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# Applying Choosing-By-Advantage for Selecting Scheduling Technique in Elevated Urban Highway Projects

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## ABSTRACT

The construction or rehabilitation of elevated highway projects presents a spectrum of challenges to project practitioners. These challenges place a demand on the multi-criteria decision making (MCDM) abilities of the project management team. Moreover, micro-scheduling of construction activities has been deemed important to the reduction of waste based on the lean paradigm due to the changing dynamics of the construction site. Choosing the project scheduling method that will facilitate value creation for the stakeholders becomes an MCDM problem and entails having a clear understanding of the advantages and disadvantages of the different scheduling methods under consideration. Choosing by Advantage (CBA) is an emerging lean construction MCDM method that has been successfully applied to the Architecture, Engineering and Construction (AEC) industry but with little application in infrastructure projects such as the construction of elevated urban highway projects. Decision makers using the CBA list the attributes and advantages of each alternative and then assign a degree of importance to each advantage relative to the one that is least preferred. The CBA helps to differentiate alternatives based on the decision context and reduces time to reach consensus. Furthermore, it manages better subjective trade-offs by basing decisions on the importance of agreed advantages. This study contributes to the body of knowledge by applying the CBA in the selection of the micro-scheduling method in elevated urban highway projects.

**Keywords:** Lean construction, Choosing-by-Advantage, Multi-criteria decision making, project schedule

## **INTRODUCTION**

The need for new and reconstructed highways is an important consideration for many nations of the world as transportation developments shift from the construction of new highways to the demolition and reconstruction of existing facilities. A large number of reconstruction and rehabilitation work is expected on existing highways either due to existing highway infrastructure nearing or having already surpassed their service life (Jeannotte and Chandra 2005; Mahoney 2007) or due to the effect of urbanization placing additional demands on existing highways. Current practice in the construction industry suggests that there is typically budget overrun and schedule slippage during the construction of elevated urban highway projects (Dawood and Shah 2007; Hannon 2007). Addressing the challenge of ageing highways can be a difficult and sometimes contentious issue as there are many options and impacts to consider. To counter these challenges, a considerable amount of time is required to ensure that the level of development (LOD) of the plan can accommodate the micro-scheduling of short duration activities. However, selecting the project scheduling method becomes a multi-criteria decision-making problem because of the different project scheduling alternatives available to the project management team.

## **LITERATURE REVIEW**

Decision-making methods influence how people make decision. These decisions trigger actions, which in turn have outcomes and consequences (Suhr 1999). During the construction of elevated urban highway projects, the decision of the project scheduling method to adopt is an MCDM problem and an important consideration in the delivery of the project. The problem, however, is that the literature does not provide much (if any) support to practitioners in this context. According to Arroyo (2014), in practice, decisions such as the planning and scheduling method to adopt are made without a formal method. She further contended that many practitioners responsible for decision-making are not even aware of the available MCDM methods.

Different MCDM methods are available in the literature and have been successfully applied in different fields. A literature review by Arroyo et al. (2014) revealed that most applications of MCDM within the construction industry are based on Weighting Rating Calculating (WRC) and the Analytical Hierarchical Process (AHP) (Aguado et al. 2011; Akadiri et al. 2013; Bakhoun and Brown 2011). The application of CBA has mainly been in the domain of research on lean construction (Arroyo et al. 2012, 2013; Nguyen et al. 2009; Parrish and Tommelein 2009).

CBA is a decision-making system that facilitates decision-making by comparing the advantages of alternatives (Arroyo et al. 2013). According to (Arroyo et al. 2015), the CBA system has four principles: (1) decision makers must learn and skillfully apply sound decision-making methods; (2) decisions must be based on the importance of the advantages; (3) decisions must be based on relevant facts; (4) different types of decisions call for different decision making methods. This method has several benefits over traditional MCDM methods: CBA helps to differentiate between alternatives based on the decision context, reduces time to reach consensus, and manages better subjective trade-offs by basing decisions on the importance of agreed advantages (Arroyo et al.

2018). Arroyo (2014) claimed that the decision-making process of CBA is more transparent than the AHP that utilises pairwise comparisons between factors to find the best alternative. CBA has been applied to choose the best design options for a reinforced-concrete beam column joint (Parrish and Tommelein 2009), a ceiling tile in the design stage from a sustainable perspective (Arroyo et al. 2013), a structural system (Arroyo et al. 2014), a project team (Schottle et al. 2015), an HVAC system for a net-zero energy museum (Arroyo et al. 2016), select fall protection measures (Karakhan et al. 2016). Moreover, CBA was combined with a 4D model to select the best construction flow option in a residential building (Murguia and Brioso 2017). Table 1 presents a glossary of terms relevant to the CBA method (Suhr 1999).

**Table 1: CBA definitions**

Term	Definition
Alternatives	Options to be considered by the method. At least two alternatives are required for a decision to be necessary.
Factor	A property of an alternative that is material to the decision. Factors can be social or environmental but do not include the cost
Criterion	“Want” criterion defines a certain value or set of values that are preferred for a factor. “Must have” criterion specifies values that a factor must have for that alternative to be considered feasible.
Attribute	Quality or characteristics belonging to one alternative.
Advantage	Difference between two alternatives when their attributes are compared

In implementing the CBA method, the following steps adapted from Arroyo (Arroyo et al. 2015) are followed.

1. Identify the alternatives for consideration in the decision process.
2. Define the factors that will help differentiate among alternatives.
3. Define the *must* and *want* criteria for each factor.
4. Summarize the attributes of each alternative.
5. Decide the advantages of each alternative.
6. Decide the importance of each advantage (IofA). The IoA corresponds to a value that is given for each factor for each alternative. The sum of the IofA for all factors represents the total importance of that alternative to the decision maker.
7. Evaluate cost data (if applicable).

In CBA, decisions are based solely on the advantages. The stakeholders access the importance of these advantages by making comparisons among them. The weighing process should be based specifically on the importance of these advantages (Suhr 1999).

### **CBA ANALYSIS: SELECTING PROJECT SCHEDULING METHOD**

Nine project managers involved in highway construction were chosen for the analysis and the steps for conducting the CBA were applied. Three different planning alternatives were identified in the literature. The Last Planner System (LPS), Critical Path



Method (CPM) and Linear Scheduling Method (LSM) were selected. Seven factors were jointly identified in an interactive session with the project managers that will serve as the basis for differentiating the alternatives. The “must” criterion for each factor on which the stakeholders will base their judgement alternatives was defined.

The attributes of each alternative were obtained from existing literature and validated by the project managers. The least desirable attribute for each identified factor is underlined and used as a comparison to describe the advantage of the alternative based on that factor. The advantage of each alternative was then decided by each respondent by assigning weights to the advantages based on the factors and criteria. The weights for each factor and criteria ranged from 0 to 100. The first author complied and obtained the average weight from the different weights provided by the respondents. The average weight so obtained was thereafter used as the relative weight for each advantage. The importance of each alternative (IofA) was then decided based on the relative weight earlier obtained. The IofA corresponds to the value given to the advantage of each alternative based on each factor by each respondent. The respondents collaboratively agreed on the IofA after some deliberations.

## STEP BY STEP CBA APPLICATION

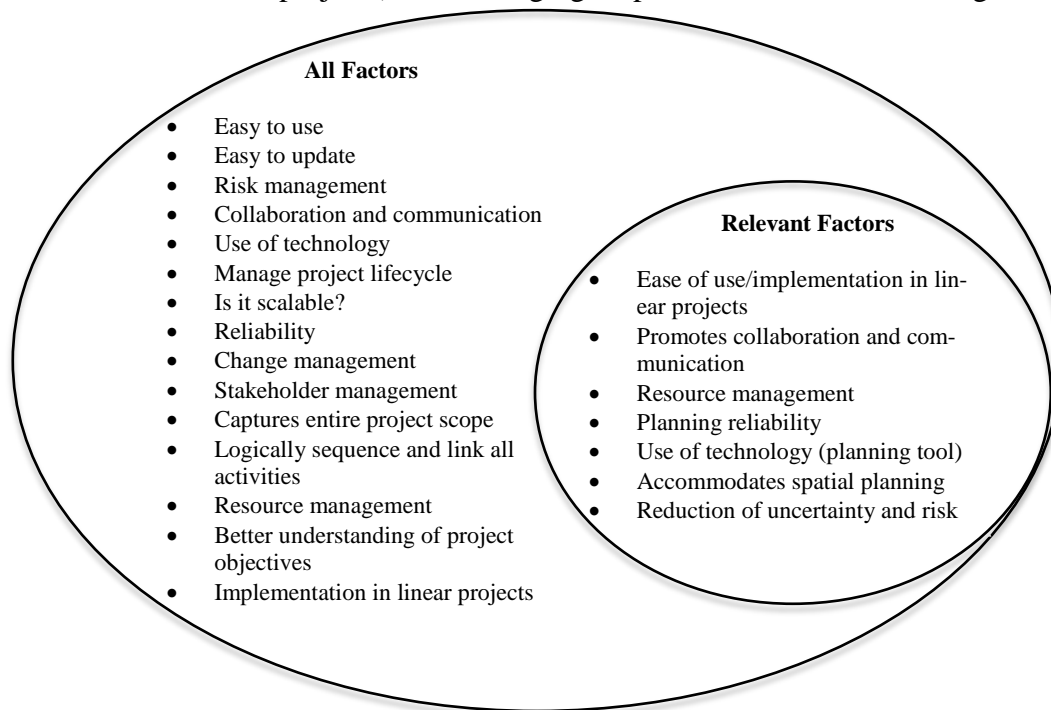
*Step 1: Identify Alternatives.* Three scheduling techniques were selected based on their suitability to linear projects. The alternatives considered are compared based on certain criteria and presented in Table 2.

**Table 2: Project scheduling alternatives**

Nos.	Factors	Alternatives		
		Last planner system	Critical path method	Linear scheduling method
1.	Reduction of uncertainty and risk	Identifies and assigns responsibility for constraints removal, facilitates reduction of risks and uncertainties.	Does not focus on identification of constraints and their removal. Makes up for this by incorporating float and slack (or modified PERT) in the schedule to account for production and duration uncertainties.	Does not tackle detailed task-level planning or identification of constraints which could have an impact on risks and uncertainties.
2.	A better understanding of project objectives	Breaking production into smaller and manageable flows ensure that project objectives are fully understood by stakeholders.	CPM networks become complicated as the size and complexity of a project increases.	Easy to use and facilitates an understanding of project objectives due to the relationship of time and space inherent in the process.
3.	Ease of use/implementation in linear projects	Easy to use. However, the absence of computer tools makes it cumbersome to apply to large work packages.	Extensive computerization has made the CPM easy to use. However, the user needs a considerable amount to produce valuable information for controlling purposes.	Very intuitive and easy to use and understand. However, limited computerization tools make it difficult to use in a large and complex project.
4.	Resource management	Address resource availability during the	Addressing key resource availability is a shortfall of this method. It focuses	Does not explicitly consider resource management. Resource levelling

		“Making-ready” process by matching workflow to capacity	on calculating the theoretical early start and finish dates, late start and finish dates for all scheduled activities.	is difficult as it lacks resource levelling capabilities.
5.	Collaboration and communication	A collaborative planning process that facilitates communication in the form of consultations at all stages of the project	Reduced collaboration and communication between stakeholders.	Provides a graphical display of how crews and equipment move through the project over time and therefore facilitates communication and collaboration.
6.	Space planning	The process of “making ready” focuses on the identification and removal of constraints and helps ensure that space-time relationships are considered but does not visualize them.	Does not consider time-space relationships during the planning process	Easy to visualize project schedule to account for time and space constraints. Facilitates space planning.

*Step 2: Define Factors.* Factors that will help the stakeholders differentiate between alternatives were identified. Several factors were considered, and the relevant factors were chosen for the decision-making process (Figure 1). Factors having the same purpose were combined due to their close relationship (e.g. easy to use and implementation in linear projects). Such merging helps to avoid double counting.



**Figure 1: Identified factors for decision making**

*Step 3: Define the “must” and “want” criteria for each factor.* The project managers agreed on the criteria upon which to base their decision making, and then weights were assigned collaboratively. In some cases, the stakeholders did not arrive at a consensus weight for some of the criteria, in this case, the arithmetic mean was obtained, and this was collectively accepted. For example, factor 1 considered the “ease of use/implementation in linear projects”. The stakeholders agreed that the criterion for this factor is “Easier is better” and collectively agreed to ascribe a weight of 50 to this criterion. Column 1 of Table 3 shows the relevant factors used for the CBA analysis, the “must criterion” for each factor and the weight of the criterion.

*Step 4: Summarise the attributes of each criterion.* The main attribute of each alternative with respect to each factor is summarised. The least preferred attributes are summarised and underlined to highlight them. This provides the basis for comparison between alternatives in describing the advantages of one alternative over another.

*Step 5: Decide the advantages of each alternative.* The main advantage of each alternative based on a given factor and attribute is determined and shown in italic. For each factor, the least preferred alternative will not have an advantage.

*Step 6: Decide the importance of each advantage.* This is done collaboratively and decisions on what weight to ascribe to each advantage are agreed upon. The maximum advantage that can be ascribed to each advantage depends on the weight given to the factor, the values range from 20 to 100. The most important advantage for each factor is agreed upon by all stakeholders as a first step to assigning it the maximum agreed weight. Thereafter, depending on the number of alternatives, the stakeholders next agree on the weight to assign to the second “best” alternative. For instance, in factor 2: “promotes collaboration and communication”, the stakeholders could not reach a consensus on the weight to assign to the second-best alternative. The first author who facilitated the CBA session resolved this impasse by taking the arithmetic mean of the different weights proposed by the different participants and this was adopted as the consensus value for the second-best alternative. The importance of advantage (IofA) for each alternative is summed up at the end of the session and the alternative with the highest IofA value is selected as the most preferred.

*Step 7: Evaluate cost data if applicable.* This step was ignored as there is no cost data associated with the choice of alternatives. However, if cost data exists, it is evaluated by plotting the IofA score for each alternative against the cost of selecting an alternative.

The summary of the CBA analysis is presented in Table 3.

**Table 3: CBA Implementation**

Factor & Criterion	Last Planner System		Critical Path Method		Linear Scheduling	
1. Ease of use/ implementation in linear projects <b>Crit.:</b> Easier is better <b>Max. Weight:</b> 50	<b>Attr.:</b> Easy to use and based on operational planning		<b>Attr.:</b> <u>Convolved in complex projects, and ineffective for linear continuous projects</u>		<b>Attr.:</b> Used in linear projects where the majority of the work is made up of highly repetitive activities	
	<b>Adv.:</b> understand the presence of variability in production, human-focused	<b>IofA</b> 35	<b>Adv.:</b> None	<b>IofA</b> 0	<b>Adv.:</b> <i>Performs optimally when applied to linear projects</i>	<b>IofA</b> (50)
2. Promotes collaboration and communication during the project execution phase <b>Crit.:</b> Higher is better <b>Max. Weight:</b> 100	<b>Attr.:</b> Planning is done mainly at the project level and is therefore flexible		<b>Attr.:</b> <u>Planning is rigid, and process focused and carried out on a strategic level</u>		<b>Attr.:</b> Planning is carried out on a strategic level and best implemented as an effective management tool at field level	
	<b>Adv.:</b> <i>More collaboration and communication during the execution stage</i>	<b>IofA</b> (100)	<b>Adv.:</b> None	<b>IofA</b> 0	<b>Adv.:</b> Collaboration and communication during the execution stage	<b>IofA</b> 60
3. Resource management <b>Crit.:</b> Higher is better <b>Max. Weight:</b> 50	<b>Attr.:</b> The process of “making ready” and constraint removal are tools in resource management		<b>Attr.:</b> Integrated with Network planning tools		<b>Attr.:</b> <u>Does not explicitly consider resource management.</u>	
	<b>Adv.:</b> Enhanced collaboration and communication promotes resource management	<b>IofA</b> 20	<b>Adv.:</b> <i>Facilitates resource allocation, levelling and smoothing</i>	<b>IofA</b> (50)	<b>Adv.:</b> None	<b>IofA</b> 0
4. Plan reliability <b>Crit.:</b> Higher is better <b>Max. Weight:</b> 25	<b>Attr.:</b> Planning is done in detail closer to the task execution		<b>Attr.:</b> <u>Planning is comprehensive with long term focus</u>		<b>Attr.:</b> Easy to schedule continuity on linear projects, improving coordination and continuity	
	<b>Adv.:</b> <i>Commitment planning by the last planners increases planning reliability</i>	<b>IofA</b> (25)	<b>Adv.:</b> None	<b>IofA</b> 0	<b>Adv.:</b> Improved coordination and continuity and visualization of the time-space relationship	<b>IofA</b> 15
5. Use of technology (planning tools) <b>Crit.:</b> Availability of technology is better <b>Max. Weight:</b> 50	<b>Attr.:</b> Simple and manual planning technique. Planning is carried out in the “big room” collaboratively using big plain boards and stickers.		<b>Attr.:</b> Well-advanced tools available for use, easily adapted to numerical computerization		<b>Attr.:</b> <u>Intuitive and easy to understand but cannot easily be adapted to numerical computerization as readily as network methods</u>	
	<b>Adv.:</b> None	<b>IofA</b> 0	<b>Adv.:</b> <i>Availability of technology supporting the implementation</i>	<b>IofA</b> (50)	<b>Adv.:</b> Limited number of computerization implementation platforms	<b>IofA</b> 0
6. Ability to accommodate space planning <b>Crit.:</b> Ability to accommodate space planning is better <b>Max. Weight:</b> 100	<b>Attr.:</b> Pull-based scheduling that facilitates micro-scheduling. Focuses on “how” instead of “what”		<b>Attr.:</b> <u>Focuses on “what” instead of “how”. Emphasizes on the critical path</u>		<b>Attr.:</b> Considers and accurately represents space-time relationships	
	<b>Adv.:</b> Constraint removal techniques facilitates space planning	<b>IofA</b> 50	<b>Adv.:</b> None	<b>IofA</b> 0	<b>Adv.:</b> <i>Facilitates the visualization of space-time relationships</i>	<b>IofA</b> (100)
7. Reduction of uncertainty and risk <b>Crit.:</b> Higher is better <b>Max. Weight:</b> 50	<b>Attr.:</b> Produces a predictable and reliable workflow		<b>Attr.:</b> Complemented by EVM and PERT with statistical abilities.		<b>Attr.:</b> <u>The ability to visualize time-space relationships provides some possibilities for risk reduction.</u>	
	<b>Adv.:</b> Project percent complete (PPC) and Variance Analysis (VA) can be used to reduce uncertainty and risk	<b>IofA</b> 35	<b>Adv.:</b> <i>Statistical abilities help planners to get a better idea of time and schedule risk</i>	<b>IofA</b> (50)	<b>Adv.:</b> None	<b>IofA</b> 0
<b>Total IofA</b>		<b>(265)</b>		<b>150</b>		<b>225</b>

The results of the CBA analysis show that during the construction of elevated urban highways, the LPS is preferable, subject to the selected factors and criteria. However, changing the factors and the criteria used in the analysis may lead to a different outcome for different types of project.

## DISCUSSION

Several issues were identified in the implementation of CBA. These include: (1) Getting relevant stakeholders to gather in one room to make project decisions. To counter this, the project kick off meeting (KOM) can be used to greater effect. (2) Considerable time was dedicated to collecting data. Currently, no research work has compared the three scheduling method used in this analysis. Hence the factors upon which the attributes were defined, and the definition of the attributes took a lot of time. It is important to note that the data collection process is integral to any MCDM method. (3) The stakeholders used for the case study analysis had to be trained in the application of the CBA method, the method and vocabulary had to be explained and the commitment to training time may present a barrier to first-time users of the method.

## CONCLUSION

CBA is an important decision-making method that integrates the perspective of multiple stakeholders. This study suggests the application of CBA in selecting the project scheduling technique to apply in the construction of elevated urban highway projects. The conclusions from the case study that may be generalized are: (1) CBA was helpful in integrating the perspective of multiple stakeholders. (2) CBA facilitated the identification of critical success factors necessary for selecting a suitable project scheduling method for highway projects. Some barriers were identified in the application of the CBA method. The most important barrier was the difficulty in getting the decision makers in one room at the time of decision.

