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Project Proactive Risk Management:
An Effective, Robust 3-D Model for Project Risk Management

by
Paul H. Lohnes, MBA, PMP and Cheryl A. Wilson, PMP, PMI-RMP
MCLMG, LLC Research Branch

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EXECUTIVE SUMMARY

As the continued poor showing of the project management and business analysis discipline results in the stagnant and unimpressive current project success rates, MCLMG's Portfolio / Program / Project Management Research Division has designed, developed, and deployed a more effective and robust project risk management model that supersedes the current "industry practices" of the limited 2 dimensional risk model based on the unit-less assessment of project risk potentials. This current model evaluates project risk potentials in only two (2) dimensions of "severity" and "likelihood" assigning to each an integer value of 1 (low) to 5 (high) of each parameter where upon the risk assessment is made by simply multiplying these values to obtain a qualitative risk priority profile of a unit-less, non-rigorous plane of values ranging from 1 to 25 with the non-assignment of the values 7, 11, 13, 14, 17, 18, 19, 21, 22, 23, and 24 since these combinations are not valid products of two integer operands of 1 to 5.

In stark contrast, the MCLMG Proactive Risk Management (PRM) model describes each risk potential with a currency-denominated value from the product of:

- a probability of the risk potential's chance of occurrence called its Risk Probability of Occurrence (RPO) with a range of values from 0-1,
- an currency-denominated value of its potential cost if it were to be realized (triggered) called its Risk Cost of Impact (RCI) with a range of values from $0 to $infinite, and
- a weighted probability of the risk potential's triggers chance of existence called its Trigger Probability of Existence (TPE) with a range from 0-1.

This more accurate, and informative assignment of risk potential's true nature of equivalent value of impact to the project's production of "fit-for-use" deliverables is called the risk potential's Risk Equivalent Value (REV) that is both currency-denominated as well as developed via more rigorous quantitative analysis approach. A risk potential's REV no longer unit-less or qualitative in character can now be used to more precisely identify those risks that have the largest possible negative cost impact to a project's deliverable(s) production – the true goal of any project management activity.

This white paper describes the MCLMG's three-dimensional (3D) risk model and its benefits in the improvement of project decision making through the application of valuable information that can be directly valued through the rigorous utilization of "information and decision theory." The uses of the MCLMG 3D Risk Management model has been shown to significantly improve a project team's ability to correctly determine the risk potential's with the greatest potential negative damage to its production of "fit-for-use" deliverables.

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References and Resources

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3	MCLMG. The New Risk Standards. eBook. 2011.
4	D. Hubbard. The Failure of Risk Management. Wiley & Sons. 2009
5	D. Hubbard. How to Measure Anything. 2nd Edition. Wiley & Sons. 2010.

Paul Lohnes, PMP
phl@mclmg.com

Paul H. Lohnes has been active in project management for over 25 years beginning soon after he left the US Navy in 1981. After obtaining his BS (CS) and teaching as an adjunct at the UC Berkeley's Extension University for 6 years during which time he completed his MBA (Finance/Op Mgmt) at Golden Gate University, San Francisco, he formed his own project management firm which he merged with Ms. Wilson's CWPMG firm in 2010.

Mr. Lohnes holds the PMI's Professional Project Manager (PMP) certification as well as the MCTS for Project 2010. Mr. Lohnes assists their client base in the MD/VA/WDC area in the maturing of their project and risk management programs while identifying aspects needing attention and remediation.

Mr. Lohnes continues to develop quantitative risk management, auditing, and indexing tools that he uses in service of MCLMG's clients and customers.

Cheryl A. Wilson, PMP, RMP, CCEP
caw@mclmg.com

Cheryl A. Wilson has an impressive resume and work history both in and around the Washington, DC area. She is a USAF veteran and a graduate of the University of Maryland with a Bachelor of Arts. Ms. Wilson is also a holder of a Master's Degree in Management Information Systems from Strayer University.

Being one of the first women to obtain the Risk Management Professional certification from the Project Management Institute, Ms. Wilson is in high demand both as a enterprise risk management (ERM) consultant and risk analysis team leader. She has held several, high-profile portfolio management and business analyst positions at firms contracting with the US Government.

