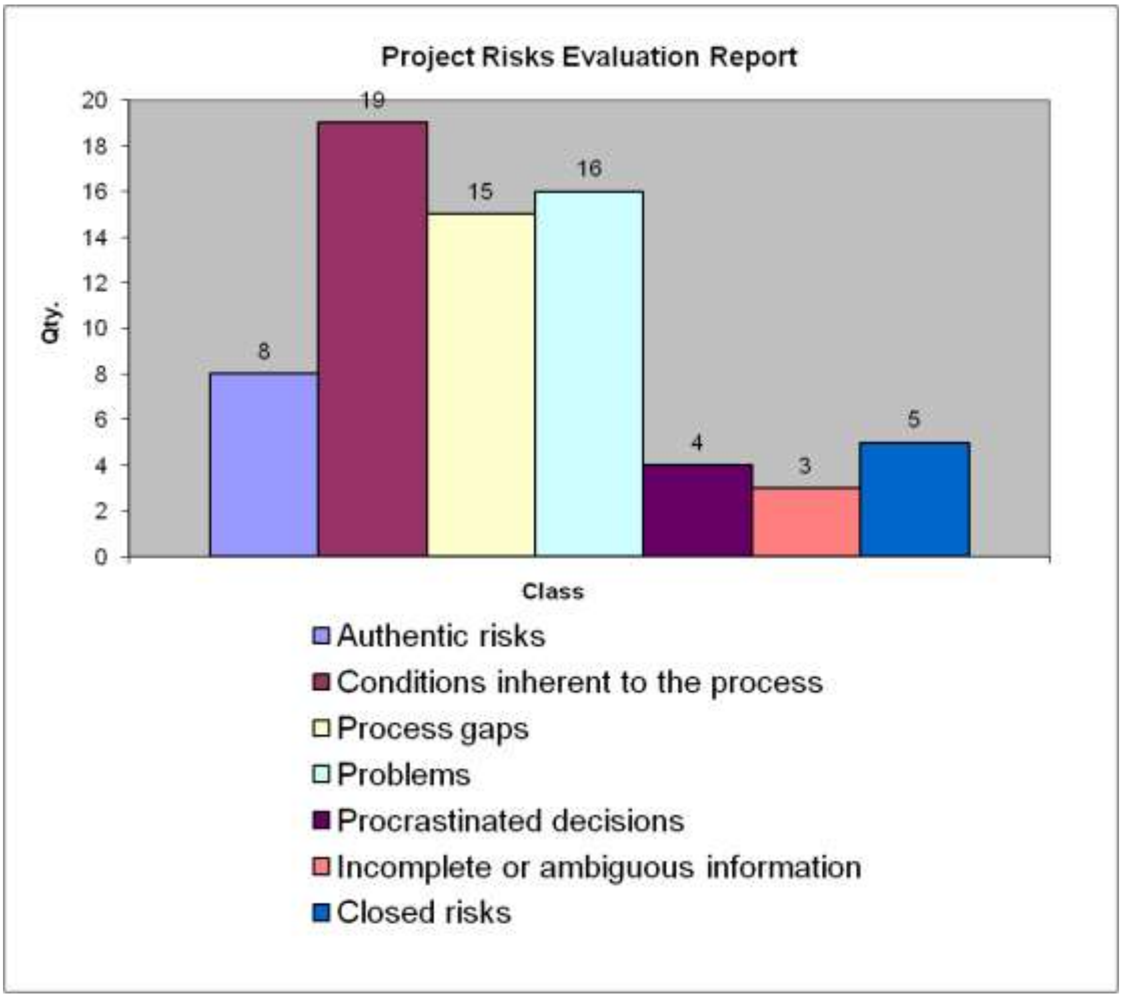

Figure 7: Results obtained from the analysis of the project risks databank.