It can be surmised that the application of CBA fosters more collaboration and exchange of ideas during the decision-making process, enhances transparency as decisions are made based on the importance of advantage of agreed factors.

## REFERENCES

- Aguado, A., Caño, A. del, de la Cruz, M. P., Gomez, D., and Josa, A. (2011). "Sustainability assessment of concrete structures within the Spanish structural concrete code." *Journal of Construction Engineering and Management*, American Society of Civil Engineers, 138(2), 268–276.
- Akadiri, P. O., Olomolaiye, P. O., and Chinyio, E. A. (2013). "Multi-criteria evaluation model for the selection of sustainable materials for building projects." *Automation in Construction*, Elsevier, 30, 113–125.
- Arroyo, P., Mourgues, C., Flager, F., and Correa, M. G. (2018). "A new method for applying choosing by advantages (CBA) multicriteria decision to a large number of design alternatives." *Energy and Buildings*, Elsevier, 167, 30–37.
- Arroyo, P., Tommelein, I. D., and Ballard, G. (2012). "Deciding a Sustainable Alternative by Choosing by Advantages' in the AEC industry." *20th Annual Conference of the International Group for Lean Construction*,
- Arroyo, P., Tommelein, I. D., and Ballard, G. (2013). "Using 'Choosing by Advantages' to Select Tile From a Global Sustainable Perspective." *21st Annual Conference of*

- the International Group for Lean Construction*, C. T. Formoso and P. Tzortzopoulos, eds., 309–318.
- Arroyo, P., Tommelein, I. D., and Ballard, G. (2014). “Comparing Weighting Rating and Calculating vs. Choosing by Advantages to Make Design Choices.” *22nd Annual Conference of the International Group for Lean Construction*, B. T. Kalsaas, L. Koskela, and T. A. Saurin, eds., 401–412.
- Arroyo, P., Tommelein, I. D., and Ballard, G. (2015). “Selecting globally sustainable materials: A case study using Choosing by Advantages.” *Journal of Construction Engineering and Management*, American Society of Civil Engineers, 142(2), 5015015.
- Arroyo, P., Tommelein, I. D., Ballard, G., and Rumsey, P. (2016). “Choosing by advantages: A case study for selecting an HVAC system for a net-zero energy museum.” *Energy and Buildings*, Elsevier, 111, 26–36.
- Bakhoun, E. S., and Brown, D. C. (2011). “Developed a sustainable scoring system for structural materials evaluation.” *Journal of construction engineering and management*, American Society of Civil Engineers, 138(1), 110–119.
- Dawood, N., and Shah, R. K. (2007). “An innovative approach for improvement of communications through visual schedule model in road construction.” *7th International Conference on Construction Applications of Virtual Reality*, Pennsylvania State University University Park, PA, 216–223.
- Hannon, J. J. (2007). *Emerging technologies for construction delivery*. Transportation Research Board.
- Jeannotte, K., and Chandra, A. (2005). *Developing and implementing transportation management plans for work zones*. US Department of Transportation, Federal Highway Administration, Office of Transportation Operations, Washington, D.C.
- Karakhan, A., Gambatese, J., and Rajendran, S. (2016). “Application of Choosing by Advantages Decision-Making System to Select Fall-Protection Measures.” *24th Annual Conference of the International Group for Lean Construction*.
- Mahoney, K. M. (2007). *Design of construction work zones on high-speed highways*. Transportation Research Board.
- Murguia, D., and Brioso, X. (2017). “Using ‘Choosing by Advantages’ and 4D Models to Select the Best Construction-Flow Option in a Residential Building.” *Procedia engineering*, Elsevier, 196, 470–477.
- Nguyen, H. V., Lostuvali, B., and Tommelein, I. D. (2009). “Decision Analysis Using Virtual First-Run Study of a Viscous Damping Wall System.” *17th Annual Conference of the International Group for Lean Construction*, Y. Cuperus and E. H. Hirota, eds., 371–382.
- Parrish, K., and Tommelein, I. D. (2009). “Making Design Decisions Using Choosing by Advantages.” *17th Annual Conference of the International Group for Lean Construction*, Y. Cuperus and E. H. Hirota, eds., 501–510.
- Schottle, A., Arroyo, P., Bade, M., Schöttle, A., Arroyo, P., and Bade, M. (2015). “Comparing Three Methods in the Tendering Procedure to Select the Project Team.” *23rd Annual Conference of the International Group for Lean Construction*, O. Seppänen, V. A. González, and P. Arroyo, eds., 267–276.
- Suhr, J. (1999). *The choosing by advantages decision-making system*. Greenwood Publishing Group.

# **Beyond Agile: Construction Cost Minimization through Optimal and Informed Risk Management, Contractual Agreements and Negotiations**

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## **Abstract**

Construction industry is in continuous need for improvement. Likewise, methods and techniques used for decision-making need improvement. Traditional approaches are not meeting the needs of fast-changing industry. In many cases issues start right from the contractual agreements and agreed terms that parties accept without truly understanding the feasibility aspects. These lead to multiple complications during the projects as well as towards the end of the project. To overcome such difficulties new approaches are developing as Agile with an expectation that targeting the project in smaller increments may help in reducing the possible negative outcomes. It works if the project can be delivered in smaller increments while for construction industry or others it may not always be feasible. Project Design-Build delivery method can be paralleled to some extent with Agile approach where the team works on the requirements and navigates over the phases of project development together. In practice even such approaches leave the stakeholders unhappy, because the terms and conditions of a project often change and lead to disagreements. In fact every project is a unique deliverable and very fragile if not managed properly. In this paper an innovative modeling technique named **Fragile**©, which goes beyond Agile approach, is proposed to help to deliver the project with its most efficient way from the given point on and especially for the conditions that may change in future.

## **Introduction**

In real life project management is much more complicated compared to conceptually analyzing the difficulties about project management. If follow PMBOK then the management of projects can be easy to navigate and keep structured. Yet, the actual problems that arise during the project can be difficult to handle as it involves multiple aspects including goal and scope, owners and other stakeholders, engineers and architects, contractors and subcontractors, suppliers and vendors, specifications and drawings, contracts and agreements and much more.

The most important thing in the process of management is to keep in mind the objective of the project in whichever capacity and preference it will be decided by the involved parties. In general the objective for any involved party is to maximize their return on their invested efforts and resources. From the perspective of the owner the objective can be to get the project completed within minimum timeframe and budget with maximum quality while for negatively involved party for the same project the goal would be the project's interruption or simply limitation of project's scope or conceptual issues defined by the owner and other involved parties. When taking such approach each involved party may practice the negotiations techniques in order to proceed with the project with the least resistance and find commonly acceptable terms and conditions that can also be stated in the contracts. All these complications bring to the idea for the need of analyzing projects step by step which in some sense can be described in terms of breaking down the project into smaller increments wherever possible. This partition of projects is much easier in IT projects. This is where Agile Manifesto comes in and it was initially developed to help with the incremental approaches. Yet, in other industries it can be challenging to divide the project into smaller deliverables that can be effectively considered and understood by the owner or other stakeholders. Construction projects will be one of the types of projects that is not always possible to deliver the project in increments and assure its smooth completion through Agile techniques.

## **Methodology**

To be able to elaborate the complexities of Agile approach it is important to present the principals of how Agile approach works, analyze its practicality then propose the new technique that may potentially be adopted for projects that might not be easy to manage with Agile. Some may find the proposed method is good in combination with Agile method as it can also complement



it if necessary other than completely replacing it. As documented by Beck et al. (2001), the Agile Manifesto is structured around 12 principles when implemented on software industry projects:

1. “Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
2. Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.
3. Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.
4. Business people and developers must work together daily throughout the project.
5. Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.
6. The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.
7. Working software is the primary measure of progress.
8. Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.
9. Continuous attention to technical excellence and good design enhances agility.
10. Simplicity—the art of maximizing the amount of work not done—is essential.
11. The best architectures, requirements, and designs emerge from self-organizing teams.
12. At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly” (Beck et al., 2001).

Straçusser, G. (2015) presented the potential application of Agile Manifesto on construction projects and still many questions can be asked about its wide and practical applications on other construction project types when incremental and segmental approach may not work. In particular Straçusser, G. (2015) discussed a project for constructing a Nuclear Power Plant and analyzed application of Agile on research, development and demonstration (RD&D). While for a project that is as large, complex and utilized 169 companies from total of 28 states to support RD&D construction, manufacturing and operations activities and during construction added more workforce by totaling it to more than 1,100 workers, it would be reasonable to divide it into increments and segments to deliver it to the owner gradually and getting the approval for the next step. Yet, if there was an opportunity to analyze the possible outcomes of brainstorming before and even during the construction stage to keep it consistent with Agile Manifesto while keeping in

mind that not only the owner needs to be happy and satisfied, but also other involved parties should be happy, the outcome of the management process and the success rate of completing the project on time and within budget might be even higher. In fact all projects are fragile and require careful management to be successful. Any project management is full of risks and it can be wisely evaluated.

With this idea in mind the proposed approach named “Fragile” is to utilize the applications of well-known and possibly well underestimated power of game-theoretic mathematical modeling that allows developing tools of application for such analysis to evaluate the possible outcomes of decisions made for the projects. Game-theoretic mathematical modeling had been and currently is widely utilized in other industries such as energy, oil and gas, sustainable infrastructure development for decision-making, market behavior analysis and much more. It can definitely be successfully adopted by Project Management society and bring the successful completion of projects one or even more steps closer to reality.

The flexibility of options in game-theory provides the luxury for setting up the relationships between involved parties in any project. In game theory the parties involved in the game which is the project are called players. These players make decisions for the project. They are the owners or other stakeholders, engineers and architects, contractors and subcontractors, suppliers and vendors and most importantly from project or program management perspective the Project or Program Managers. Within the flexibilities provided by game-theoretic setup the relationships can be defined in terms of number of players, simultaneous or sequential decisions also known as moves in the game, random moves, presence or absence of perfect or complete information, presence or absence of communication between parties, cooperative or non-cooperative actions.

To represent the proposed approach in this paper it is useful to analyze couple example setups with few participant for decision-making process. Assume there is a large project as discussed above for Agile Manifesto discussion. Large projects in many cases are delivered in multiple packages other than granting it to a single entity. Large projects also bring many changes during the project realization. If analyze from owner/s or stakeholders perspective it can be seen as a bidding and negotiation process for deciding with which contractor to proceed. If consider the contractor perspective it will be hard for the contractor to decide with which subcontractor to proceed. Depending on item under consideration either from stakeholder, contractor or subcontractor perspective when dealing with suppliers it will be challenging to decide with which supplier to proceed. If consider a choice or an option for the project from stakeholders perspective it can be cumbersome to find a point that all will agree on a certain choice. All these and any other scenarios can be structured as a game with few participants where they decide either together or in sequence, with perfect or imperfect information, with gain and loss consideration and more.

### **Details – Part 1**

Given the above information the proposed approach can be narrowed down to a hypothetical example. If assume there are two contractors and they have different options to deliver unit output for the owner and stakeholders based on the technology implemented then how should the contractors manage their strategies to get more orders from the owner and make more capital? Owner wants to go with lowest cost option. Other stakeholders/investors for this project have different opinions and perhaps based on other parameters may decide to go with not the least cost option. What should be the contractors' strategy be to maximize their chance of getting the additional amount of work for the project, keep the stakeholders satisfied and committed? To better analyze this situation assume there are three (A, B, C) different technologies that can be used for

delivering the same output. Each comes with a different cost that can be offered by each contractor to the owner and stakeholders. Each contractor charges its own prices per unit. Option A can be delivered for \$20.00, option B for \$40.00 and option C for \$50.00 per unit. For the low price trade there is 40,000.00 units of demand for each month by the owner directly and if both contractors bid with the same low price the amount of work is split between them. Based on the changes in the project it is expected that stakeholders will decide that there will be additional 60,000 units of work. Surely strategy by any of the contractor can possibly be to try to undercut the other contractor by bidding for the lowest price it can. Yet, it can be not wise if consider the payoff matrix. If payoff matrix is calculated then it will be easy to sort things out without difficulty.

If Contractor I charges \$20.00 per unit and Contractor II Charges \$40.00 per unit then Contractor I will get the 40,000.00 units form the owner and with probability of 50% chance it will attract 30,000.00 units from other stakeholders, resulting to 70,000.00 units to be completed with \$20.00 by returning total of \$1,400,000.00. Other 30,000 units (50% of 60,000.00 units) will go to the Contractor II who charges \$40.00 per unit resulting to \$1,200,000.00. Table 1 provides all payoffs per option in 1000s of dollars. First column second row of Table 1 depicts results of sample calculation above.

Table 1. Payoff Matrix of Contractor I and II accordingly

	A - \$20	B - \$40	C - \$50
A - \$20	\$1000, \$1000	\$1400, \$1200	\$1400, \$1500
B - \$40	\$1200, \$1400	\$2000, \$2000	\$2800, \$1500
C - \$50	\$15,00 \$1400	\$1500, \$2800	\$2500, \$2500

From this payoff matrix it can be observed that the least favorable option for any of the contractors is to proceed with \$20 option, because all other options are preferable by both and

there is no incentive for any of the contractors to call that price. Therefore it can be eliminated from the matrix to simplify the payoff and reduce the game (Table 2).

Table 2. Reduced Game Payoff Matrix of Contractor I and II accordingly

	B - \$40	C - \$50
B - \$40	\$2000, \$2000	\$2800, \$1500
C - \$50	\$1500, \$2800	\$2500, \$2500

From here it can be observed that \$40/\$50 option is not preferable for any of the players and they have an incentive to deviate from such choice by knowing there is better option for them to make 2,000,000 if they both call for \$40. There is also a better option if both call for \$50 per unit, but since this is a simultaneous game there is big risk that the other Contractor would play \$40 per unit game and get 2,800,000.00. Therefore both would preferably stay on \$40 option to make \$2,000,000.00 each. In reality it will be really rare that neither contractors nor the owner or owner's representative will do this calculations to understand what is actually happening. If Project Manager adopts this strategy they can serve the client better during any stage of project management through better negotiations and knowing that there is a calculated room for a better low cost option. Likewise, the game can be Nash equilibrium with non-cooperative setup. In other instances some players in the game will have more power than others, will act as leaders and others as followers in the market by making it Stackelberg game (Avetisyan et al., 2013, 2014, 2015, 2017, 2018). The above example is surely oversimplified situation, but at the same time very common situation in projects leading to wrong decisions. There is a lot more analysis completed for this project, but not all of it is presented here due to space limitations.

## **Details – Part 2**

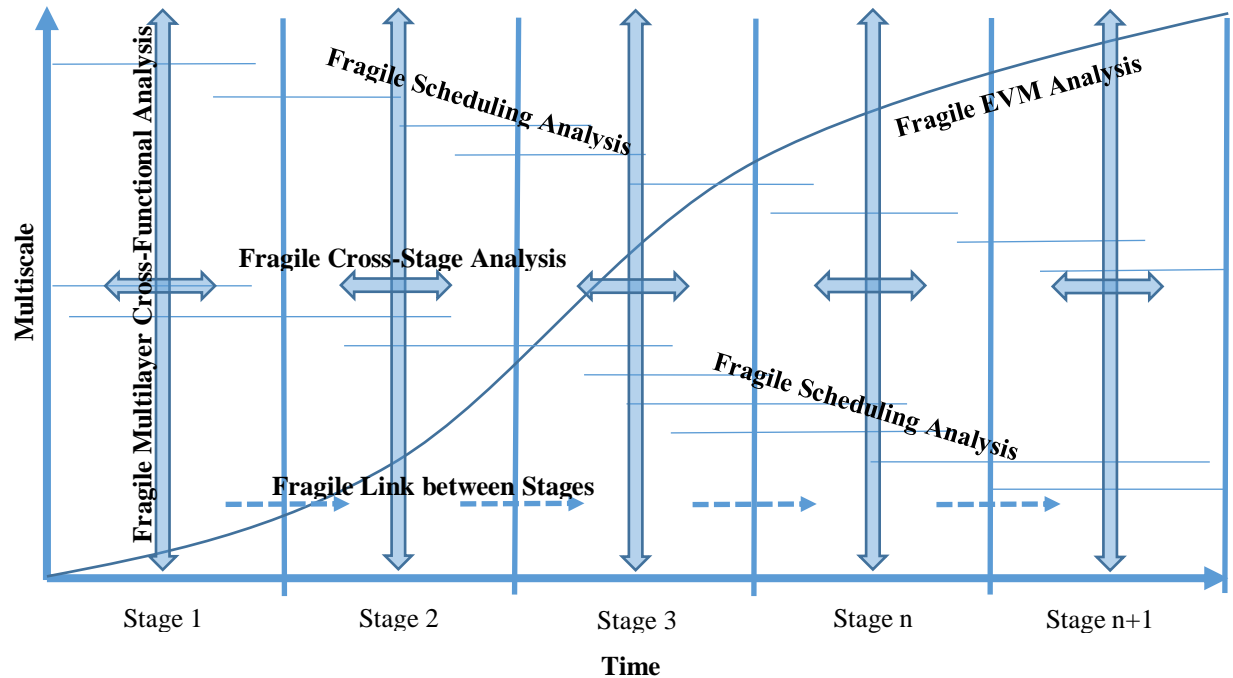
To give a better understanding what else goes into the proposed method that also addresses some drawbacks of Agile principles it is important to address the importance of prioritization

process of small increments in a project. How things are evaluated and categorized for the sprints and stages is one of the most important things to do correctly to be able to proceed with Agile system. This is impossible to do without providing a proper approach for prioritization such as Analytical Hierarchy Process as an example. Even after the right setup of priorities of small segments the flow in the process considering the highest priority items to be completed first may not be efficient. Here is how it happens and what can be done to make sure that projects can benefit. If consider a classic problem setup from Operations Research area the concept would be easy to follow. Let's consider a production problem with two products where the producer can make \$300 profit per unit from producing product one and \$200 profit per unit from product two. Each product uses resources and there are resource limitations. Product one uses two units of resource one and product two uses one unit of resource one. For resource two both products use one unit each. If now impose the resource and market limitations the manufacturer should decide which product and how many to produce to maximize the profit. Resource one is available up to 100 units and resource two is available up to 80 units. Product one can be produced for maximum of 40 units and no market cap on product two. If follow the Agile approach for managing this process then the manufacturer should produce the highest profit product first as much as possible then proceed with the second product after that. In fact "cherry picking" is not the best strategy in this situation. If utilize the resources and produce product one first with maximum 40 units possible by generating \$12,000.00 profit then only after that produce product two 20 units based on left resources by generating \$40,000 units the maximum profit that can be expected would be \$16,000.00. This is similar to the Agile Manifesto approach as high priority items will be completed first by allocating all the forces and resources on it. Yet, if we do simple calculation then we can quickly notice that producing 20 units of product one and 60 units of product two the

expected profit can be \$18,000.00. The difference of \$2,000.00 of profits as a result of not going with highest priority item first, but doing things in parallel and allocating the resources properly. This is just due to calculating it and not changing resource availability or usage. If we think of millions of dollars for large projects the difference can be unimaginable. The same thing can be translated into the schedule savings or any other aspects of decision-making process.

### **Fragile Approach**

Once having some of the concepts discussed earlier for the developed methodology the following can be considered to improve the management and decision-making process and potentially improve the project management and successful completion of projects. Figure 1 gives graphical representation of the developed process, which is presented with limitations due to space requirements as well as due to intellectual property issues. Project is treated in Stages and each Stage analyses the current State conceptually similar to Dynamic Programming. Then at each Stage the State of the project is evaluated from multi-angle perspective including game-theoretic models, earned value management, schedule impacts and resource allocation and other additional pertinent limitations or risks. Tools are developed to assist in each type of analysis in each Stage. Stage is defined by the user that can be the owner, owner's representative, project/program manager, contractor or anyone else who wants to make informed decisions for the project. If any of the ***Fragile***© processes in Figure 1 is missing or not analyzed properly the projects' optimal and efficient completion is questionable and mostly impossible given the number of variables involved.