Ms. Wilson provides MCLMG's clients with proactive risk management program initialization and ERM startup services.

1. The Traditional 2D Project Risk Model

1.1. Current Bodies of Knowledge

With the release of the Project Management Institute's (PMI) Project Management Body of Knowledge (*PMBOK® Guide*) Fifth Edition on January 1, 2013 [1], the PMI unfortunately made a decision to continue the dissemination of the current two-dimensional (2D) model of project risk management. This model which has been unchanged since the PMI's PMBOK® Guide Third Edition released in January 2005 is based on the very simple, qualitative assessment of a risk potential's "impact" via the resulting product of two unit-less values called the severity and likelihood of the risk potential. The Association for Project Management (APM) in its Management of Risk: Guidance for Practitioners [2] as well as the International Standards Organization (ISO)'s 31000:2009 Risk Management Principles and Guidelines standard both concur with this 2D project risk model.

The severity vector is a proxy for the risk potential's impact to a project, but without any determination as to the direction or focus of this impact. It is simply an assessment by the risk potential's owner (risk owner) with approval of the project manager (PM) that this risk potential may have on a project. Most severity valuations are assigned using an ordinal scale of 1 (low) to 5 (high) of this characteristic of the risk's potential "impact" to the project. When asked how they (the risk owners) arrived at the assignment of the severity value, most respond with a blank stare or quiet assertion that they really do not utilize a rigorous evaluation process in the assignment's evaluation, but either using intuition or "gut feel" about how the risk if it materialized would impact their project.

In like fashion, the assignment of the likelihood vector value is also obtained outside the workings of a rigorous assessment of the risk potential's true probability or chance of becoming a reality. The assignment of a unit-less value of 1 (low) to 5 (high) is normally achieved via the same steps as the above severity vector value – intuition or "gut feel."

1.2. Limited risk potential assessments

The result of these non-rigorous assignments is determined by the mathematical product of the severity times the likelihood that achieves a subset of the ordinal range of 1 to 25 with only fourteen (14) of the total possible values being valid: 1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 15, 16, 20, and 25. The remaining 11 values of 7, 11, 13, 14, 17, 18, 19, 21, 22, 23, and 24 are not possible given the values of the operands (severity and likelihood) being 1 to 5 inclusive.

The current "best practices" of the project management industry is to then graph the values of the risk potentials in a 5 by 5 matrix of green, yellow, and red or green, yellow, orange, and red showing the relative unit-less values of the risk potential's multiplicative total assessment. The following figure is a representative of such a matrix used in many multimillion dollar projects as witnessed by the white paper's authors.

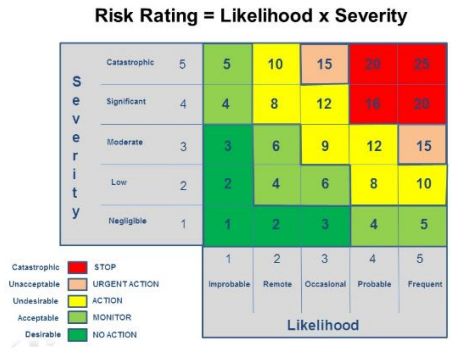

Figure 1: 2D Risk Assessment

The assessment that is currently the industry "best practices" suffers from two very dramatic limitations and weaknesses:

1. The assignment of unit-less values tends to support a non-rigorous almost "what looks good" attitude from the risk owners since in the current bodies of knowledge the use of quantitative analysis is down played since it "requires significant computer and mathematical knowledge."

2. The use of such non-rigorous values does not support informed allocation of limited risk mitigation resources since the values are not quantitatively defined, the application of funds for mitigation are normally withheld in abeyance of issue management, i.e., for the resolution of risk potentials that have actually materialized.

Thus, in our research and over 60 years of combined project management experience, we have seen the use of such qualitative assessments support the lackadaisical treatment that most PM deliver to their risk management programs.