Process flow analysis of validated risks

For each of the eight risks validated as "authentic", the evaluators identified to which level the risk should belong and which process flow the risk should potentially follow. Based on the sequence of numbers available in figure 5 (that define the "paths" for the risks to follow). The results of this analysis are listed below:

- Risk ID 1: (1) → (2) → (3) → (5) → (6) → (9)
- Risk ID 7: (1) → (2) → (3) → (6) → (9)
- Risk ID 23: (4) → (5) → (6) → (9)
- Risk ID 37: (4) → (5) → (6) → (9)
- Risk ID 38: (4) → (5) → (6) → (9)
- Risk ID 41: (4) → (5) → (6) → (9)
- Risk ID 60: (1) → (2) → (3) → (5) → (6) → (8) → (9)
- Risk ID 67: (4) → (5) → (8) → (9) or (4) → (5) → (6) → (9)

Comments and Conclusions

Upon completion of diagnosis a debriefing was conducted to foster a debate about the results, where the evaluators' testimonials were collected:

"Doing this analysis was very good to comprehend people's behavior and understanding regarding the theme 'risks' within projects and makes us ask if we have a proper environment to capture and manage other things which aren't risks, such as : "fears", worries, lack of decisions and problems within projects." - Sergio Cavalcante Rabelo.

"The excess of items erroneously registered as risks shows the weakness of the project's management processes at the project studied: Project members tend to register as risks the problems that will certainly elapse from existing process gaps, as they don't trust the schedules, the engagement agreements and the goals defined by blind decisions (in other words, goals defined without proper analysis and foundations). In this sense, this analysis greatly favors the development of critical thinking necessary for careful consideration of project issues, as well as its correct classification, be it a gap, a problem, a risk or mere apprehension." - Andre Luiz Zimmermann.

Besides the positive results achieved through the proposed method, it was possible to collect enough information to establish a mental reflection regarding people's maturity on risk management while working in project teams. The high volume of information registered as risks, but not recognized as authentic risks in the assessment shows that it is necessary to invest a considerable amount of time from the specialists in acculturation of teams about the risk theme. It is important to remember that the information labeled as "non-risk" are as important as those labeled as risks, but should be analyzed and managed in an adequate forum, since the way to handle these other types of information are quite distinct from the model for risk management.

"It is difficult to share knowledge if you don't have enough time to think about what you know and what you need to learn. Most companies have eliminated the reflection from its business processes. People just don't have enough time to think about what they are going to do or who should they talk about it." - John Old (former Director of Information Systems, Texaco).

Paper Review – Dr David Hillson, The Risk Doctor

"I enjoyed your paper and I like the model you have developed. It is important to recognise that risk exists at different levels, and to be sure that each risk is managed at the appropriate level. The level of the risk is defined by the level of objective that would be affected if the risk occurred. We also need to accept that risks can affect other levels above or below them. This is

why a systemic approach to risk management is so important. I am encouraged to see that you are promoting this type of multi-level connected risk management in your projects."

References

NAS SYSTEMS ENGINEERING MANUAL (Section 4.1, Version 3.1, page 4.3-5, 06/06/06).

About the Author

Wantuir Felippe da Silva, Jr.

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Wantuir Felippe da Silva Junior has 27 years of experience in the aeronautics industry, with 17 years in project management activities. He has knowledge and practical experience adhering to the concepts and fundamentals of PRINCE2, PMI, IPMA, Agile Methods and Deming Cycle. Mr. da Silva is currently a consultant, mentor, instructor and head of PMO in Integrated Product Development at Embraer (DIP). He is also founder of GPSimples (www.gpsimples.com), an entity whose focus is the qualification of people to the project environment.

Wantuir is creator of the methods:

- Risk Strainer (a framework that facilitates segregation between risks and issues).
- Lean Scope Overview (understanding, deploying and managing project scope),
- Lean Risk Overview Matrix (project risk identification and management),
- Lean Project Direction - LPD (Progress Management and Project Decisions),
- E2I2 - Extreme Experience In Innovation (development of creative engineering solutions in product and service design),
- Wandala (management of interests and deployment of project requirements),
- Blended 7S Model & TOC (strategic deployment for projects),
- Spock Analysis (judgment and decisions associated with deviations in projects)