**Figure 1. Graphical representation of Fragile Approach©.**

## Conclusion

As much as Agile is challenging to apply beyond Software and IT industry **Fragile** is easy to apply in projects and programs in other industries. Each project and program is very fragile and if not managed properly or issues not captured as early as possible projects and programs fail. **Fragile** is an approach suggested to evaluate projects at every stage very carefully, take actions as necessary for optimally managing it instead of just feasibly managing it. It assists in avoiding unnecessary risks and even developing better contract terms. The question that can be answered by Fragile Approach is that if there is any better way of doing things while keeping all involved parties to its possible highest level of satisfaction.

## References:

Beck, K., Beedle, M., van Bennekum, A., Cockburn, A., Cunningham, W., Fowler, M., Thomas, D. 2001. Principles behind the Agile Manifesto. Retrieved from <http://www.agilemanifesto.org/principles.html>



- Hakob Avetisyan, 2013. “Sustainable Infrastructure Modeling and Policy Analyses: Construction, Transportation and Energy Industries”, Ph.D. Dissertation, UMD College Park.
- Hakob Avetisyan, Mirosław Skibniewski, 2014, “Web-Based Management System for Construction Equipment Fleets: Global and Local Allocation of Equipment” Automation in Construction, Project Management Symposium 2014, June 9-11, 2014. pp. 35-43.
- Hakob Avetisyan, Mirosław Skibniewski, 2015, “Analyzing Sustainability State of Construction Equipment in the State of California” Automation in Construction, Project Management Symposium 2015, ISSN 2374-9377.
- Hakob Avetisyan, Mirosław Skibniewski, 2017, “Profit Maximization and Strategic Management for Construction Projects” Construction Management and BIM, Project Management Symposium 2017, ISSN 2374-9377.
- Hakob Avetisyan, Mirosław Skibniewski, Abhinandh Ramasami, Niranjan Mahamuni. 2018, “Life Cycle Cost Optimization Within Decision Making on Alternative Designs” Risk and Big Data, Project Management Symposium 2018, ISSN 2374-9377.
- Straçusser, G. 2015. Agile project management concepts applied to construction and other non-IT fields. Paper presented at PMI® Global Congress 2015—North America, Orlando, FL. Newtown Square, PA: Project Management Institute.

# **Big data from social media and scientific literature databases reveals relationships among risk management, project management and project success**

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## **Abstract**

The literature reviewed highlights that previous studies have been identifying risk management as an essential tool for project management and could increase the chance of successfully meeting project objectives. In addition, as found from the reviewed literature, risk management has been seen as a tool of allowing the project team to communicate risk information, so as to enhance the decision making process towards balancing threats and opportunities. Thus, this research aims to examined participants' views on the alignment of risk management, project management and organisational project success. Machine learning algorithms were employed to explore collective data from posts on twitter in order to obtain valuable knowledge about discussions regarding risk management, and project management. Additionally, the corresponding scientific literature obtained from Scopus database was analyzed utilizing bibliometric tools, in order to investigate diverse perceptions in academia and industry. Findings of this study will have implications for practitioners' perception of project risk management.

**Keywords:** Risk management, Project success, Decision making, Project management, Machine Learning, Big Data, Bibliometrics.

## 1. Introduction

In this work, we investigated significant concepts surrounding the project management (PM) and risk management (RM), the related concepts, as well as whether any relationship among them exist in academia or professional practice. Increasing the understanding of the relation between project management, risk management and people perception will lead us to gain knowledge about the use of the risk data regarding the decision making process. This will contribute on building project risk aware culture. Shi in [1] argues that proper implementation of project management, creates added value holistically to an organisation, both in strategic and operation level. In other words, effective risk management must be defined broadly in order to avoid strategic failures, that may lead operational ones. In addition, Drew *et al.* [2] introduce five integrated elements that underpin a firm's ability to manage risks, engage in effective corporate governance, and implement new regulatory changes: Culture, Leadership, Alignment, Systems, and Structure. Benjamin Franklin in 1748 when offering advice to a young tradesman; said "Remember that time is money". The definition of this statement is very pragmatic; any delay to project execution by unexpected or unpredictable factors makes cost increase, thereby directly affecting one another.

Risk is a subjective concept, highly related to people's perception, and many times extremely rare phenomenon occur, which cannot be quantified by statistics or forecasting methods [3]. This may be an outcome of tradition, attitude, and perception. People have a different behavior to the way that they perform risk management; some of them do it more than others or others do not do it at all, because is seen as unnecessary overhead [4]. Hence, human perception in the execution of the risk management process plays a vital role in the successful deployment of the process.

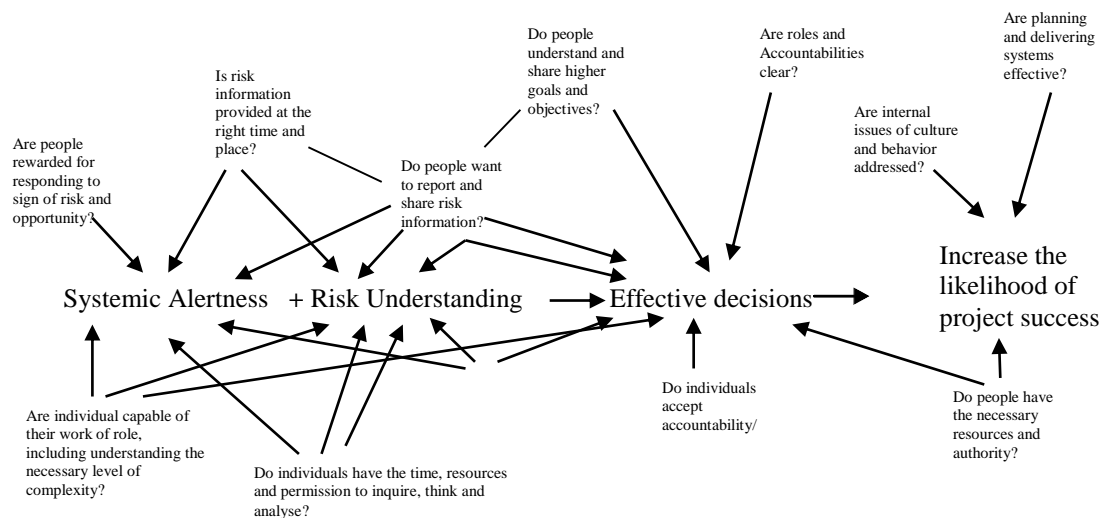
It is essential that decisions taken in a project take account of the level of risk in the project. Therefore, risk management plays a vital role throughout decision making-process. Project managers and all the parties that are affected by risks have to be fully aware of the risk and their impacts on the project objectives. A primary characteristic of a decision according to Charette [5] is that "*a decision process must be visible, repeatable, and measurable*". In the decision process, project members have to make decisions with consideration of risk in a daily basis.

Therefore, risk management and more generally risks have to be a part of daily thinking and know-how. It is like a culture, project members have to be fully aware of risk and the consequences positive or negative and be able to manage or mitigate them in the most efficient way.

The willingness of contracting parties to bear risks depends on the factors listed below [6]:

- General attitude to risk; each parties' preferences for different risk/returns trade-offs;
- Perception of project risks;
- Ability to confront the consequences of a risk occurring;
- Ability to manage the associated uncertainty and thereby mitigate the risk;
- Need to obtain work: will affect willingness to take risk directly; and
- Perception of the risk/return trade-offs of transferring the risk to another party.

In particular, Barber [7] explains the influences and interrelationships affecting responsiveness of risk. The following **Figure 1** shows factors such risk information, individuals understanding, accountabilities, risk rewards that influence decision making process and therefore increase the likelihood of project success, therefore Barber's work is indicating that there is a direct relation between the concepts of risk, decision making and project success.



**Figure 1:** Responsiveness split into understanding of effective decision making

In general, the perception of success is changing nowadays from the traditional iron triangle that focused on time, cost and quality. Recent examples are the mega-project of Burj Khalifa where

the plan cost was \$M876 and the final cost reached \$B1.5. Although the above examples of projects do not satisfy the iron triangle and some of the stakeholders' expectations, they are still considered as efficient finally. Therefore, how project success perceived is more a philosophical question that can be analysed from different aspects. According to Turner and Zolin [8], a project should be evaluated beyond its immediate completion, while mega projects will have a wider range of stakeholders making judgments. This work, investigates the relation between project success and risk management, which go beyond the traditional iron-triangle, to the existence of the project. Risk management is an essential tool through the traditional project life-cycle, but also beyond its initial completion. Therefore, perceptions of people influence decision making process at the modern life cycle of a project, highly affecting its success. To this end, in this work, a big data investigation was performed, utilizing Scopus [9] and twitter [10] databases as well as machine learning algorithms for their analysis.

## **2. Bibliometric literature review**

### *2.1 Machine learning deployment for project success with focus on project management*

In order to investigate a large database of papers on project success, and reach reliable conclusions respectively, this work deployed the use of machine learning algorithms. In particular, a novel bibliometric procedure developed in [11] was utilized to analyze the current work's database. This will demonstrate the terminologies that used alongside with project success, as well as their inter-associations. Therefore, a database was developed from Scopus for the purpose of understanding and analyzing project success from the literature. As a general concept, project success has received a considerable attention within the project management literature over the last three decades [12].

The database was derived from the Scopus website [9]. The term project success is used as a research term in the field of keyword. This investigation will facilitate the better understanding of the literature on the field of project success. It is important to identify other keywords and make a final database closer to the project success. As a first step a database with 2822 papers was identified. For this analysis the database was comprehensively checked and limited to publications with project management focus, therefore the query was limited by choosing

specific keywords from the drop down menu which was more relevant for this investigation. Final results constituted a list of 1.243 items from journals, books and peering review conference proceedings. The database can therefore be considered as a reliable material for further analysis with text mining machine learning and tools. Next step was to extract the basic keywords included in the database.

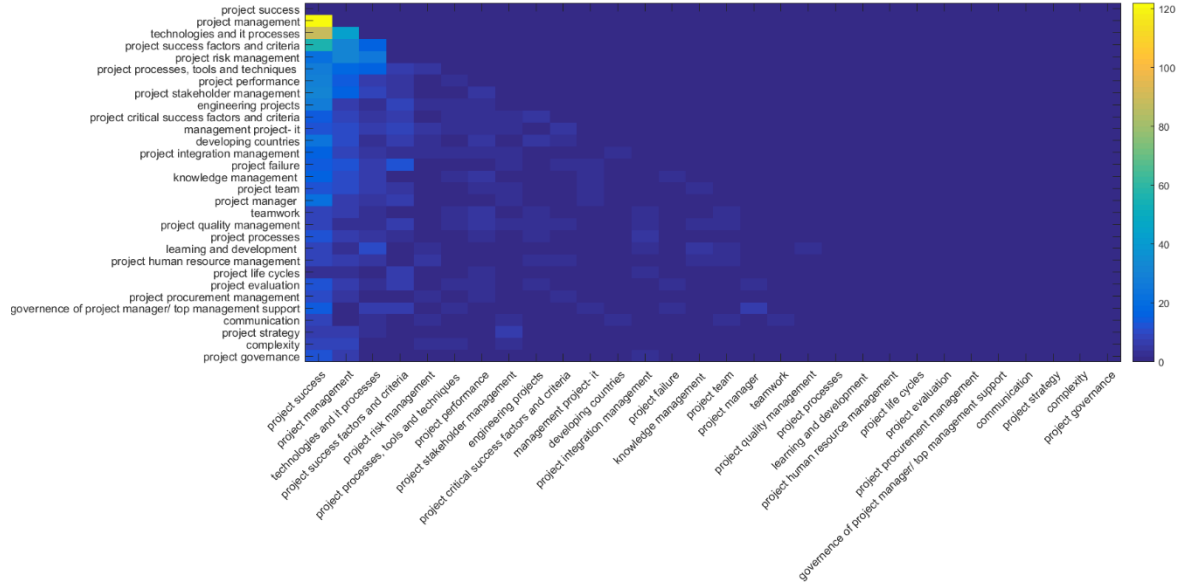
Due to the vast contained information, regarding the keywords, the authors decided to make a further classification of the keywords using fundamental of the project management theories and available approached from the literature. Projects where classified using Newton [13] approach. According to Newton there are two categories the engineering and management projects. Where the first encompass civil, electrical, mechanical, where the deliverables are physical objects such as a bridge or engine. The second category refers to thing like developing an IT system where the final result is not considered to be physical item but a process or a system. DeWit [14] top success criteria were also used as generic classification (Delivering on time, cost and budget). On main limitation of the database was that there are not standardised project management keywords so this is make it very difficult and time consuming for researchers to make relations of terminologies.

The authors found it useful to also include the standard terminology from the PMI and APM associations. Accordingly, the 10 PMI knowledge areas will be used as a further categorization among with the behavioral and the contextual competencies adopted by APM (2008). In addition, because this research is based on actors the role of project manager was also considered as separate category for the classification.

## ***2.2 Numerical procedure***

The next Table 1, demonstrates the computational process for the constitution of the bibliometric map. The procedure initially reads programmatically the author keywords column from the \*.csv file -exported from Scopus- and calculates of the co-occurrence table of the keywords (**Figure 2**). Through the constitution of the co-occurrence table the simultaneous existence of the keywords is demonstrated. The colors of the map indicate the amount of co-existence of the keywords. For example, in **Figure 2**, it is depicted that project management and project success,

exhibit major co-occurrence (yellow color), the project risk management with technologies and it processes immense, project performance and project stakeholder management with project success high, project manager and project team with project success medium, and, governance of project manager/ top management support, communication, complexity and strategy with project success as well as with almost all the other existing keywords, low.



**Figure 2:** Co-occurrence colored matrix


Consequently, the similarity matrix is formulated, and the dis-similarity matrix is computed by inverting each component of the similarity matrix. Accordingly, the optimization algorithm, initialize randomly the positions  $\mathbf{p} = (x_i, y_i)$  of each item (keyword), and calculates the distances among the features on the bibliometric map. The objective function is the norm of the deviation between the pairwise distances, and the matching dis-similarities. After a vast amount of optimization steps and objective function calculations, the optimal values of the positions  $x_i$  are exploited to depict the outcomes on the bibliometric map.

**Table 1:** Algorithm for the clustering

1.  $c_{ij}$ : = contingency table (co-occurrence of objects)
2.  $s_{ij}$ : = similarity
3.  $ds_{ij} := \frac{1}{s_{ij}}$  (dis-similarity)
4.  $d_{ij} = \|x_i - x_j\|$  (distance on map)



*Optimization Algorithm*

5.  $f_{ij} := |ds_{ij} - d_{ij}|$  (objective function)
6. Optimality criteria satisfied? *NO*  
 *YES*
7. End => drawing of bibliometric map

The bibliometric map represents each item (keyword), located in a point on the 2-Dimensional drawing, with  $(x, y)$  coordinates. The entities (keywords), which found to co-occur, are linked though a line, with width proportional to the co-occurrences, that is to say the similarity (link strength) between the objects. The distance among the items indicate their dis-similarity, which is written in the middle of each link (exact value), with a suggestive arrow ( $\rightarrow$ ), while the corresponding dis-similarity is reported in parenthesis. Finally, each object's font size is equivalent to its number of occurrences, in order to direct identify the most important objects (keywords).

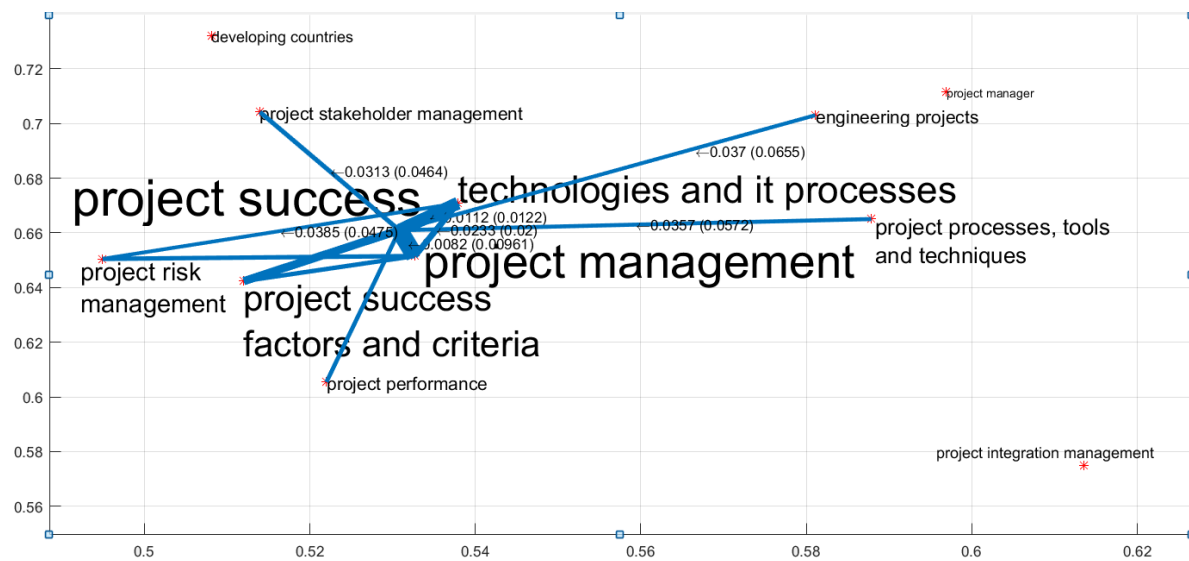


Figure 3: Overview of project success keywords bibliometric map

Consistently with the above described procedure, in Figure 3, the overview of the database regarding project success keywords, bibliometric map for the thirty top keywords existing is demonstrated. The map is optimally consistent with the co-occurrence matrix as described previously. However, it contains significant information depicting the overall associations of the keywords studied, as the relative positions of the keywords on the bibliometric map, is an indicator of the conceptual association among them. For example, in **Figure 4**, in the center of the map, the keywords project success, project management and technologies and IT processes



were identified. Furthermore, the keyword project success is highly associated with keyword engineering projects, which was previously described by Newton [13], classification theory approach, were deliverables are physical objects. Another important relationship that was indicated on the bibliometric map, is that a significant amount of research papers was mentioning developing countries. Furthermore, the keywords project manager and project stakeholders are highly related to the project success as well, because they were positioned in the central region of the map.



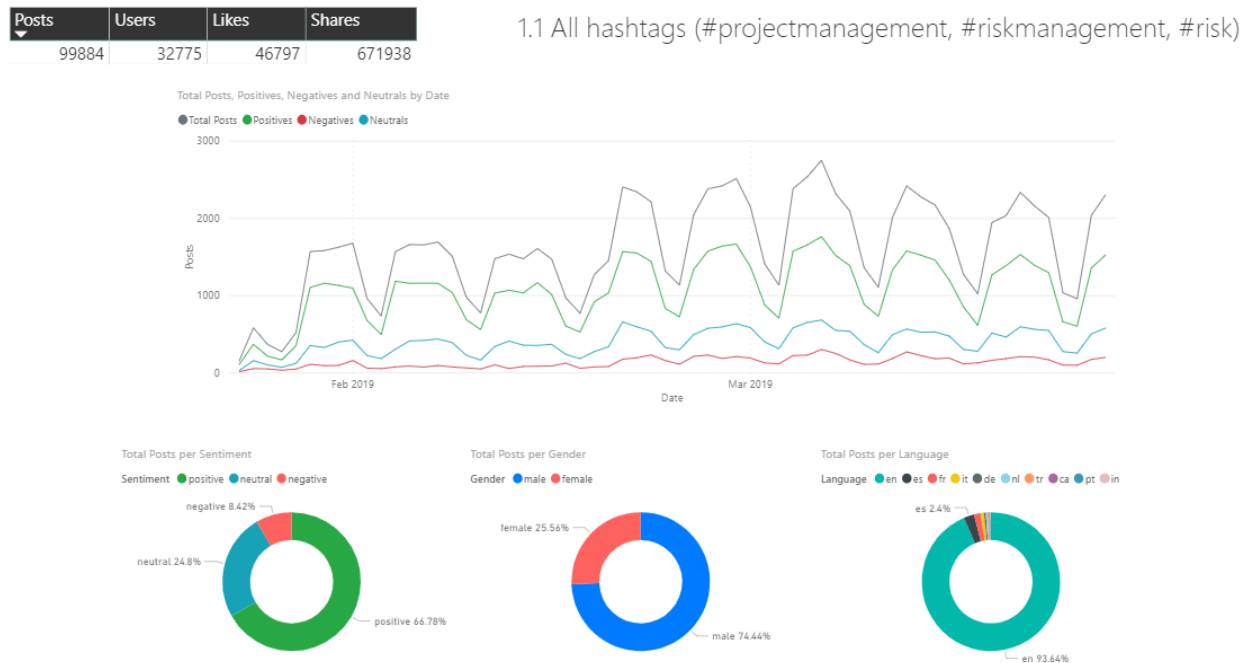
**Figure 4:** Focus of bibliometric map top keywords

Finally, **Figure 4**, which is a focus of the core area of Figure 3, reveals that the keyword project risk management, is highly associated with the keyword project management. Because this analysis is based on a rigorous computational methodology and on adequate database of peer reviewed papers it can be reliably to conclude that in scientific literature on project success the concept of project management is studied simulated with the concept of risks management. This finding is contradictory from the later analysis from twitter. Therefore it is proposed to practionares to investigate more on the importance of risk management in the project context. While literature demonstrates the importance, people discussion from social medial does not perceive risk management as an important discussion when referring to projects.