1.3. Response versus Mitigation

The final shortcoming discussed in this white paper of the current 2D project risk model, and by no means the only shortcomings, is the continued and almost myopic acceptance of the attitude of risk response. While at first most PM and stakeholders do not grasp the idea behind this somewhat infantile misuse of the phrase with respect to risk potentials, once it has been explained many understand the confusion and mistreatment of project risk management the phrase portends.

All project risks as well as any other type of risk potential is entirely a future event that may or may not ever occur to impact a project's production of "fit-for-use" deliverables. This recommends to the reader that all risks therefore lie within the future temporal vector: a risk is a future event that has yet to materialize. We will speak towards its nature of uncertainty in the next section. Thus, a risk potential is something or some event that has not yet occurred, so the question is: how can one respond to an event that has not as present materialized?

The corrected conceptualization without going too in-depth is that one cannot. The corrected terminology is that one can only attempt to mitigate the impact of a future event by studying its possible outcomes and the costs associated with each of these possible outcomes. This leads one to understand that a project team can only "mitigate a risk potential," while it can indeed

"respond to an issue" since an issue is a risk potential that has materialized, but one cannot mitigate an event that has already occurred.

The attitudes portended by these incorrectly utilized phrases leads most project teams to treat risk potentials as simply possibilities, and only get engaged when a risk becomes a reality. This forms the current basis for the industry practice of reactive risk management whereby risks are given a precursory review, assigned a unit-less value, and placed in a risk register until they increase their urgency through triggering.

1.4. Limited Application and Information Value

Thus, one can surmise that the current project risk management model is woefully limited in its ability to identify, assess, and then management risk potentials confronting their projects. The use of unit-less ranking values does not provide the valuable information a PM or stakeholder would need in order to truly understand how the expenditure of real project funds in order to mitigate a risk potential's possible impact to the project's deliverables would be well spent. The decision most make is to discuss risks during their weekly project meeting time, populate them in the risk register, but retain risk program funds for the real problems that actually occur – the issues. Since risk potentials may not occur, why "waste funds or time" on their uncertain outcomes.

1.5. Source of Traditional 2D Model Assessment

The above treatment of the current modeling and management or project risk potentials is provided from empirical measurements of direct observations and experiences of this white paper's authors, it has also been the reason that MCLMG researched, designed, and developed a more "information valuable" three-dimensional (3D) project risk model for use by our firm's clientele and customers. The authors have seen many projects that either ignore risk potentials as unimportant, or simply provide it lip service in order to "obtain the necessary check-off" signature demanded by the Project Management Office (PMO) procedures.

2. The MCLMG 3D Project Risk Framework

2.1. 3D Model Concepts

The MCLMG 3D Risk Model™ for the PPPM environment is based on several implemented and beneficial concepts:

1. Project risk management is about the reduction of uncertainty,
2. Project risk management must be proactive in its application,
3. Project risk potentials must be tied to project deliverables, and
4. Project risk potentials must be quantitatively assessed.

2.2. Derivation of the 3D Risk Model

The MCLMG 3D derives its name, purpose, and value from its more complete and accurate analysis of the three vectors of project risk (probability, impact, and triggers), not the traditional two vectors (likelihood and severity). Project risk management has matured over the past two decades coming more in alignment with the prodigious amount of research, principles, and application of risk analysis and assessment that has been amassed in financial and investments industries over the past five decades. Risk management is a core component of any future

decision making process where the expenditure of organizational funds are being considered. Project risk management requires the same treatment.

The MCLMG 3D risk model extends the traditional project risk model through two very important and significant enhancements and extensions:

1. The traditional vectors of likelihood and severity are replaced with rigorously defined vectors of Risk Probability of Occurrence (RPO), and Risk Cost of Impact (RCI), and

2. The addition of a third risk potential vector called the Trigger Potential of Existence (TPE) that characterizes a risk potential's dependencies on its associated triggers for its conversion into an issue.

Figure 2 illustrates the additional third vector of the MCLMG 3D Risk Model showing the more complete and accurate depiction of a risk potential's budget impact.