### 3.Text mining using twitter data

Text mining is an application of data mining to find patterns in the text [15]. In addition, the text mining provides a valuable business decisions insight, from text-based content such as word documents, emails and postings on social media streams as Twitter, Facebook and LinkedIn. For data analysis, public user-generated content derived from Twitter, a text sharing social media network, is used [16]. In our case, we have collected tweets regarding the project management, risk and risk management as well as the relationship among these keywords. The data analysis process consists of a) data acquisition, b) data cleansing and storage, c) data querying and filtering and d) data visualization. For the data acquisition process, the system communicates with Twitter repeatedly through their RESTfulWeb Services (RESTful APIs) to collect all the new generated data in an unstructured form, such as post text and language, image URLs, likes, shares, dates and times, etc.

After the acquisition, data cleansing and transformation is needed to select the required data and transform them into a structured form to be stored in the SQL database. The data from the main SQL database table (holding all the collected and transformed records) is also transferred to a cloud data warehouse. Data visualizations can reveal popularity and sentiment for specific hashtags during the examining period. Using text mining/sentiment analysis it is found that positive sentiment dominates during that period, while the negative posts are at low levels [17]. Data was collected approximately for two months (start 24/01/19- finish 26/03/19). A total of 99.894 posts tweets from 32.775 users, 46797 likes and 671.938 shares (**Figure 5**).



**Figure 5:** All hastags - overview

Figure 5 demonstrates a generic overview of all the results gathered from the search of project management (risk/risk management). It is important to note here that the authors tried to investigate on using the project success keyword; however, the obtained results were insufficient for big data analysis. Therefore, the research concentrated only on the keywords mentioned above. In particular Fig.4 presents the proportion of positives negative and neutral words appeared in the study tweets. It is worth mentioning that utilizing sentiment analysis, the majority of the studied tweets contained positive words (66,78%). Additionally, the posted tweets were obtained mainly from male users (74,4%) rather than female (25,56%) indicating that males are more active project management practitioners on sharing their opinion through social media. Finally, it was revealed that the tweets were consisted by different languages such as English, Spanish, French, Italian and German words. However, the majority of tweets are posted in English (93,64%)

### Top 100 Hashtags

### Top 100 Words



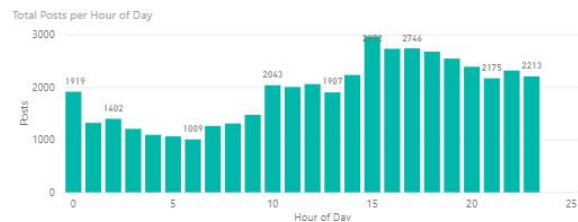
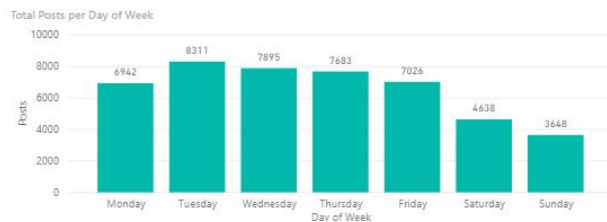
Posts	Users	Likes	Shares
473	208	197	231

### Top 100 Words



Further study demonstrated a deeper knowledge about the content of the tweets (**Figure 7**). In particular, when the hashtags #project management and (risk OR risk management) were combined in the database query then the resulting posts were 473 only, published by 208 user with 197 likes and 231 shares. It is revealed that on the common word cloud the most popular hashtags are #Cyber, #data, #machinelearning, #engineering, #riskanalysis etc. In addition, in the same **Figure 7**, some of the most popular words are cost, software, innovation, register, change, resource and knowledge.

Top 100 Hashtags



Finally, it is important to show data revealed separately from the area of project management. **Figure 8**, shows that some common hashtags were #artificial intelligence #planning, #leadership, #construction, #technology, #engeneering, #mashine learning, #security, #productivity etc. Through this analysis it was revealed that risk or risk management was not in the most popular hashtags when people are discussing project management. This is contradictory with the previous research done in Scopus, where academic research in project management is very closely related to risk management. Therefore, it could be argued that practitioners' perception about the importance of risk into project are limited. The question is why practitioners are not engaging with the importance of risk in the project context; when most of them think that it is

important. Do really practitioners do proper risk management; and if they do actually why its benefits is an open question. The challenges are to investigate why if so important is not discussed enough. This work show that there is a gap between academic and public perspective in the importance of the use of risk management.

Through the above analysis, we could argue that engineering, and IT have a significant influence in project management, both in academic publications and people's discussions in twitter. The fourth industrial revolution exhibits a high impact in projects, as revealed by the corresponding discussions. Similarly, risk, is highly associated with the same concepts, of cyber-security, artificial intelligence, big data analytics and relevant topics.

#### **4. Conclusions**

Risk management and more generally risks have to be a part of daily thinking and know-how. It is like a culture, project members have to be fully aware of risk and the consequences positive or negative and be able to manage or mitigate them in the most efficient way. This paper was an investigation in the area of project management and risk management insights from academic and practitioner's risk management in relation to project success. As a general concept project success has received a considerable attention with the project management literature over the last three decades [12]. This research utilized data from social media (twitter) and from an academic literature database (Scopus). Hence, in order to investigate a large database of academic papers on project success, and reach reliable conclusions, this work deployed in the research methodology the use of machine learning algorithms. In particular, a novel bibliometric procedure developed in [11], was utilized to analyze the current work's database. Then in order to identify different patterns and practitioners opinion the research looked on data derived from twitter and analysed using big data analytics techniques. The present study provides additional evidence with respect to the relation between risk management, project success and people's perception.

In particular, from the study on Scopus, it was found that project management, project success and risk management are highly associated in academic research. In addition, the same data, revealed that publications are more generated from the engineering and it fields, as the top

keywords appearing in the Bibliometric map which is highly related to project success, project stakeholders, the project manager, process tools and techniques. Furthermore, it is encouraging, that projects from developing countries, highly contribute to the academic research. The second analysis, with twitter data, verify Engineering and IT sectors' importance in formulating public opinions. Also, discussion on project management, mainly concern topics as tools, planning, learning, skills, big data and people. The deeper investigation regarding the relation among project management and risk or risk management, as attained by a specific database query, shown that 99884 total tweets, were limited to 473 tweets only. This further underlines the insufficient use of risk data in people's decision making with respect to project management. This work is a part of an ongoing research on increasing the awareness of people towards a risk aware culture.

## 5. References

- [1] Q. Shi, "Rethinking the implementation of project management: A Value Adding Path Map approach," *Int. J. Proj. Manag.*, 2011.
- [2] S. A. Drew, P. C. Kelley, and T. Kendrick, "CLASS: Five elements of corporate governance to manage strategic risk," *Bus. Horiz.*, 2006.
- [3] S. Makridakis and N. Bakas, "Forecasting and uncertainty: A survey," *Risk Decis. Anal.*, vol. 6, no. 1, pp. 37–64, Jan. 2016 [Online]. Available: <https://content.iospress.com/journals/risk-and-decision-analysis/6/1>
- [4] M. Papadaki, A. W. Gale, J. R. Rimmer, R. J. Kirkham, A. Taylor, and M. Brown, "Essential Factors that Increase the Effectiveness of Project/Programme Risk Management," *Procedia - Soc. Behav. Sci.*, 2014.
- [5] R. N. Charette, "Large-scale project risk management is risk management," *IEEE Softw.*, 1996.
- [6] S. C. Ward and C. B. Chapman, "Risk-management perspective on the project lifecycle," *Int. J. Proj. Manag.*, 1995.
- [7] R. B. Barber, "Understanding internally generated risks in projects," *Int. J. Proj. Manag.*, 2005.
- [8] R. Turner and R. Zolin, "Forecasting success on large projects: Developing reliable scales to predict multiple perspectives by multiple stakeholders over multiple time frames," *Project Management Journal*. 2012.
- [9] "Scopus." [Online]. Available: <https://scopus.com/home.uri>
- [10] "Twitter." [Online]. Available: <https://twitter.com/>
- [11] V. Plevris, N. Bakas, G. Markeset, and J. Bellos, "Literature review of masonry structures under earthquake excitation utilizing machine learning algorithms," in *Proceedings of the 6th International Conference on Computational Methods in Structural Dynamics and Earthquake Engineering (COMPDYN 2015)*, 2017, pp. 2685–2694 [Online]. Available: <https://www.eccomasproceedia.org/conferences/thematic-conferences/compdyn->

2017/5598

- [12] L. McLeod, B. Doolin, and S. G. MacDonell, "A perspective-based understanding of project success," *Project Management Journal*. 2012.
- [13] P. Newton, *The Principles of Project Management, Project Skills*. 2008.
- [14] A. de Wit, "Measurement of project success," *Int. J. Proj. Manag.*, 1988.
- [15] S. VijayGaikwad, A. Chaugule, and P. Patil, "Text Mining Methods and Techniques," *Int. J. Comput. Appl.*, 2014.
- [16] M. Komorowski, T. Do Huu, and N. Deligiannis, "Twitter data analysis for studying communities of practice in the media industry," *Telemat. Informatics*, 2018.
- [17] K. Vassakis, E. Petrakis, I. Kopanakis, J. Makridis, and G. Mastorakis, "Location-Based Social Network Data for Tourism Destinations," in *Big Data and Innovation in Tourism, Travel, and Hospitality*, 2019.



## **Bridging Organizational Divides: From Distrust to Cross-Team Collaboration**

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### **ABSTRACT**

As most projects span multiple departments and organizations, project leaders are increasingly challenged to align teams with differing business objectives, connect often contradictory working cultures, and mentor staff in developing best practices for collaboration. This paper reviews the benefits of applying elements of organizational design to a cross-team project environment. The paper utilizes a case study from a large healthcare system to demonstrate that structural linking mechanisms can be deployed to establish lasting alignment across multiple departments. By using cross-unit groups and integrator roles, the program manager increased collaboration, knowledge sharing, and helped solidify a sense of shared goals across the teams.

**Key Words:** collaboration, organizational design, leadership, linking mechanisms, project management, change management

### **BACKGROUND**

Have you ever been on a project where cross-team dysfunction almost brought all forward progress to a halt? What if you had to work with a team that was more risk-adverse, or sales-focused, or driven by personality types radically different from your own organization? This happened to me.

My team was co-developing a clinical software system with a large healthcare information technology (IT) vendor. The team's success was tied to both development of the clinical applications, as well as successful deployment of the software across several hospital sites. As with any complex IT project, there was a large risk the clinical systems would not be deployed in a timely manner. In fact, surveys of software projects around the world show that less than a third of IT project implementations could be deemed successful, with most projects categorized as "challenged", and 19% are considered failures. (Standish Group, 2015) The risk to my program, came not from the external vendor, but from a team internal to my own organization.

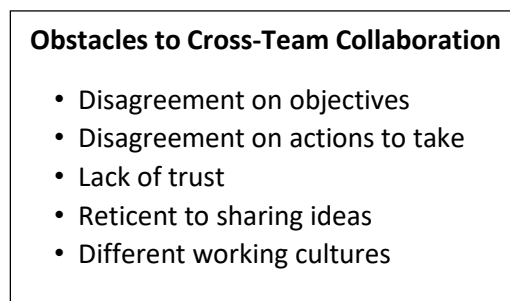
To achieve our goals, my team was heavily dependent on an operational team supporting legacy IT systems who we needed to execute a product roll out of the clinical applications. The operational team was neither ready, nor even happy to take on such a large IT and business change we presented them. Bridging the gap between the two departments did not come easy. At times it seemed the two organizations were not aligned on the goals of the program, and actively working in opposition of each other!

Most projects span multiple departments and organizations. As project leaders, we are increasingly challenged to: align teams with differing business objectives, connect often contradictory working cultures, form open lines of communication, and help teams develop best practices for collaboration. (Pinto, 1991)

As we know, collaboration in the business environment is both necessary and widespread. However, it is by no means uniformly successful, with recent studies finding that nearly 75% of cross-functional teams are dysfunctional. (Tabrizi, 2015) Successful collaboration is hard. We all experience this in our day-to-day jobs. And as I learned at my current organization, aligning cross-organizational teams is extremely tricky!

## **BARRIERS TO COLLABORATION**

Why does coordination fail within organizations? Why is it hard for teams to work together? There are several major factors that come into play that may raise obstacles to cross-team collaboration (see Figure 1).



**Figure 1. Common Obstacles to Collaboration.**

First there may be disagreement on objectives and goals. If teams are not working toward the same business goals, then coordination and collaboration will be limited.

A related obstacle is disagreement on what actions to take to achieve common objectives across the teams. Who here has not worked in organizations with shared goals, but different teams wanted to take different approaches to reaching those goals?

Lack of trust. It is hard to trust other people, especially when your professional success depends on them. Fellow colleagues and co-workers are not your friends – you might not have anything in common with individuals from the other teams – and yet you need to rely on one another in order to make things happen. Building trust both inside teams and across teams is critical to project's success. And I can tell you that building trust takes work and time. You need to be willing to trust others, to look past their differences, and also to prove to them that you yourself are a reliable person.

We live in a competitive society where we are taught since childhood that we are in competition with everybody else. Another obstacle to cross-team coordination is reluctance to sharing ideas, results, and even success. Teams can often be competitive with their experience and knowledge and are unwilling to share expertise with outside groups.

Different business cultures play a big role in why teams may be reluctant to collaborate or coordinate. Whether it is a team half way across the world or half way across town, different teams have different working styles. As a project leader, it is important to understanding that and work to bridge those differences.

As someone responsible for the overall success of their project or program, project leaders need to find solutions to establish coordination across teams, departments, and organizations, and temper down resistance or anti-collaborative behavior. They need to make sure the groups are aligned to the same goals. The mis-alignment can be a big risk to a project's success if teams do not play well together. And this was exactly the position that I was in.

## **CASE STUDY: COLLABORATION CHALLENGES**

After a year into the IT program at the large hospital system, the most notable organizational dysfunction was the absence of shared vision and goals across all departments. The product development team that was eager to see our software deployed and in use by the radiologists. The operational team, on the other hand, was not as enthusiastic and saw great risk in replacing the legacy IT systems with the new clinical systems.

### ***Different Working Cultures***

One of the primary challenges we faced, was that the two departments had radically different culture and business drivers. The product development team was: agile, design-focused, willing to entertain new ideas and take risk, willing to prototype and test concepts with users. The product development team worked closely with the primary users of the system (the radiologists), spent more time planning and thinking strategically, but were in general were relatively new to the radiology IT domain.

In contrast, most of the staff working on the operations team had come up through the ranks as radiological technologists or clinical supervisors. They had deep knowledge of the clinical domain and had been supporting the existing IT systems for over a decade. They excelled at putting out fires and trouble-shooting issues. However, they were risk averse. Any outside individual would need to prove their value, and gain their trust, before they would show acceptance to working together.

### ***Poor Hand-offs Between Teams***

Hand-offs between the product development and operations teams were not formalized, nor were there shared tool sets to allow closer coordination. Early in the program, hand-offs between teams were not handled very well. Code drops were often made with minimal forewarning and the functional documentation was lacking. As the product development team started to work more closely with the operations team, we stood up regular calls to review development timelines, milestones and hand off dates. The information was primarily contained in spreadsheets and emails and not easily accessible or searchable.

Two years into the program the teams began using a cloud-based collaborative development environment (CDE) to track defects and enhancement requests across the various applications. The CDE became the key tool to bridge the gap between the product development and operations teams.

### ***Low Organizational Trust***

To make matters worse, there was low trust between the teams. The root of this distrust stemmed from reorganizations a few years back that decimated the operational team's ranks and forced the retirement of their former director. The operational team faulted the product development organization for the down-sizing and was skeptical of any collaboration efforts. There was an undercurrent within the operational team that their positions were not secure.

To be successful, I needed to align the two organizations in both strategic planning and tactical execution.

So how did I overcome these challenges? The path was not easy, nor did relations between the teams change quickly. It took time, effort and planning. The solution to the organizational dysfunction (i.e. the icy relationships between the teams) was to borrow tips and tricks from organizational design and associated collaboration models.

## **ORGANIZATIONAL DESIGN**

Organizational design is defined as a field that studies "how to organize people and resources in order to collectively accomplish desired ends." (Greenwood and Miller,

2010) When organizational design is applied to the business environment, it should originate from an organization's strategy. The design needs to factor in the existing workflows and processes used by the business unit or teams. In many ways, organizational design is like a blue print that an architect drafts before constructing a building.

While studying organizational design, I came across the concepts of *grouping* and *linking*. These concepts are the two primary building blocks that organizational designers have at their disposal. (Oliver Wyman, 1998)

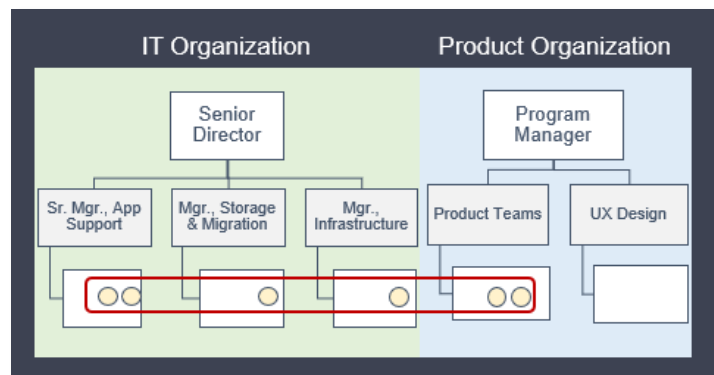
*Grouping* is how individuals, functions, or activities are differentiated and aggregated. Businesses organized by function, such as Sales, Product Management, Engineering, Finance, etc. are good examples of organizational groupings. Effective grouping optimizes information sharing within the group, but often creates barriers with other groups. This is what happened at my organization between the software development and operational business units.

*Linking* is an integration mechanism used to coordinate and share information across groups. Organizational linking enables leadership to provide guidance and direction across the organization and eliminates some of the silos that can exist across teams. While most companies use a combination of both grouping patterns, *linking* is often an afterthought and not given the same attention as *grouping*.

There are four types of linking mechanisms to consider (Oliver Wyman, 1998):

- 1) *Liaison roles*. These involve coordination by trusted and respected individuals between teams. This is fairly common with a manager above two or more business units coordinating their activities.
- 2) *Cross-unit groups*. These are standing or ad hoc committees focusing on a specific process, product, or customer. (See Figure 2 for representation of a cross-unit group at the hospital.)
- 3) *Integrator roles*. These are managers, not directly supervising, but ensuring that processes are executed smoothly across groups.
- 4) *"Dotted lines"* These are mechanism which linking individuals within functions who are distributed across the organization. This is similar to informal communities of interest within an organization.

It would be increased organizational *linking* that proved to be effective at increasing alignment and coordination across disparate teams at my current organization.