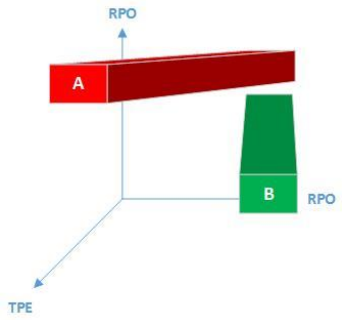

Figure 2 REV for Trigger Management Risk

Graphic A illustrates the REV value of a risk potential showing the traditional placement of a high severity / high likelihood risk potential extended into the 3rd dimension along with a very high corresponding TPE value. After trigger management and/or modification, Figure 2 shows Graphic B with a much reduced plane of impact as the TPE has been significantly reduced, but the RPO and RCI remain relatively significant. This shows that controlling and managing the triggers can and does have an important role to play in intelligently reducing the negative budget a risk potential could impart to a project's deliverables.

These extensions are at the heart of MCLMG's overhauled project risk management framework that implement the above four (4) beneficial concepts, and the remainder of this white paper discusses and illustrates their creation and benefits in producing a more valuable and effective project risk management program for any project manager or sponsor.

2.3. The 3D Model's Vectors: RPO, RCI, and TPE

2.3.1. Vector #1: Risk Probability of Occurrence (RPO)

The first risk vector of the MCLMG's 3D risk model is an enhanced and more accurate depiction of a potential's chance for becoming an issue with a negative impact to the project's deliverables. Without getting side tracked, the new terminology and concepts that support the 3D risk management model can be found at the MCLMG's website where the reader can download the "New Risk Standards" eBook [3]. This foundational artifact sets the stage for updated project risk

management terms, relationships, and concepts that will aid in the understanding of the 3D risk management principles.

The RPO is a mathematical distillation of the chance that a risk potential will materialize during the lifecycle of a project thereby providing a negative impact or imposition to the production of a project deliverable. As stated in the above eBook, the term risk is considered to be an uncertain future event with a negative impact whereas an opportunity is an uncertain future event with positive outcomes towards a project's deliverables.

The RPO is usually calculated through a statistical method such as 3 point estimation, probability density analysis, or even a Monte Carlo simulation. The point is that given the distribution and availability of computing resources, this more rigorous and quantitative treatment of the risk potential's probability of occurring is not out of reach of most if not all project teams. If you are using a software package to create and analyze your schedule, you have the tools capable of accomplishing even a moderate amount of quantitative analysis for your risk potentials.

2.3.2. Vector #2: The Risk Cost of Impact (RCI)

The second risk vector of the MCLMG's 3D risk model is a currency-denominated estimate or predictor of the risk potential's financial cost to the project. It is most important that this estimator be determined in the currency of the project's budget in order to support the decision making parameters of the PM which is usually oriented along the impact to the project's cost baseline or approved budget. In order for risk potentials to be comparable to risk potentials in other project or programs, the RCI, denominated in the project currency, when combined with the other two risk vectors produces an REV in currency value that more accurately describes the equivalent impact in budgetary terms. In other words, the product of the three vector parameters -- two being probabilities, and one being a currency denominated value -- produces an equivalent currency value that can be both prioritized, compared, and ranked amongst other risk potentials on the same or other projects. This last part is made under the assumption that the same evaluation process is used with a single organization. If the assessment process is different, a mapping function would be needed to standardize the risk potentials' REV between such organizations. Please contact MCLMG on additional research and procedure for accomplishing this comparative analysis.

2.3.3. Vector #3: The Trigger Potential of Existence (TPE)

This third vector is the most novel and promising of the MCLMG's 3D Risk Model in terms of both value to a project by improving the team's decision making success as well as the ability to apply scarce risk mitigation funds and resources to those risk potentials that not only rank the highest in terms of REV, but also that show the best possibility for mitigation return on investment (ROI). However, it is important to understand what trigger management is about and how it takes the project risk management environment into a new era of usefulness and value to the forward-thinking PM or project sponsor.

The entire concept of trigger management is beyond this summary white paper; however, MCLMG has produced a detailed research and application eBook on the topic. Please contact the authors' for details and availability of this important innovation to project risk management.