**Figure 2. Cross-unit Group Example of Organizational Linking.**

According to The Bridgespan Group, organizations tend to spend the majority of their energy on grouping activities, but very little on linking. Most individuals assume incorrectly that the organizational problems are caused by having the wrong groupings, when in fact, it is poor coordination and minimal organizational *linking* that are the primary structural problem facing organizations. (Bridgespan Group, 2008)

As project leaders, we need to be proactive in building structural linking mechanisms across the teams we work with and manage. Organizational *linking* should be one of the tools in the toolbox for every project manager leading teams across organizational units. Collaboration is hard, and it is not something that comes easy to everyone.

## THESIS

Let us return to the situation at my organization, where there were two departments that really were not working well together, nor were they aligned on the same goals. The existing challenges (different working cultures, poor hand-offs, low collaboration and low organizational trust, etc.) had to be addressed in order to get the deployment program back on plan.

I had a working thesis that by applying some concepts from organizational design, we would be able to increase collaboration, and improve staff satisfaction and attitudes across the teams.

1. First, increased collaboration and organizational *linking* would bring about greater alignment and more efficient execution of project activities.
2. Second, we would address cultural differences by promoting a “One Team” mindset across the teams. (Winter, 2008)

### ***What We Did: Implemented Linking***

We spent time to plan and implement increased *linking* mechanisms between organizations. The first action was to adjust my focus to be an “integrator role” and to cover both product development and deployment activities. I embedded myself into the other team’s activities and was physically collocated with them for multiple months.

We also encouraged cross-unit groupings that focused on particular processes or gaps that we wanted to be addressed. It turned out that some of the expertise resided in development team and some in the operations team. By working together collaboratively, the teams were more efficient at planning, solving problems and handling change management with the user base. In the end, these steps helped to solidify a sense of shared vision and goals across the teams.

In summary, we spent time building effective relationships across the two teams.

### ***What We Did: One Team Mindset***

A key tool to address the cultural differences across the teams was to promote what we called a “One Team” mindset. Our approach borrowed heavily from Australian leadership consultant Graham Winter who has been promoting the practice of “Think One Team” since the late 2000s.

What does a “One Team” mindset mean? (See Figure 3 below for a summary.) The approach breaks down as follows: (Winter, 2008)

- *Share the Big Picture* – Everyone across the teams knows and plays their part in a bigger picture. Everyone shares commitment to the big picture and does not pursue separate agendas.
- *Share the reality* – Everyone is open and honest about performance, so the teams can learn and grow from mistakes or wrong turns. The teams should bring conflict to the surface to be addressed.
- *Share the knowledge* – Take each other’s ideas, expertise, and energy and put to use for the common goal and vision. Respect each other’s contributions and different working styles.
- *Share the load* – Everyone should tackle the big issues as one unified team. The teams need to share the challenges, as well as the accountability.
- *Share the Wins and Losses* – The teams would all win, lose, and learn together. As leaders we needed to guide how the teams deal with losses and to channel that into something more positive and productive.

Managers from both the product development and operations teams included the “One Team Mindset” as part of the performance goals to ensure the collaborative

behaviors were reinforced. By promoting a “One Team” mindset, the teams naturally dropped collaboration and cultural barriers and over time grew closer together.



**Figure 3. Summary of the “One Team” Mindset.**

## **LESSONS LEARNED**

While addressing the collaboration challenge at my organization, I gained several insights that are useful for other project leaders facing similar issues within their organizations.

1. Taking on the integrator role and embedding myself within the other team helped to build trust and break down walls. I learned a lot from the operations team and gained a greater appreciation of their expertise by working with them on a daily basis. Where my team excelled in planning and coordination, the operations team was great at detective work and problem solving. Their learning process, while seemingly slower, ensured collectively that all team members understood the technical matter and solutions that they identified.
2. The increased *linking* across the teams helped to tremendously improve hand offs, overall communications, and execution of project work. An early win included individuals on my team being seen as experts by the others on the operational team. By achieving that level of trust, they were pulled into deeper collaboration with the operations team.
3. Both teams wanted to do well and succeed at their jobs. Everyone wanted to do their best for our users, and ultimately for the patients and patients' care at our hospitals. This core desire naturally helped pull the teams together despite their differences.



4. Lastly, the progression toward increased collaboration was not linear. There were setbacks and emotional blowups that happened from time-to-time. After these occurrences, the leadership for both teams investigated why and took lessons from them.

## **RESULTS**

This case study began with two teams that had organizational walls separating them (both mentally and physically), low trust and collaboration, and reluctance of one organization to support higher level goals. After we implemented the organizational linking mechanisms and promoted a “One Team” mindset across the teams, we began to see positive results from the changes:

The teams gained a sense of shared vision and goals across the business. Staff from both business units could be heard saying: “We are in this together!” or “We are One Team!” and they meant it. There was increased collaboration and alignment across the organizations, as well as higher levels of trust, better handoffs, and improved division of labor on the deployment program. We had multiple linkages at various levels between the two organizations to reinforce the collaboration and teamwork.

In the end, the program accomplished both its product development goals, as well as its system deployment goals. Yes, this story has a happy ending!

## **RECOMMENDATIONS**

Now that you have heard my story, here are some recommendations for other project leaders:

1. Become better educated on organizational design so that you can use the knowledge on your projects and programs. Organizational dysfunction is not going away.
2. Take time at the beginning of a project to think about the organization structure and what mechanisms are needed
3. Be proactive and deliberate about building relationship and bonds between teams. It takes time to build up social capital needed for effective collaboration.
4. Try holding a “Session Zero” with teams to communicate clear roles and responsibilities prior to getting too far into program execution.
5. Be willing to go the extra mile to break down silos. Take on an integrator role, become a diplomat, collocate, or even roll out a “One Team” mindset with your teams.
6. Be willing to help the other teams when they are “in a pinch”. This is a certain way to help bridge organizational divides and build social capital.

## REFERENCES

- Bridgespan Group (2008). *Key Elements of Effective Organizations: Bridgespan's Organization Wheel*. The Bridgespan Group. Available at: <https://www.bridgespan.org/insights/library/organizational-effectiveness/key-elements-effective-organizations>
- Greenwood, R., Miller, D. (2010). Tackling design anew: getting back to the heart of organizational theory. *Academy of Management Perspectives*, 24(4), 78-88.
- Pinto, M. B. & Pinto, J. K. (1991). Determinants of cross-functional cooperation in the project implementation process. *Project Management Journal*, 22(2), 13–20. Available at: <https://www.pmi.org/learning/library/determinants-cross-functional-cooperation-team-performance-2076>.
- Standish Group (2015). *CHAOS REPORT 2015*. Standish Group International. Available at: [https://www.standishgroup.com/sample\\_research\\_files/CHAOSReport2015-Final.pdf](https://www.standishgroup.com/sample_research_files/CHAOSReport2015-Final.pdf)
- Tabrizi, B. (2015). *75% of Cross-Functional Teams Are Dysfunctional*. Harvard Business Review. Available at: <https://hbr.org/2015/06/75-of-cross-functional-teams-are-dysfunctional>.
- Oliver Wyman (1998). *Strategic Organizational Design: An Integrated Approach*. Delta Organization & Leadership LLC. Available at: <http://dev.orgwise.ca/sites/osi.ocasi.org.stage/files/resources/Strategic%20Org%20Design.pdf>
- Winter, G. (2008). *Think One Team: An Inspiring Fable and Practical Guide for Managers, Employees and Jelly Bean Lovers*, Jossey-Bass/Wiley, Brisbane, Australia.

## About the Author

Bruce W. Gay, PMP, has over 20 years of experience managing programs and customer relationships across healthcare Information Technology, telecommunications, and defense industries. Currently a Senior Program Manager at UPMC Enterprises (the commercialization arm of the University of Pittsburgh Medical Center), Bruce manages a multi-million dollar program to develop the next generation of Radiology Informatics systems. Over the past 13 years, he has managed creative teams that incorporated UX Design & Design Thinking methodologies into their product development processes.

Bruce has presented at both regional and international conferences, including the PMI Global Conferences in Chicago, Los Angeles, Dublin, Ireland, Netherlands, and Jamaica. He holds an MA in International Affairs from The George Washington University and a BA in International Affairs from the University of North Carolina – Chapel Hill. Bruce lives in Pittsburgh, PA with his wife, two daughters, and his dog. He is an active volunteer with the PMI Pittsburgh chapter and manages corporate sponsorship for his local chapter. Bruce shares his experiences and ideas around Design Thinking on twitter as @brucegay and on his website: [www.brucegay.com](http://www.brucegay.com)

**UMD Project Management Symposium**  
**Capturing Costs and Value of Research Products<sup>1</sup>**

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**ABSTRACT**

The nature of research projects does not lend itself to project management. Requirements are rarely concrete, scope is evolving, and each project is an entirely new problem to find solutions for. With so much unpredictability, how can we possibly estimate research costs accurately? Is there a way to determine the value of research products?

This paper will discuss the project management methods and processes developed to help estimate costs, manage budgets, and better determine the value of products for research initiatives. I will also discuss useful tips on how to effectively manage costs and budget from the planning phase through project closeout.

**INTRODUCTION**

Research is an approach to solving problems, developing new methods, and improving existing processes. Research involves creativity, trial and error, and exploration, exposing it to variability, unknowns, and risk. How can we possibly assign a level of effort to a research initiative when all these factors are at play?

From my experience managing externally sponsored, reimbursable research projects at the U.S. Census Bureau, the budgets for these initiatives are never large, scope is complex and ever-evolving, and the process for initiating and tracking these projects was often informal and inconsistent. Due to the nature of research projects, it was challenging to avoid issues, such as poorly estimated costs, budget overruns, and scope creep. It was also difficult to determine the value of the final ‘product’.

In this paper, I will discuss methods to improve cost estimation, budget management, and how to better determine the value of research.

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<sup>1</sup> This paper is released to inform interested parties of ongoing operations and to encourage discussion of work in progress. Any views expressed on operational issues are those of the authors and not necessarily those of the U.S. Census Bureau.

## **COST ESTIMATION**

The goal of cost estimation is to produce an estimate that is accurate, all-encompassing, reasonable, and defensible. Achieving all of these factors is not easy, especially when estimating costs for research initiatives. Here is an eight step cost estimation process that can help accomplish this goal.

### **Cost Estimation Process:**

1. Determine Scope
2. Provide Historical Data
3. Estimate Effort
4. Estimate Costs
5. Review & Update Cost Estimate
6. Develop Cost Estimate Memo
7. Send & Negotiate Cost Estimate
8. Follow Up & Finalize

Below I will go into each step in more detail, adding in some best practices and lessons learned.

### **Step 1: Determine Scope**

Work with the project sponsor to determine the scope.

- Start with the overall goals of the project then break that down further into requirements
- Ensure that the final deliverable is defined (i.e. a final report on project findings)
- Discuss constraints, initial risks, and any information that could be useful to the project
- Determine if the project is feasible given staff skillsets, availability, and timeframe
- Make sure key project stakeholders are in agreement and fully understand the scope
- Set realistic expectations

Lesson Learned: This step is crucial! It sounds simple, but too often projects have ill-defined scope and the final product is unclear. You are almost guaranteed to experience scope creep and/or budget issues down the line if you do not thoroughly discuss and agree to expected outcomes of the project.

### **Step 2: Provide Historical Data**

Provide historical project data to the subject matter experts (SMEs) to assist with their effort estimates.

- Schedule actuals from similar past projects
- Lessons Learned from similar past projects
- Average effort of standard products (Table 1)

**Table 1. Standard Products - Average Effort by Project Type and Resource Grade.**

Standard Product	Qualitative Project (hrs)			Quantitative Project (hrs)		
	GS-12	GS-13	GS-14	GS-12	GS-13	GS-14
Operations Plan	11	6	7	91	67	28
Analysis Plan	59	22	7	67	17	15
Expert Review	72	43	33			
Analysis	139	106	26	312	132	29
Recommendations	48	30	28	0	0	0
Report	67	21	7	116	65	18

This example shows the average hours, based on past schedules, required to produce a standard research product.

**Lesson Learned:** Put good in, get good out. Put in the effort to develop and maintain up-to-date, comprehensive schedules and encourage your project teams to report accurately. As a result, you will get good output in the form of usable schedule data to reference for future project costs. The more data we collect, the better our estimates get. This means no longer needing to rely solely on the “best guess” of SMEs.

### **Step 3: Estimate Effort**

Provide a user-friendly effort estimation template with instructions for SMEs. Using historical data from step 2, SME provides information needed for cost estimate.

- Research project proposal- revised to capture updated scope based on initial meetings with the sponsor
- Timeline of work/milestone schedule (planned fiscal year by task)
- Three-point effort estimate (optimistic, most likely, and pessimistic) for each project task
- Level of confidence in each estimate (high, medium, low, guesstimate)

**Table 2. Effort Estimate Example.**

Deliverable	Fiscal Year	Resource A Effort (hrs)			Resource B Effort (hrs)			Confidence
		Optimistic	Most Likely	Pessimistic	Optimistic	Most Likely	Pessimistic	
Deliverable 1	19	5	8	12	5	8	12	high
Deliverable 2	19	24	48	64	16	24	32	medium
Deliverable 3	20	48	72	96	32	48	64	medium

**Lesson Learned:** Using a mix between bottom-up and parametric estimating creates more reliable, defensible cost estimates than expert judgement alone. Leveraging historical data to make informed deliverable-level effort estimates leads to more accurate costs.

Ensure the SMEs are accounting for the following effort.

- ✓ If the project requires assistance from other areas- work with those areas to account for their effort, availability, and costs
- ✓ Project management - consider team meetings and meetings with the sponsor
- ✓ Project-specific background research or staff development and onboarding

- ✓ Project planning and preparation
- ✓ Stakeholder management
- ✓ Addressing comments and feedback on deliverables
- ✓ Travel expenses, if applicable
- ✓ Project Closeout- lessons learned, finalizing and archiving documents, and planning for related future projects

#### **Step 4: Estimate Costs**

Build in risk and uncertainty.

Using the data gathering from the previous step (example in Table 2), calculate a final estimate that accounts for risk and uncertainty. There are many methods of doing this, I use SPERT®.

“Statistical PERT® (SPERT®) is a freely licensed, probabilistic, estimation technique. Use Statistical PERT to estimate uncertainties that have bell-shaped risk properties, like: task duration, work effort, revenue, expenses, agile story points, project portfolios, event attendance, and more.” (Davis, 2019)

I learned about SPERT® at the 2017 University of Maryland Project Management symposium and have been using it to build uncertainty into all research project cost estimates ever since. All you need to do is plug in the three-point estimate and the SMEs feeling of confidence then SPERT® uses Microsoft Excel statistical functions to calculate a reasonable set of final estimates that incorporate uncertainty. You then choose the probabilistic estimate that works for you, for example, since research is more variable than regular projects, we use the 90% confidence level estimate. As a result, we feel more comfortable with our estimates being able to say we are 90% likely to complete the project within the estimated cost.

Build in training, leave, and overheads.

Run the final effort estimates through the most up-to-date cost estimate worksheets to get the final cost including any overheads, training costs, leave.

Lesson Learned: For various reasons, we experience pressure to keep our research projects low cost. For example, federal budgets are especially tight in recent years, research is usually lower priority than production work, and often research is initiated as a result of small surpluses that need to be spent before funding expires. Because of this, in the past we were providing bottom-up, optimistic cost estimates that didn't account for any risk, uncertainty, or other non-project related time, such as, training, onboarding, and leave. We found ourselves frequently going over budget. The research staff are obviously entitled to take leave and trainings so this is something we have to build in to each and every project no matter how tight the budget.

### **Step 5: Review & Update Cost Estimate**

Review of cost estimate.

- Compare to past similar projects to ensure the estimate is realistic
- Are we able to predict how the sponsor would react to the cost estimate? If they already have a budget in mind or are limited by how much they can spend, we should keep this in mind
- Receive management and SME approval

Lessons Learned: If we know the project budget is small, suggest cost saving alternatives for the sponsor to consider.

### **Step 6: Develop Cost Estimate Memo**

Develop cost estimate memo.

- Addressed to the project sponsor
- Summary table of cost estimates by fiscal year
- Project proposal/scope
- Cost saving options (if offering them)
- Proposed milestone schedule (if available)
- Routing List- all necessary approvals needed
- CC list- ensure the appropriate stakeholders are all included
- Cost estimate breakdown/worksheets to account for bureau and division overheads
- Document all known assumptions, constraints, and risks

Management review and updates incorporated.

### **Step 7: Send & Negotiate Cost Estimate**

Send draft cost estimate memo to the project sponsor.

- Provide a deadline for feedback
- Highlight any important information that the sponsor needs to be aware of

Sponsor reviews and provides feedback.

- Schedule a meeting to discuss or negotiate (if needed)
- If the sponsor is trying to cut costs, determine ways to cut back on scope without compromising the integrity of the project.



Lesson Learned: Since it is challenging to get an accurate estimate (hence the word “estimate”), we experimented with providing a cost estimate range. This backfired on us. Our project sponsors almost always gave us the lower end of our range. Completing our project within our “best case scenario” cost estimate is obviously more challenging than if we were to provide a reasonable single estimate.

### **Step 8: Follow-Up & Finalize**

Follow up with project sponsor.

- Incorporate agreed upon changes from step 7
- Send cost estimate memo back to sponsor
- Receive sponsor approval

Finalize costs.

- Route the cost estimate memo for finalization, receiving all necessary approvals
- Distribute cost estimate memo to stakeholders on the CC list
- Update project status on appropriate project directories and maintain notes associated with the decision
- Store finalized costs estimates in the appropriate document repository for easy reference

**Finally, execute project and manage your budget!**

## **BUDGET MANAGEMENT**

Proper budget management begins from the kickoff meeting for any project, but is especially important on research initiatives. Below are budget related topics that should be discussed before the project starts.

- Confirm the funding you are receiving is in line with the agreed upon budget
- Determine the sponsor’s tolerance for budget variance

On research projects you may find yourself going down a certain path, hitting a dead end, then starting back from the beginning. Some trial and error should be expected, but how much exploration can we afford?

- Decide on frequency and format of budget updates
- Establish a list of initial risks

Budget Monitoring

- Change Management- Because research scope is often evolving, change control procedures are extremely important. Make sure you have an understanding for the sponsor’s tolerance for change with respect to budget and schedule. It’s amazing how much small requests and changes here and there can really add up, especially when you

are working with a small budget. Formally document every change no matter how small and ensure that you are getting sponsor approval for any change that could have even a slight impact on any of the triple constraints (scope, schedule, budget).

- Risk management- After the kickoff meeting, estimate the potential impact of the risks on the project budget and communicate this to the sponsor. Continue to manage risk throughout the project. Frequently communicate risks and issues to the sponsor so that if issues do arise they are more prepared and willing to provide additional funds if needed.
- Schedule management- When developing the schedule, align schedule effort with the cost estimate so that the status of the budget is directly linked to schedule health. This allows you to use the schedule as a budget tracking tool. For example, you can easily pinpoint budget concerns if a task is taking longer than the baseline plan.
- Reporting- Provide regular budget reports and updates to management and the sponsor. Create and analyze monthly reports to ensure projects are staying on track. Use earned value management to assess project health and use time reported and work remaining on schedules to forecast the potential project surplus or deficit. Good budget reporting enables informed decision making throughout the project.

#### Project Closeout

- Ensure the sponsor is in acceptance of the final deliverable and acknowledges project completion
- Develop a final budget report, share with necessary stakeholders, and store for future reference
- Perform a lessons learned session

Lessons learned sessions have had a huge positive influence on planning for future projects. We have been able to acknowledge and break bad habits, pinpoint weaknesses in our processes, and make the necessary improvements.

- Release remaining funding back to sponsor if necessary

## DETERMINING VALUE

There are two aspects of value to consider in relation to research products. The first is the usefulness of the product to the customer and the second is the monetary worth or cost. Usefulness is fairly simple. Did the customer use the final product? Did the project results influence decisions or create cost saving efficiencies? If the answer is yes to these questions then the research is considered valuable. The monetary worth takes some effort to fully understand.

In order to assign a monetary value to a research product, you must track the costs. This is possible using a deliverable/product-based schedule that the project resources report their time to. Use the time reported on a deliverable to calculate the associated costs. Tracking the costs that are needed to develop these products allows us to provide the sponsor with options on future

projects. The more data you gather on projects, the more informed your decisions become. For example, if we know how much on average two rounds of cognitive testing costs on a project, we can convey that to our project sponsors when they are deciding what their needs are. We can more easily show them where their money will be best spent, where the value added is highest.

An example of a situation when the value of the product was not necessary worth the cost is developing a final report when the customer gets what they need from the preliminary results. On some research initiatives, after the preliminary results are delivered to the sponsor, developing the final report falls in priority to other projects that are more time sensitive and competing for resources. This happens when the preliminary results provide all the research outcomes and answers that the sponsor expected from the project and therefore, they are not as concerned with receiving a final report. The valuable product here is the preliminary results and, although a useful summary of the project, the final report is not valuable enough to be worth the cost and effort. The resources can be better utilized elsewhere. This is just an example. Often the final reports are extremely valued depending on the project or sponsor.

## CONCLUSION

Since establishing formalized procedures for cost estimation and budget management of our research initiatives, we have a better understanding of the actual costs and value of the research products and are able to more successfully manage our budgets. As you can see from Table 3 below, our likelihood of going over budget has greatly decreased in recent years.

**Table 3. Research Project Budget Improvements.**

Year of Project Initiation	Percent of Over-Budget Projects
2015 - 2017	53%
2018 - 2019	17%

Note: The project budgets include any approved changes from the original plan.

Achieving greater value from research initiatives begins with thorough planning. The more time spent planning, the more likely projects will have well-defined scope, realistic budgets, desired outcomes, and less room for misinterpretation and issues. Because research lends itself to uncertainty, focusing effort on schedule and budget monitoring, change control, and risk management during the execution phase of a project will decrease the likelihood of surprises and issues. Lastly, don't forget to apply your lessons learned to future projects.

## REFERENCES

Davis, William W. (2019). *Statistical PERT® Normal Edition, Version 3.0.*, Statistical PERT®

<https://www.statisticalpert.com/download-free-templates/#duration>

# CONSTRUCTION MANAGEMENT AT RISK (CM@Risk) DELIVERY METHOD FROM AN OWNERS REPRESENTATIVE PERSPECTIVE (THE GOOD, THE BAD AND THE UGLY)

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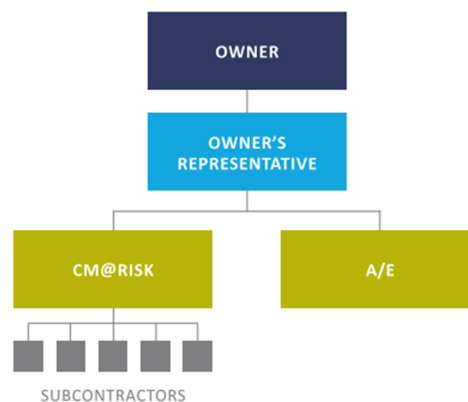
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## **Abstract:**

This paper is based upon lessons learned from Owner's Representative perspective managing and auditing over 60 construction management at-risk (CM@Risk) projects for public owners over the past 10 years. The paper provides an overview of the benefits, risks and lessons learned to owners associated with the CM@Risk delivery method from selection through construction to closeout. Our discussion will provide insightful solutions to manage the process efficiently, to guide the owner, and to provide a check that will keep the project on the right path. Owners want to keep projects on schedule, under budget, and to have high quality, so our solutions mentioned in this paper will help facilitate trust amongst the parties of the project through transparency (not only the Good aspects of a project, but also the Bad and Ugly and how to openly address them in a collaborative and tactful manner). Our discussion also provides a unique perspective, gathered from lessons learned from the auditing of public CM@Risk projects.

## **Introduction:**

CM@Risk delivery method has been utilized for over 30 years and continues to be used as a popular method for construction project delivery. Like all project delivery methods, there are pitfalls, benefits, costs, and risks. The objective of this paper is not to provide a comparison of the various delivery methods, but rather to examine the use of CM@Risk delivery method for the owner's benefit and discuss what issues and challenges can be anticipated in its use. The information presented is based upon lessons learned developed as an Owner's Representative on CM@Risk projects and providing financial auditing of CM@Risk projects. The result is a list of recommendations and solutions to assist owners in this delivery method for achieving better results and better outcomes for construction projects that employ this method of delivery.



## **Definition of CM@Risk:**

The Association of General Contractors (AGC) defines CM@Risk as:

“A specific variation of construction management in which the public owner engages both a project designer and a qualified construction manager under a negotiated contract to provide both preconstruction services and construction. The CM@Risk (CM/GC) provides consulting and estimating services during the design phase of the project and acts as the general contractor during construction, holding the trade contracts and providing the management and construction services during the construction phase. The degree to which the CM/GC provides a cost and schedule commitment to the public owner is determined during the negotiation of the final contract. (This is a risk issue. If there is no risk involved, it is not CM/GC.)”<sup>1</sup>

The Construction Management Association of America (CMAA) defines CM@Risk as:

“A delivery method which entails a commitment by the construction manager to deliver the project within a Guaranteed Maximum Price (GMP). The construction manager acts as consultant to the owner in the development and design phases, but as the equivalent of a general contractor during the construction phase. When a construction manager is bound to a GMP, the most fundamental character of the relationship is changed. In addition to acting in the owner’s interest, the construction manager also protects him/herself.”<sup>2</sup>

## **The Nature of CM@Risk:**

From these two definitions, we can come to agreement on the nature of CM@Risk. The first is that it is a delivery method where the construction manager will wear two hats, simultaneously. The first hat is to be the owner’s consultant during the preconstruction services phase and the second hat is that of general contractor during the construction phase, but when and how do these two phases mix? They will certainly mix at the time the first subcontractors are brought under contract, if not before.

The second fundamental is the Guarantee Maximum Price (GMP) and the defining agreements that set the GMP. Many times, the GMP is not negotiated until after construction begins. The GMP should be signed when the information for design has reached a point where defining the unknowns has become a small part of the design. Many times, there will be an “Amendment Agreement” that allows construction to start ahead of the final GMP. As a minimum, the GMP should contain the cost of the construction work, construction contingency (negotiated amount), general conditions fees, insurance and tax fees, and the construction management fee. ***(Note: it is also important that the Construction Manager’s Assumptions, Clarifications and Exclusions be included with the GMP).*** And at this point, everyone from the Owner, Designer, and Construction Manager will be thinking, “what’s in it for me” what are my risks? It is important to have these discussions. After all, that’s what it’s all about!

So “what’s in it for me?” Every Owner should ask this continually during a CM@Risk project. Let’s start with the CM@Risk selection process and the types of projects that tend to be contracted with a CM@Risk delivery method.

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<sup>1</sup> CM/GC Guidelines for Public Owners, second edition 2007 by the Association of General Contractors and the National Association of State Facilities Administrators.

<sup>2</sup> CMAA: Construction Management Standards of Practice 2003

### **Selection of the CM@Risk:**

Most States allow the use of CM@Risk delivery over the traditional, Design-Bid-Build and Design-Build delivery method on projects of a minimum value or highly complex projects of unique construction. Typical Higher Ed projects include, dormitories, museums, arenas, performing and visual art centers, hospitals, laboratories, and other Higher Ed facilities. These projects usually must be approved by a governmental entity (Board of Visitors, Capital Outlay, Facilities Management). The most important aspect in this phase is to select a CM@Risk that has proven experience in the type of construction and the knowledge that comes with having constructed and managed similar types of building projects in the jurisdiction having authority. Without this prior knowledge, most of the cost estimating and scheduling done by the CM@Risk could be unreliable. The CM@Risk should provide a proven history of project cost estimating and scheduling successes with references. Public owners are highly encouraged to call the references. Lastly, as the consideration for final selection progresses, the owner should evaluate a CM@Risk for reasonable preconstruction fees, general conditions costs, overhead and profit percentages, contingencies, allowances and other fees and costs.

### **Pre-construction Phase:**

The services that will be performed by the CM@Risk in the preconstruction phase is usually defined during the selection process and paid for as a lump sum for those services. Expectations of the CM@Risk, owner, and design team should be defined in the solicitation documents. It is important for all team members to understand what is expected in terms of deliverables and schedules. Please note that the CM@Risk may list the number of cost estimates and schedules they will perform under the preconstruction phase costs (and should). Owners should require cost estimates and schedule during the Schematic, Preliminary and Working Drawings (at a minimum). If this number is exceeded, the CM@Risk could request additional fees for the extra work. That is important information if the designer gets behind schedule and wants to make piece-meal submissions.

During the preconstruction phase, the CM@Risk is responsible for cost estimating. This becomes the basis for the eventual GMP and most importantly, the owner's construction budget. The CM@Risk must be informed of any abnormal features anticipated for a project. If these expectations are not defined, the estimate will not be conclusive and the responsibility shifts again to the Owner and design team to identify missing features, which results in an updated cost estimate that likely was not included in the original scope of work. For instance, if you are building a performing arts center, the experienced CM@Risk will know that acoustic walls will be a necessity. Of course, there are many types of acoustic walls, so defining the type(s) and the amount in the estimate is a necessity. Failure to include these walls in the cost estimate will result in a cost estimate that is too low and eventually, as the cost estimate and design efforts move closer together, the budget will suddenly jump and the owner will be frustrated with the CM@Risk and the A/E as both parties begin to argue over the responsibility of the cost overruns.

At later stages, the value engineering (VE) effort done by the CM@Risk will cost the owner in quality as items are deducted or substituted that originally would never have been considered. Many times, owners are simply too busy and lack the resources to perform adequate reviews of the cost estimate and everyone gets caught up in the issue of the budget. The owner depends upon the CM@Risk to look out for his interests during this phase and little to no risk is carried by the CM@Risk for cost estimating. If there are extra costs added into the cost estimate, which include the potential for a higher budget, these could become profit for the CM@Risk at the conclusion of the GMP negotiation. It is very important that the owner does a formal facilitated VE work session, especially for technically complex facilities such as labs, etc. The value added to the project by performing a VE work session has helped all

parties feel that they have enhanced the program and functionality of the facility, instead of simply lowering the cost of the construction.

To complicate the issue, the CM@Risk is usually responsible for making and updating the project schedule, so when issues arise for budget and redesign, you will hear the common mantra of “You’re holding us up!” The fact is, much of this can be avoided with properly vetting the CM@Risk during selection, setting a realistic budget, thorough review of the design, cost estimating and scheduling, and developing the scope of work in such detail that the quality, types of materials, and the size of the project can be anticipated from the RFP.

The schedule must include reasonable times for code reviews and other uncontrollable activities. You should not include a duration for the code review that falls under the “I hope so” category. Remember, the project is complex, and the code official, board of visitors, or council may need extra time for reviews. Beware of the promise to build it faster than anyone else feels possible. If it sounds too good to be true, it is. It is imperative to maintain realistic and attainable goals.

During design, since the owner carries the contract with the A/E, we have experienced that some A/E firms have a patented exterior design and will use it over and over again in different forms. This may be the same “signature” style no matter what type of building. It will be the owner’s responsibility to reign in a design that is not true to the owner’s design intent and no doubt will increase scope. It is much easier for owners to stay within budget if the designer is clear as to meeting the “design intent” needs of the owner and not trying to sell their “signature” designs. Owners can help themselves with the process of earmarking design scope creep by making this the responsibility of the CM@Risk to document. It is not uncommon for the end-users to be a part of the initial design progress meetings and for something unexpected to creep into the design process that will increase the initial pricing. During initial discussions, at a Programming/Pre-Planning meeting, what the A/E hears in the discussion may be totally different than what the owner’s decision makers have heard and so forth. It is important that the A/E bring suggested changes back to the owner’s decision makers for approval but most times, in the interest of keep the design on schedule, they will proceed. Not managing the design process from the initial phases will likely cause Scope creep. Scope creep is one of the main culprits of cost overruns. The CM@Risk should alert the owner when an item is identified as scope creep which results in a cost impact. The owner at that time should approve/disapprove the added scope or determine another resolution pending anticipated cost.

### **The Construction Phase and Contingency:**

First, we need to have a discussion regarding contingencies. Generally, there are two types, owner and construction manager. The owner normally holds the owner contingency. An owner contingency is usually mandated by the State Agency or State general services. Change orders from the owner contingency are issued for changes that are caused by scope changes, design errors and omissions, unforeseen conditions, or owner requested changes. The Construction Manager’s contingency is generally defined as a component of the GMP that sets aside costs for components of the GMP that were reasonably unforeseen at the time of the GMP. These costs could be scope gaps between subcontractors, costs due to refinements of the ongoing design, corrective work, constructibility issues, and field issues that the CM@Risk should have reasonably foreseen. Scope changes during the design phase are not a part of the CM contingency as they are considered outside of the normal design intent scope. Have we read the term reasonable or reasonably enough yet? We have found more often than not, that every design change is considered a change order and should be paid from the owner contingency, as the CM@Risk has now converted to general contractor and claims they could not have reasonably foreseen such an issue.

If during negotiation of the GMP you find yourself with other contingencies required by the CM@Risk, owners need to figure out why a contingency is needed, for what it is to be used, and to define the use and ownership of the contingency and disposition of any remaining balance.

One of the overriding issues with contingencies is how they are accounted for in the final numbers. Many times, we see overhead, and profit markup applied to the CM@Risk contingency for change orders. This sometimes constitutes a doubling up of overhead and profit. It's important to remember, a change order paid from the CM@Risk contingency has already been marked-up for overhead and profit in the GMP.

The construction phase starts when the CM@Risk advertises for the first subcontract. Some States require that subcontracts be procured according to public procurement laws. Others allow the CM@Risk to handle all the bidding without an open book. The best way to make sure you get the appropriate value and quality is for the CM@Risk to have open books and always include the owner in the bidding process. The perception that competition is limited can only be mitigated by the open book approach. Local contractors should have the opportunity to bid. If you have an out of town CM@Risk that is based in a State far from the project site, there is a great deal of certainty that many of the subcontractors will come from out of town, and it is hard to accept that the subcontractor who must live in hotels for the duration is cheaper than a good prequalified local subcontractor.

#### **CM@Risk Audit Findings:**

Audits Definition- Systematic or methodical review; to examine with intent to verify. Most audits are done after the project has been completed and all monies (retainage) are released or paid to the CM@Risk. MBP has been involved with performing limited construction audits on several projects for clients to ensure the CM@Risk billings are accurate and in accordance with the contract documents. We have seen the owner received a Return of Investment (ROI) of up to 2:1 from our construction audits. Our main focus was around the following items:

1. Review of Contingency Use
2. Review of the GMP and Subcontractors Contracts
3. Review of the Monthly Pay Applications
4. Review of Change Order Request

#### **Lessons Learned:**

- Contingency Use- many public agencies state that any use of the contingency has to be approved by the Owner. Also, any unused contingency is shared between the CM@Risk and Owner. The key is to understand how contingency will be addressed in the contract.
- GMP Schedule of Values (SOV) vs Subcontractor Agreements- The main concern with Owners is verifying what was in a CM@Risk GMP contract was truly based on their subcontractor agreements. (There are issues with some CM@Risk not truly being transparent on explaining to the Owner why the numbers changed)
- Documentation – You should verify that you have all the documentation that is needed to perform a thorough audit. (i.e. change orders, allowances, pay applications, and multiple pay applications if there is more than one phase of the project).
- Arithmetic – You should verify the accounting of all allowances and change orders as they are deducted from the Contract amounts are accurate. – (an example we have seen is that in multiple GMP phase contracts, the previous contracted amount was not deducted from the successive GMP contracts).
- Mark Ups – You should review in detail the mark ups on change orders applied to the owner and construction contingencies as well as the project allowances. On a CM@Risk project the



Prime is not allowed to markup Change Orders that are applied to the Construction Contingency or Allowances. The Prime can markup Change Orders applied to the Owner Contingency.

- Self-Performed Work – On CM @ Risk projects, you should identify what percentage work was performed by the Prime. There is typically a limit on how much work the Prime Contractor can perform.

### **Summary:**

Owners may face challenges in determining the best delivery method for their construction programs. It is important that owners have a full understanding of procurement process requirements and the project risks when pursuing the CM@Risk delivery method. Is the CM@Risk delivery method adding value to your program/project as it relates to time, budget and quality? Are owners capable of managing a CM@Risk project from Programming phase to Construction Closeout. Below are some Solutions and Recommendations that owners should consider from MBP, based on our role of being an independent Owner's Representative on CM@Risk delivery method projects:

Solutions and Recommendations:

1. Develop a list of permit reviews and other activities that will take time, cause design to slow, or otherwise have an effect on the overall schedule. Make sure the CM@Risk incorporates these into the schedule individually and linearly. Do not allow "bundling" of schedule activities. This obscures the durations and allows the CM@Risk an advantage over the owner and A/E. The more detail is in the schedule and the more the owner has provided input, the greater chances for an on-time finish and success of the project.
2. Hire an agency construction manager (owner rep) to assist owners through the design phase and construction phase, to review the submitted costs provided by the CM@Risk for the GMP. This will ensure that the project budget stays on track and that all project related cost are accounted.
3. Hire an agency construction manager (owner rep) to perform a detailed review of the design and construction phase schedules, starting with the baseline and monthly updates during each phase.

Engaging an Agency Construction Manager earlier in the Planning process will add peace of mind. They will provide independent confirmation that all information has been thoroughly reviewed. This will go a long way in developing and keeping the trust with the project team.

# How to Get More from Your Performance Data with Microsoft's PowerBI<sup>1</sup>

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## **Executive Summary**

*This paper outlines the process for creating a Performance Dashboard in Microsoft's PowerBI that will enable an organization to see their data in new ways. PowerBI lets you upload, model and create measures to help you explore your data with visualizations organized in reports and dashboards. This paper will outline the processes for creating a dashboard in the PowerBI application. It will cover:*

- *The Microsoft Power BI application*
- *Data and Relationship Managers*
- *How to create data visualizations*
- *How to format data visualizations*
- *How to create data slicers and cards*

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<sup>1</sup> *The views expressed in this paper are those of the authors and do not necessarily represent those of the U.S. Census Bureau.*

# Microsoft Power BI

## What is Microsoft Power BI?

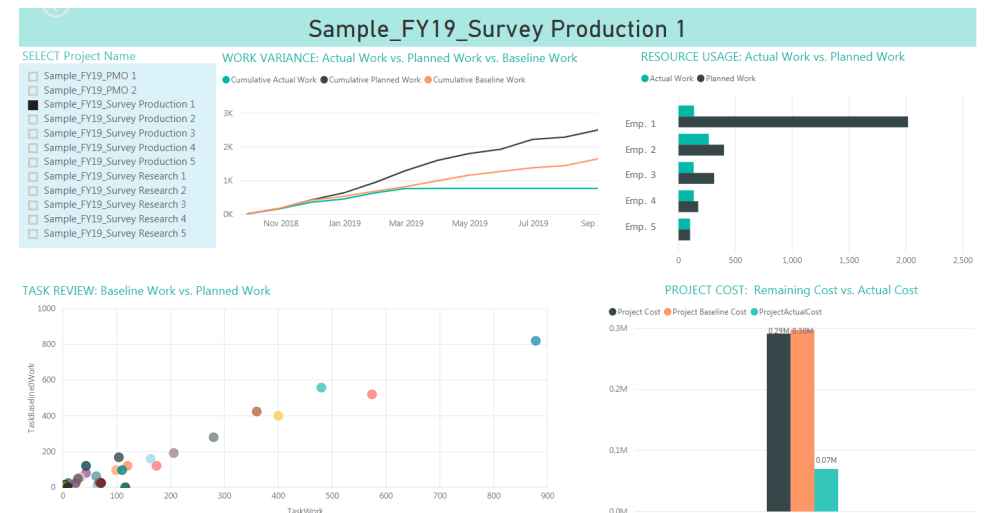
- Power BI is a Microsoft business analytics application and service that combines tools from Excel and Access into an easy to use format.
- It provides interactive charts and graphs, called visualizations, with self-service business intelligence features.
- It allows users to create reports and dashboards by themselves without any advanced database knowledge or dependence on IT staff.