Basically, a trigger to a risk potential is analogous to a detonator to an explosive device. Regardless of the size or potential impact of the explosive device, or the probability that it will indeed go off, an explosive device can be rendered harmless through the application of trigger or detonator management. If this is unclear, watch any US crime drama or law enforcement television show or movie, and sooner or later, the "bomb squad" or other so designated person is brought in to defuse the device. This defusing of the explosive device is almost exactly the same concept of project risk potential trigger management.

First, project risk is tied to project deliverables in the following logic chain: no deliverables, no project; no project, no risk; no risk, no uncertainty; no uncertainty, no decisions to be made. Therefore, project risk is all about the inability of a project team to produce "fit-for-use" deliverables. While is cuts across the grain of the traditional project risk model, the logic is inescapable, and bares the soul of the true value of project risk management:

> the improvement of project success rates by improving the decision making ability of the project team by discovering and managing valuable information that reduces the uncertainty surrounding these decisions that matter.

While we at MCLMG do expect the current purveyors of project risk management bodies of knowledge to accept this definition without a struggle, the logic of the definition is axiomatic under the concepts of information and decision theory. Hubbard [4,5]. However, since the negative of the above definition cannot be true, it leads to the acceptance that the goal of project risk management must be the improvement of decision making skills in an environment of uncertainty about multiple future outcomes: the quintessential definition of project management.

Secondly, triggers are not risks but events associated with risks. Triggers in and of themselves do not cause deliverables to be late, costlier, of unacceptable quality, or not with the project scope. Only risks can accomplish these; however, triggers are the future events that cause the realization of the risk to become an issue or a materialized risk potential. Thus, triggers can be identified, isolated, remediated, and managed which illustrates their causal relationships to the actual risk potential in question.

The example of the explosive device, its detonators, its timing circuits, its power source, and its containment environment are all triggers, but not risks. All these components must be in existence and close proximity in the right portion or recipe for the device to impact its surroundings. The analogy with a project is very similar. The primary risk potential for all projects are NOT the seemingly endless list of events that populate most project risk registers, but simply the inability of the project team to produce the "fit-for-use" deliverables as defined by the project sponsor, customer, or client and for which the project team accepted responsibility.

Thus, and in the final position, the value of the TPE vector of a risk potential's REV is a probability weighted average of all the significant triggers that are associated with that risk potential. This calculated value when factored along with the RPO and RCI produces a REV that more accurately describes the risk potential's true impact on the project's deliverables.

3. Calculating the 3D Model's REV

3.1. The 3D Risk Model Formula

The primary formula for the MCLMG's 3D Risk Model is straight forward and explanatory of the three vectors comprising the true characteristics of a risk potential's behavior and ultimate possible negative impact to the project's deliverables. The formula defines the currency-denominated probability-adjusted impact value of a risk potential's cost to a project if the potential were to materialize:

$$REV = RPO * RCI * TPE \quad [1]$$

Where

REV is the risk equivalent value: currency-denominated
RPO is the risk probability of occurrence: range 0 – 1
RCI is the risk cost of impact: currency-denominated negative budget
TPE is the trigger potential of existence: range 0 – 1, a probability weighted average of all triggers, and their associated 'weights of importance'

Equation 1 is the mathematical description of the risk potential's equivalent negative budget impact to the project in project currency units.

The complete mathematical treatment of each factor is covered in detail in the follow-up research paper which is available to interested parties by contacting the authors' of this paper.

While the RPO and RCI are enhanced versions of the unit-less 'likelihood' and 'severity' descriptors of the traditional 2D risk model currently in favor with the PMI, APM, and ISO organizations, their treatment and development are both straight forward and easily facilitated given the state of desktop computing and software tools. Any desktop computer equipped with an Excel 2010 or similar product is more than enough computing resources for adequate and accurate treatment of all the vectors of the MCLMG 3D Risk Model.

3.2. Special Note for Developing the TPE

While the complete development and treatment of the trigger potential of existence (TPE) is described in the follow-on research paper from MCLMG, the basic formula is listed and described in this paper for completeness and to set preeminence of concept by MCLMG:

$$TPE = \sum_{i=1}^{n} w_i \, P(a_i) \quad [2]$$

Where

TPE is the trigger potential of existence: range 0 – 1,
i is the trigger of interest,
n is the maximum number of triggers considered significant for this risk potential,
w_i is the 'weight of importance' describing the trigger of interest significance to the risk,
$P(a_i)$ is the probability of occurrence for the trigger of interest for current conditions.