## What are the Benefits of Microsoft Power BI?

- Makes your data stand out - your data becomes more life-like and gets noticed!
- Helps your stakeholders understand complicated problems with clear and easy visuals
- Visualizations show the big picture. Dashboards make it possible to see relationships and aspects of your data that you missed before.
- Quickly creates visually appealing drag-and-drop graphs and charts that give meaning to your data – without having any advanced data knowledge
- Brings your charts and graphs into the modern age by creating crisp and clean data visualizations

## Where can I get Power BI?

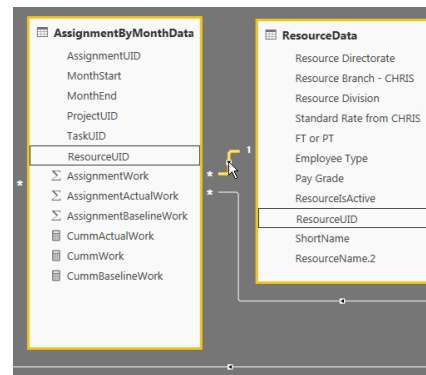
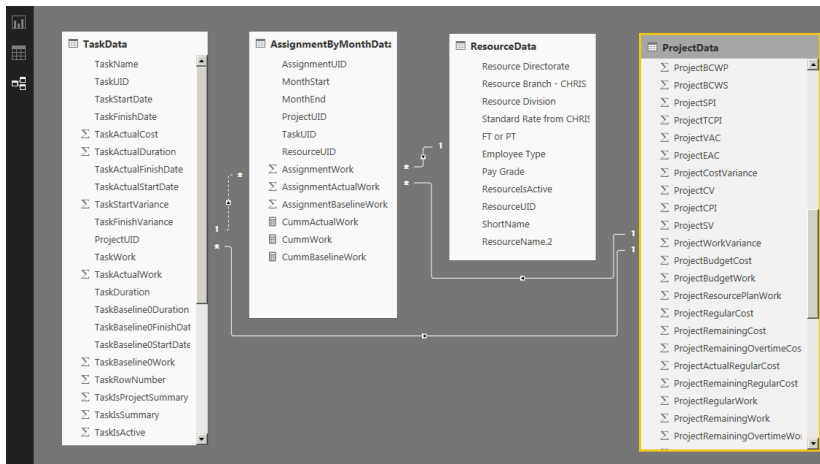
Power BI Desktop is free and you can download it here: <https://powerbi.microsoft.com>



# Data and Relationship Managers

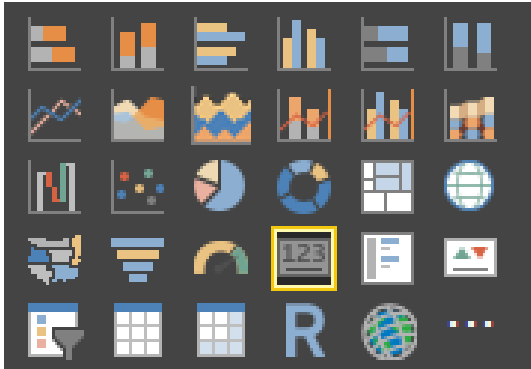
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PRIVATE PRINCIPALS - NTPS 17-18 - Receive Final ISR File from AD	7E947F55-DEDE-4525-9344-121F4FC0D018	6/14/2018 8:00:00 AM	6/14/2018 5:00:00 PM	0	0	NULL	NULL	
Finalize School Weighting Specification after CHAD to Incorporate	A5157101-417A-4FD8-8845-1253D08957C37	6/14/2018 8:00:00 AM	6/14/2018 5:00:00 PM	0	0	NULL	NULL	
NTPS 17-18 Data Collection Planning	E64A9808-F757-462F-A418-12CA7724D8C6	6/14/2018 8:00:00 AM	6/14/2018 5:00:00 PM	0	0	NULL	NULL	
City Teacher Unit NRBA (Base and Final Weighted (Files, Tables an	24E88F4E-03DE-4459-8410-12F5F8708D66	6/14/2018 8:00:00 AM	6/14/2018 5:00:00 PM	0	0	NULL	NULL	
NTPS 17-18 Bias Analysis Sections of the "Response Rates" chap	D5970919-F9F4-477D-ASF9-153807540725	6/14/2018 8:00:00 AM	6/14/2018 5:00:00 PM	0	0	NULL	NULL	
Receive Unit Response Rates from ADOP for Principals	2F4A9511-F254-4625-93C9-13412884D48E	6/14/2018 8:00:00 AM	6/14/2018 5:00:00 PM	0	0	NULL	NULL	
PLAN 1 of 2: NTPS 17-18 School, Principal and Teacher Weighting	864835C7-F263-4738-9109-144456F99426	6/14/2018 8:00:00 AM	6/14/2018 5:00:00 PM	0	0	NULL	NULL	
NTPS 17-18 Non-Response Bias Analysis Plan	C7F8E9CD-68F1-4985-908B-1528A7299C19	6/14/2018 8:00:00 AM	6/14/2018 5:00:00 PM	0	0	NULL	NULL	
Week 12	1902C44B-734B-41CC-902B-1594463C9F9C4	6/14/2018 8:00:00 AM	6/14/2018 5:00:00 PM	0	0	NULL	NULL	
Teacher Item Bias Analysis - PRIVATE	A132801F-1F6C-4550-881B-101FCD2D0C7	6/14/2018 8:00:00 AM	6/14/2018 5:00:00 PM	0	0	NULL	NULL	
DSMD Internal Review and Comment Draft 1	07868815-2D1C-499C-895C-16A103588398	6/14/2018 8:00:00 AM	6/14/2018 5:00:00 PM	0	0	NULL	NULL	
Incorporate Comments Draft 1	053107AD-3308-4308-AB9F-16C7AC913449	6/14/2018 8:00:00 AM	6/14/2018 5:00:00 PM	0	0	NULL	NULL	
PUBLIC PRINCIPALS - Principal Weighting - CAN START AFTER SCH	85EC0A2D-2529-4A09-BACE-17CE4084C9F9	6/14/2018 8:00:00 AM	6/14/2018 5:00:00 PM	0	0	NULL	NULL	
DSMD Internal Review and Comment Draft 1	5046C038-4F44-44D0-8267-17CD093AA58D	6/14/2018 8:00:00 AM	6/14/2018 5:00:00 PM	0	0	NULL	NULL	
NTPS 17-18 Teacher Weighting Specifications Complete	1C2864F2-38E8-40F5-888E-183A702132D6	6/14/2018 8:00:00 AM	6/14/2018 5:00:00 PM	0	0	NULL	NULL	
NTPS 17-18 Programming School and Principal Weighting and Ver	1803DE7B-244C-4F19-8295-18B869ED4966	6/14/2018 8:00:00 AM	6/14/2018 5:00:00 PM	0	0	NULL	NULL	
Week 13	8FF16C5A-77D6-4485-8433-1958A4545623	6/14/2018 8:00:00 AM	6/14/2018 5:00:00 PM	0	0	NULL	NULL	
Teacher Weighting Spec Draft 2	A0E77ED8-09F9-4F45-4775-19D0320263C0	6/14/2018 8:00:00 AM	6/14/2018 5:00:00 PM	0	0	NULL	NULL	

Managing data in Power Bi is very similar to Excel. The data is displayed in spreadsheets and you have all of the formatting tools from Excel available to you. It is in the data manager where you can add in variables for your dashboard visualizations, change a data type, or correct typos and other problems with your data. You also can access data queries and advanced editors here.



Power BI has a relationship manager similar to what you would find in Access. The relationship manager shows the fields within each table and then shows the data relationship linkages between the data sets. These linkages between the data sets are important as they allow you to combine data from different tables into one visualization. Each linkage will have a one to many relationship and the lines and highlighted fields show which items are linked between the tables.

# Data Visualizations in PowerBI

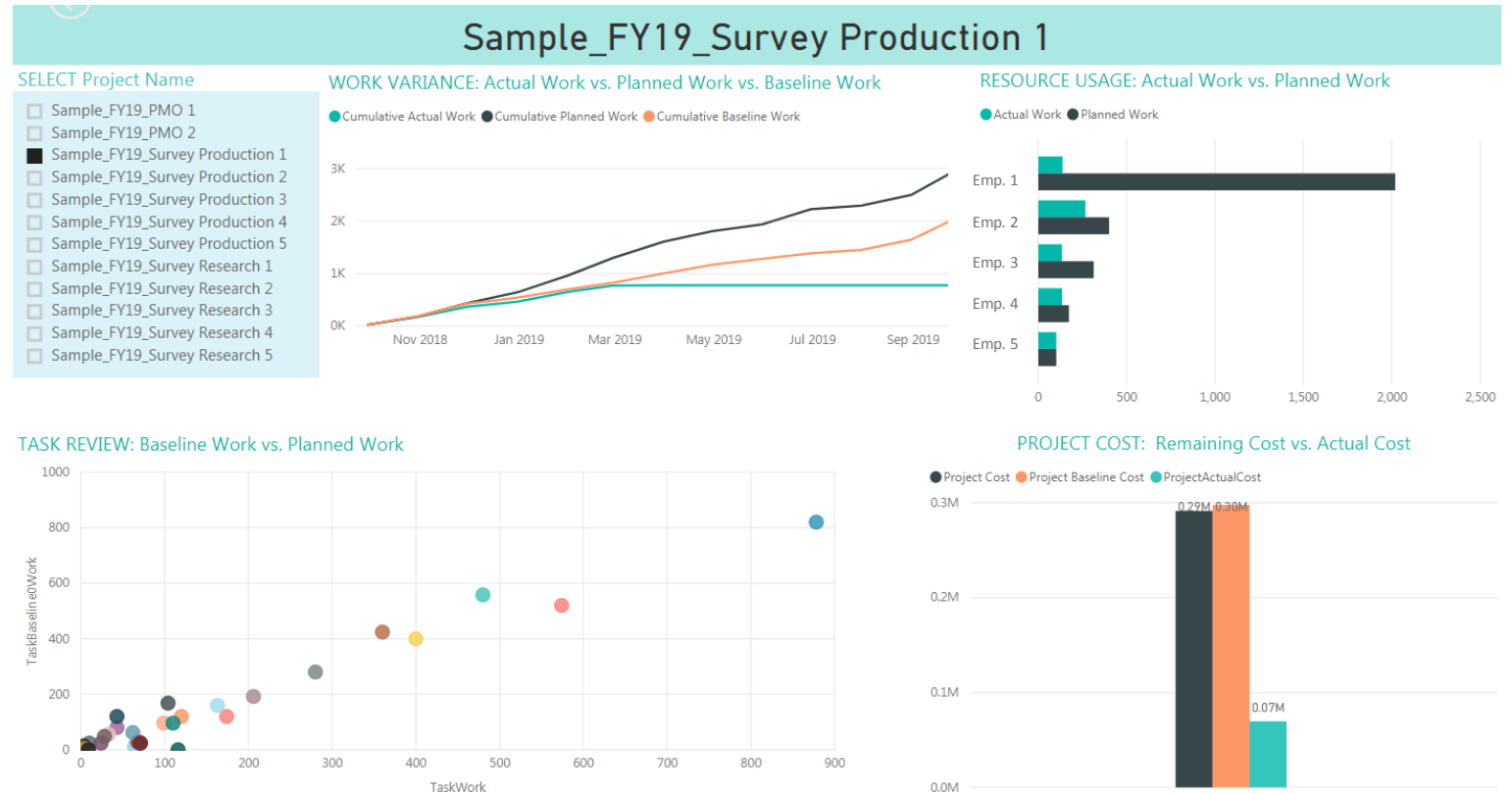


In the report section of Power BI you are given a blank sheet and access to many visualization options. We will show you how we created the dashboard shown here and provide details on how to use the Power BI controls to add data fields and format the charts.

We will cover how to create a slicer, a card, a clustered column chart, a clustered bar chart, a line chart and a scatter chart.

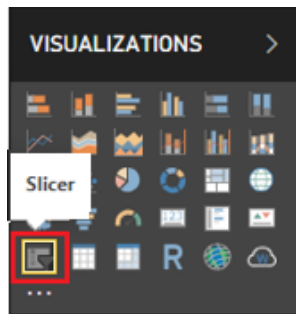
Power BI offers many other “out-of-the box” visualizations such as:

- Charts – Waterfall, Pie, and Donut
- Maps – Filled, Tree, and ArcGIS
- Funnel
- Gauge
- KPI
- Word Cloud

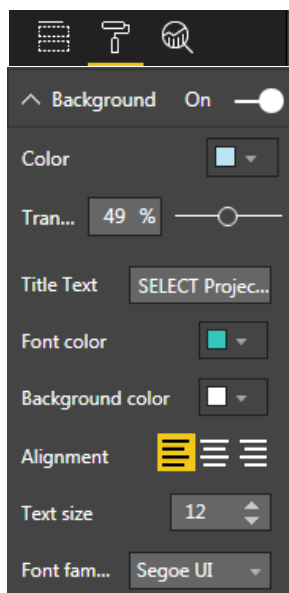


Dashboard with the visualizations we will be discussing.

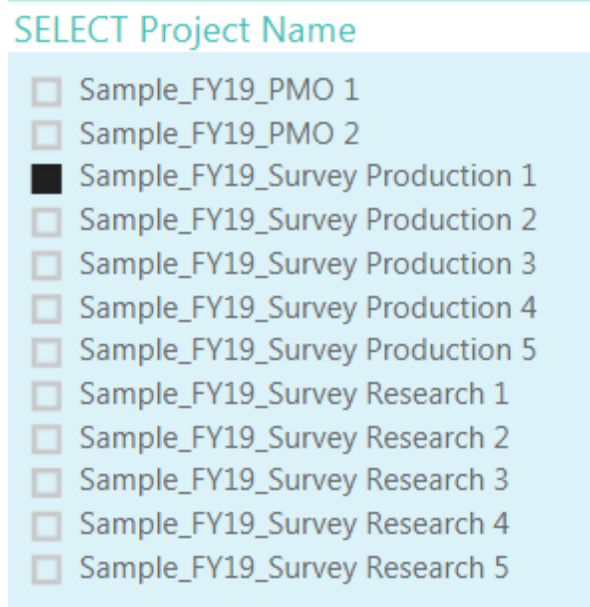
# Data Slicer



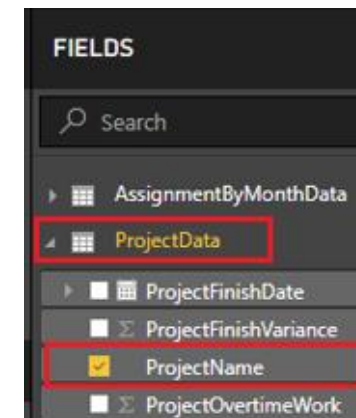
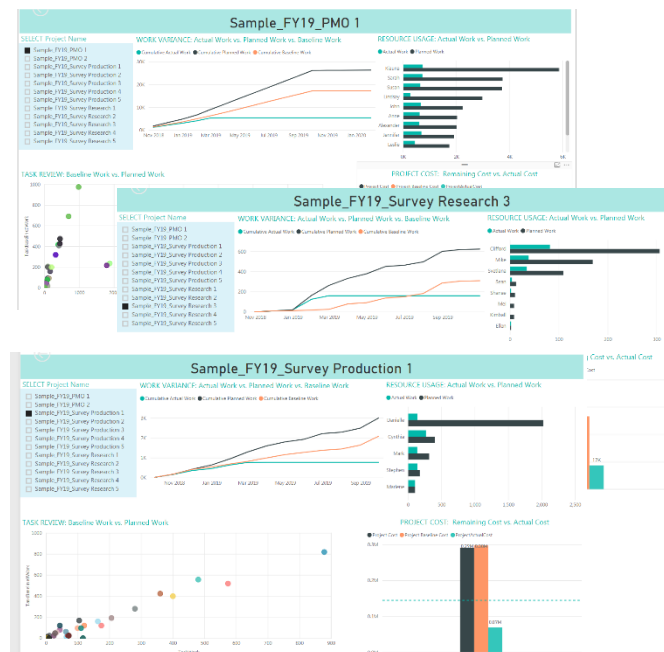
Select the Slicer icon from the Visualizations



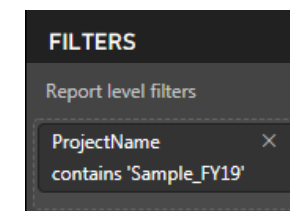
Use the Format section to set the background color and the title text, font, size and color



A Data Slicer is the best thing since sliced bread. This feature will save a lot of time by allowing you to build the measures once and then use them for multiple projects/data sets. Above we show 3 of the 12 dashboards that the slicer created. Each card and chart on the dashboard reflects the data specific to the item (project schedules in this case) that is used in the slicer.

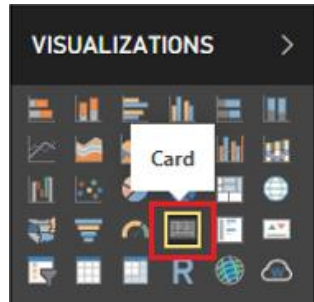


Use the Fields section to populate the item to drive the slicer. Here we used the Project Name field from the ProjectData table.



Use the Filters to limit the data that is in the slicer. This is a useful feature when you are using a large data set.

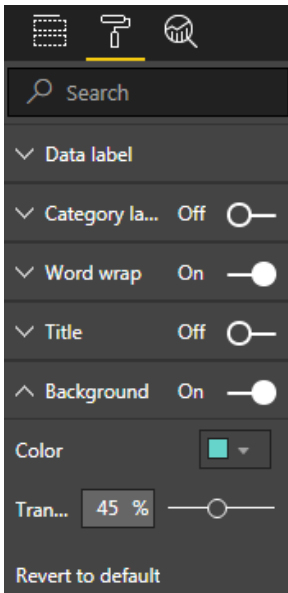
# Data Card



Select the Card icon from the Visualizations.

## Sample\_FY19\_Survey Production 1

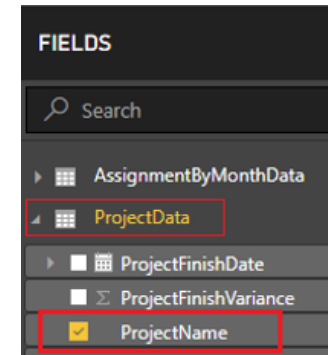
The card is useful for displaying or highlighting important information. We used the card as a title bar for the dashboard and were able to use the project name already included in our data. Shown below are examples from another dashboard project. The bottom example used data already included in the data set and the top example needed it's data built into an excel file and then added to PowerBI.



Use the Format section to set the background color and to turn off labels and titles that may distract from the card content.

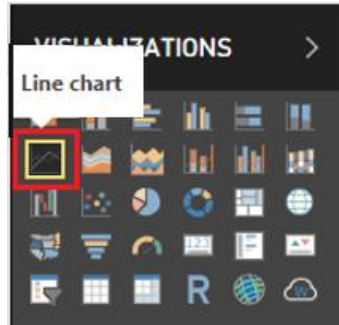
The Consumer Expenditure Surveys (CES) are monthly ongoing computer-assisted personal interviewing (CAPI) surveys sponsored by the Bureau of Labor Statistics. Together, the CE surveys provide a current and continuous series of data on consumer expenditures and other related characteristics used to revise the Consumer Price Index (CPI) and in expenditure studies and policy analyses.

Will look into adjusting operating plan to better reflect monthly projections. Also there was some unplanned work in November.

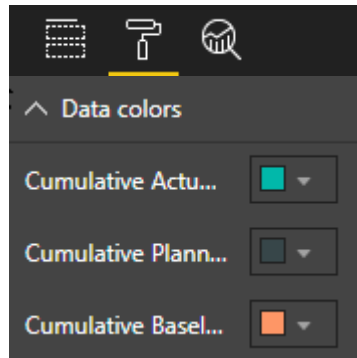


Use the Fields section to select the data to showcase.