For each trigger (i), there exists both a probability of its occurrence ($P(a_i)$) and a corresponding weight of importance (w_i) that describes the behavior of a particular trigger under the conditions for which the TPE has been authorized for development. Since the conditions for which the TPE is

calculated can and do change given alterations in time, locale, project type, industry, project constraints, etc., this third vector of the model now provides the missing dynamic characteristic missing from the traditional 2D model.

A final formula for sake of completeness is that of the calculation of the w_i weight parameter:

$$\sum_{i=1}^{n} w_i = 1.0 \qquad [3]$$

Where

i is the trigger of interest, and
w_i is the 'weight of importance' describing the trigger of interest significance to the risk

Equation [3] is simply the description that all the weights of importance for the triggers of interest should sum to unity in order to provide a normalization range for w_i.

An example would be if the risk potential to a data center relocation project in the State of Oklahoma in the USA is not having the organizational data stores available by project completion date to support normal business operations, a trigger might be the incidence of a tornado which is mapped to the time component of the project's constraint profile. During the tornado season in 'tornado alley' (upper State of Texas, Oklahoma, Arkansas, Iowa, Kansas, and portions of other Midwestern US states) of late spring to early summer, the weight of importance (w_i) for the trigger would be high, maybe 0.05 to 0.1 while during the winter months, the (w_i) might drop to a mere 0.0001 to 0.0005.

The value from these calculations is both in providing a more accurate depiction of the risk potential's budget negativity to the project, but also as a decision making support aspect that would seem to indicate a better time for the data center relocation would be during the winter months of the off-tornado season. Risk management with the more robust 3D risk model lends itself to both improved cost information as well as more valuable (uncertainty reduction) information acquisition in support of improved decision making.

4. Benefits and Applications of the 3D Model

4.1. Benefits of the MCLMG 3D Risk Model

The utilization of a more robust and mathematically rigorous risk model has many benefits beyond the obvious improved acquisition of value information that can support improved decision making by the project team. It is axiomatic in nature that over time, the project team that acquires more valuable information on decisions that matter are going to improve their potential for higher project success rates as the primary foundation for improving project success rates is the ability and capability of making better decisions about project activities and resources. The proof is that reversing the hypothesis that improving project success rates is through making less adequate or poorer decisions is simply axiomatic silliness.

Benefits of the 3D risk model that can accrue to a project team are:

1. Lower costs for risk mitigation,
2. Lower project failure rates due to issue impacts,

3. Improved tracking of risk management budgets and expenditures,
4. Improved acquisition of valuable information through trigger research,
5. More accurate description of a risk potential's true project impact.

These benefits support the demand for a more robust and effective risk management model which the decades-old and mathematically limited traditional 2D risk model provides. The MCLMG 3D Risk model with its additional treatment of risk triggers and improved mathematically depictions of the three risk vectors provides the valuable information that can result in the significant reduction of uncertainty than is provided by the current industry risk model.

4.2. Application of the MCLMG 3D Risk Model

The applications for the 3D risk model include many beside the described deployments in the PPPM environment; however, the main application of the model is the support of an improved and expanded risk management program that needs to take its place as a core foundational component of a success project. The current process-oriented project management bodies of knowledge focus on the processes that a PM needs to understand and utilize, but little on how to improve their decision making which MCLMG believes is at the heart of improving project success rates. The MCLMG 3D Risk Model in stark comparison to the traditional 2D model provides not only a more accurate description of a project's risk environment, but through the research and identification of risk potentials and their associated triggers, acquires more valuable information that can be applied to all project decisions from the scope to defined quality definitions of the project's "fit-for-use" deliverables.

A project risk management program utilizing the MCLMG 3D Risk Model can and has improved the overall decision making abilities as it acquires valuable information that reduces uncertainty surrounding project decisions that matter. This form of risk management is more akin to the robust and effective risk management programs already deployed in many financial, banking, insurance, and construction projects based on the copious amount of research and experience these industries have implemented these types of concepts.