# Work Variance Line Chart

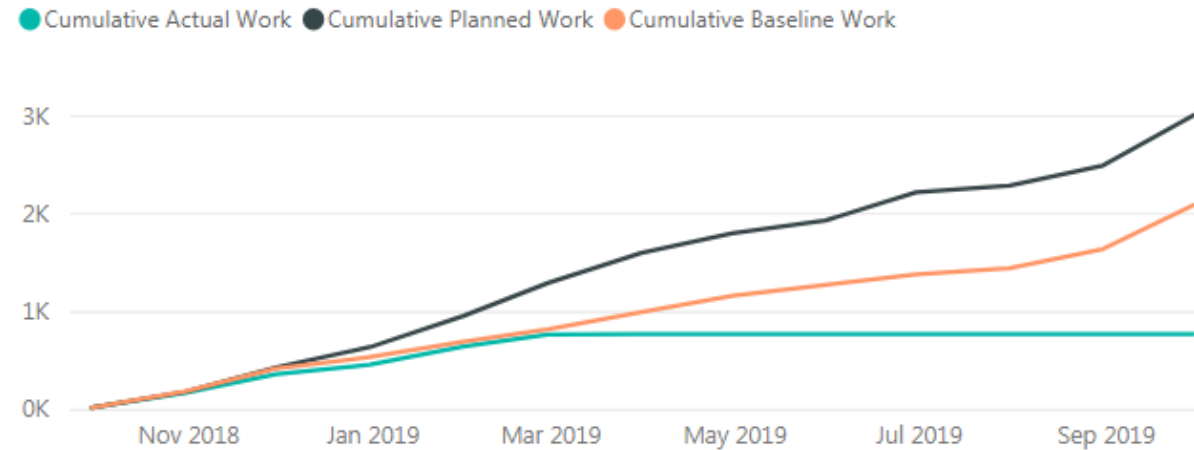


Select the Line chart icon from the Visualizations.

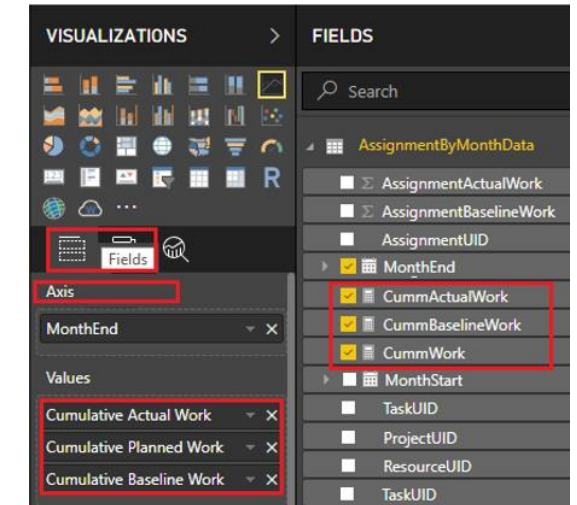


Use the Format section to set the line colors.

WORK VARIANCE: Actual Work vs. Planned Work vs. Baseline Work



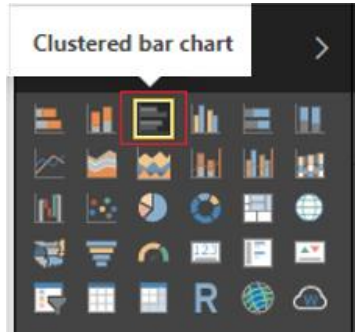
A line chart works well for showing the variance from baseline to plan and plan to actual. Looking at this chart you can see quickly that the planned work changed from the baseline in December and the actual work is following closely to the revised plan. Note: Actual work values are only updated through March 2019.



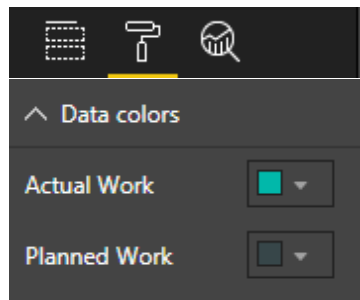
Use the Fields section to set the axis value and select the data values for the lines.



# Resource Usage Clustered Bar Chart

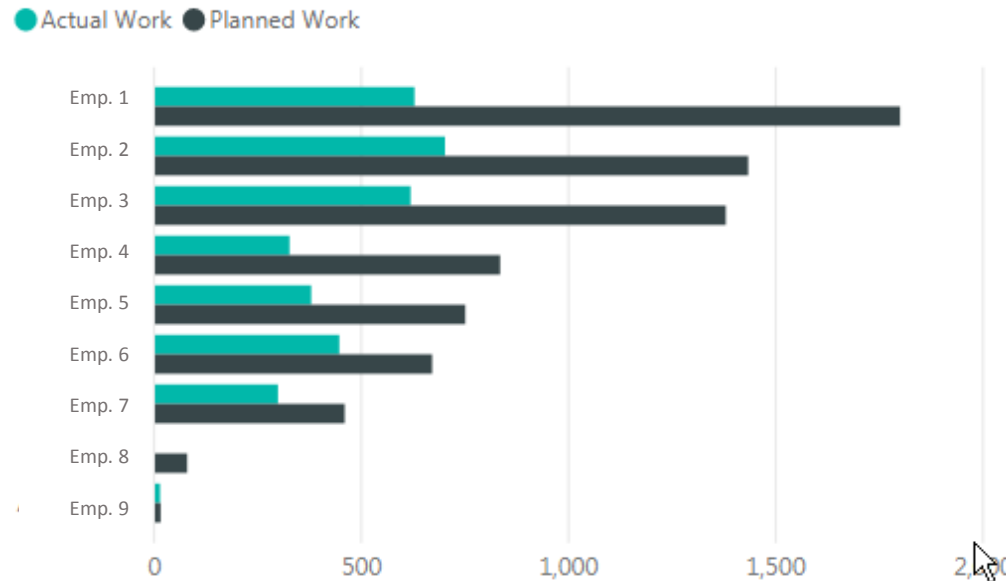


Select the Clustered bar chart icon from the Visualizations.

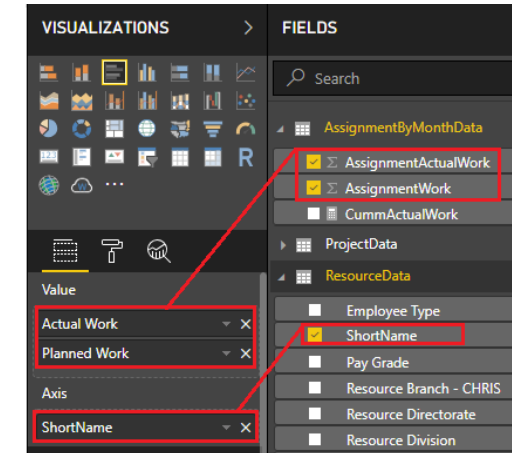


Use the Format section to set the bar colors.

## RESOURCE USAGE: Actual Work vs. Planned Work

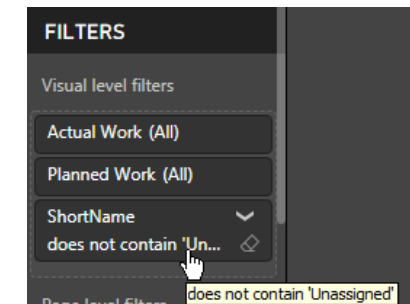


A clustered bar chart works well when you want to have data sets broken out into multiple categories. Here we show planned to actual work assignments broken out by assigned project resources.

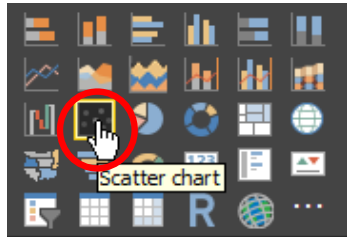


Use the Fields section to populate the values with actual and planned work. Add an Axis field to break the value data out into categories.

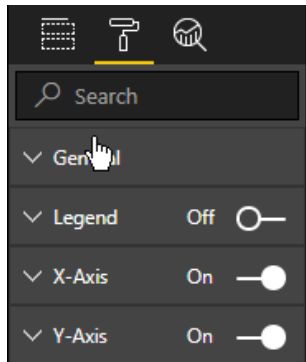
Use the Filter section to restrict values in your chart. Here we use it to eliminate the "unassigned" values from the chart.



# Task Review Scatter Chart

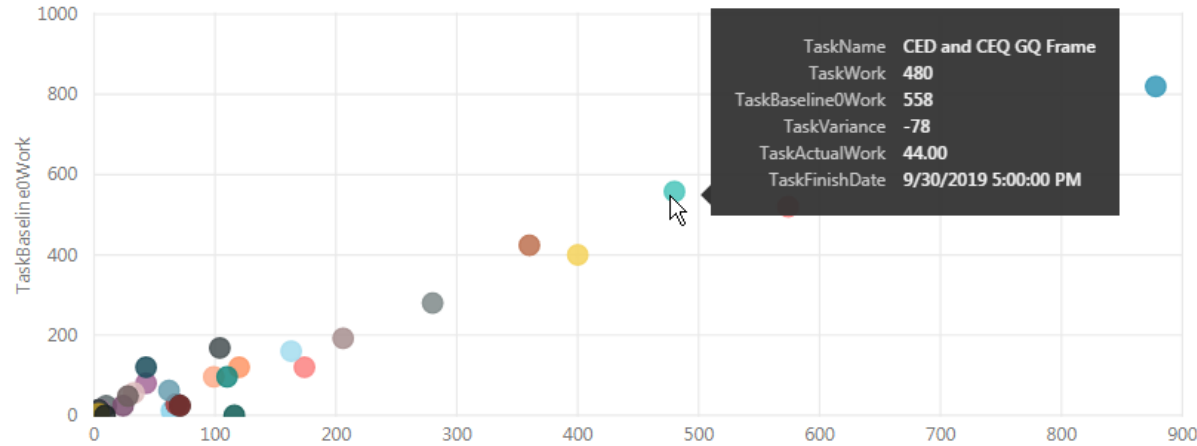


Select the Scatter chart icon from the Visualizations

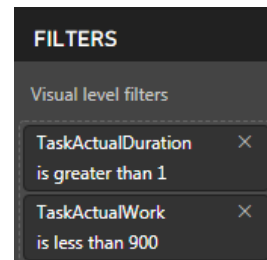


Use the Format section to turn off the legend since there are too many items to display.

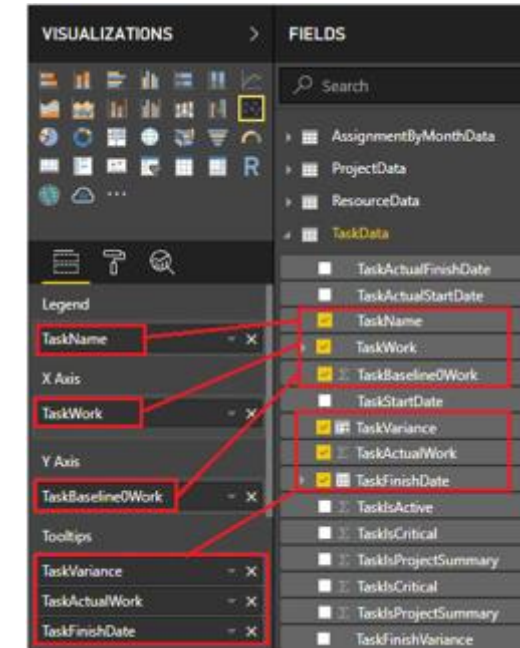
TASK REVIEW: Baseline Work vs. Planned Work



A scatter chart is an interesting way to show variance for many data points. Here we use it to show the baseline to planned variance for work tasks. A large variance will be drawn to the left or right of the central line. Tasks with large values will be positioned at the top right corner of the plot.

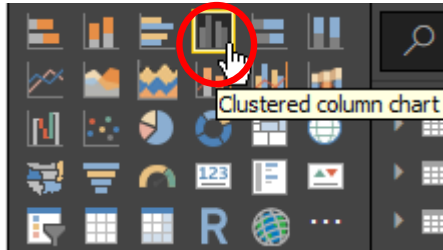


Use the Filters to take out data points with zeros and large items. (In this case we eliminated incomplete items and summary lines from the schedule.)

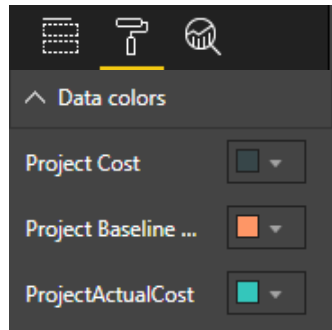


Use the Fields section to select the legend and x and y axis data values. Adding Task Name to the legend makes the dots different colors. Use the tooltips function to add more information about your schedule task in the popup box.

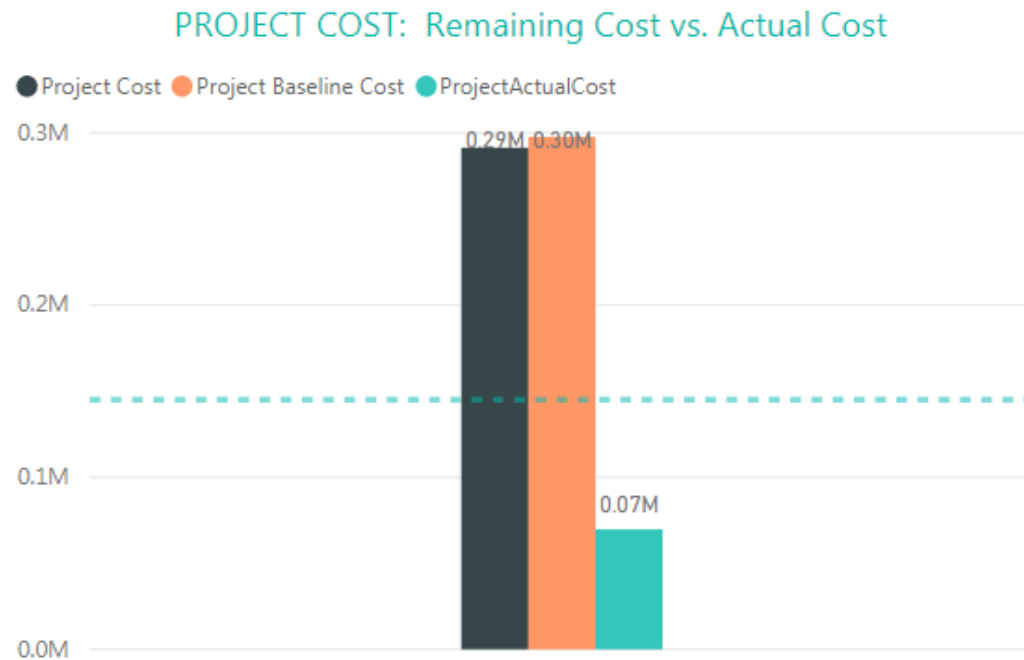
# Project Cost Clustered Column Chart



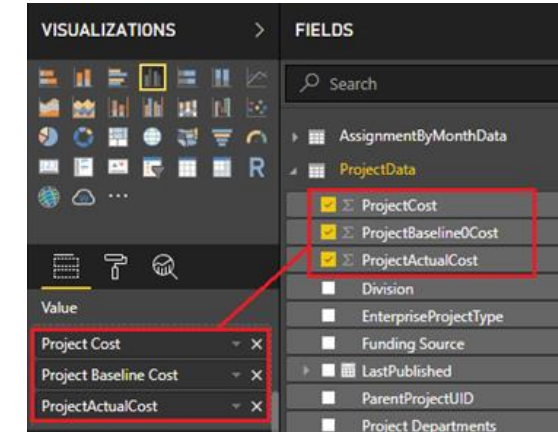
Select the Clustered column chart icon from the Visualizations.



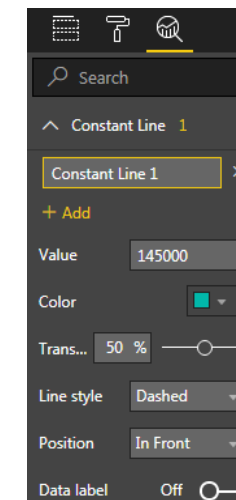
Use the Format section to set the column colors.



A clustered column chart is one way to show summary data for baseline, planned and actual costs for your project. Note: The actual work column reflects actual costs through March 2019 and the planned and baseline costs are for the whole year. The fiscal year begins in October so costs through March represent half the year. We added a trend line to show the half year value for baseline costs. The constant line in analytics works for this specific chart but will be inaccurate for other projects when you use a slicer.



Use the Fields section to select the data values.



Use the analytics section to set a trend line. Here we set the value to equal the half year value of the baseline costs to represent the passage of half of the fiscal year.

# How to Recognize Project Failures and Initiate Project Recovery

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[jim.roessling@clarkconstruction.com](mailto:jim.roessling@clarkconstruction.com)

## Abstract

This paper is to feature the importance of recognizing several causes of project failures and initiating the recovery of the construction projects at the initial stage. Project failure can happen to any organization and to any level project. There are numerous reasons for failure and sometimes it is out of control of a project manager or team members to control failure. Failed projects and people involved with the failure have few things in common. In such cases, they are directed for quick fixes which typically prove to be ineffective and sometimes causes catastrophic side effects. In this paper, we will discuss and emphasize several factors causing project failures, how to classify and categorize project failures, how to conduct, plan and develop an assessment process for project failure. With these key focus areas for assessment, project controls and management review process could be analyzed and can be selected. The study will also help to clarify the necessity and a suitable process an organization should develop to analyze project failures.

## Introduction

For contractors, both GC's and subs, an effective project is one finished on time and within budget. The client is happy with the finished product and the contractor leaves with a clean benefit. Everyone wins. At the point when construction project comes up short, it's regularly because of conflicts and issues that cause cost overruns and delays in the schedule.

If not properly managed, it will eventually lead to running over budget and blowing past the scheduled substantial completion date. Going over budget eats into the GCs or subs profit in addition to being hit with liquidated damages for every day past the

agreed upon completion date. It can also impact upcoming projects if a contractor's workers and equipment are tied up trying to finish up a failing project.

So, what causes the project to fall flat? Any number of variables can lead to project failures, yet often it comes down to how well the project manager or leadership performs regulating the project.

## **Factors affecting project failures**

- a) **Under estimating the project:** A standout amongst the most widely recognized – and expensive! – reasons a project may fall flat is because of an inaccurate estimate. Miscalculations, specification errors, oversights, excluded permits, and changing economic situations (e.g., costs of materials and work) can all lead to costly overruns, leaving the contractor stressed and the client unhappy.
- b) **Scope Creep & Change Orders:** Scope creep depicts the procedure in which the amount of work grows beyond the original contract or DPP (Detailed Project Plan). The three-fundamental driver of scope creep include:
  - 1. Owner requests that are out of the scope of work originally settled upon
  - 2. Unforeseen or general conditions that are unknown to the contractor at the time the contract is signed
  - 3. Owners not doing thorough preliminary work (e.g., site surveys, proper planning, Geotech report etc.)

While the number one goal of any project is a happy Owner, this can now and again move toward becoming traded off in the event that they consistently make demands without thinking about the cost or don't give you the most exact data forthright.

- c) **Delays:** Government approvals, site regulations, and permit delays moderate down the timetable for your project and can cause cost overruns if not accounted for correctly. Contingent upon your area, you may need to consider union requirements and area-specific rules such as building codes. Making sure you have the correct licenses before beginning a project is also essential to prevent delays.

- d) **Surprise conditions:** General Conditions obscure to the project manager can rapidly turn into an issue and keep running up the costs of a project. Cataclysmic events, asbestos, mold, soil conditions and structure or auxiliary issues are the principal offenders and can be hard to plan for during the bidding process. Be that as it may, neglecting these potential issues can result in higher costs and risks associated with the project.
- e) **Unclear Specification:** Owners don't generally comprehend everything that needs to be fleshed out to make sure necessary objectives are clearly identified and the construction project runs smoothly. Unclear specifications can become very costly, especially when the owner's and contractor's interpretations differ significantly.
- f) **Financing Issues:** You've consented to the scope of work and a schedule for the project. Things are going easily until out of the blue, the owner runs out of money to finance the project. Construction is stalled and delays the project. You lose out on a significant amount of time and money as a general contractor because that business might not come back if they can't provide the funds.
- g) **Unreliable workers or subs:** A lack of qualified workers or a team that is unreliable is a recipe for disaster when it comes to construction projects. It is particularly imperative to vet your subcontractors, who can tarnish your reputation if they don't do their part or, even worse, don't pay their suppliers. Since the construction projects depends so intensely on other individuals, it is imperative to realize who you're working with and on the off chance that they can be trusted to work admirably.
- h) **Communication gaps:** Effective communication is incredibly critical to the success of any project. When any of the parties involved aren't getting the right information at the right times, it can become a very costly issue. It is vital to establish a chain of command to make sure that all parties are getting the necessary updates regarding changes on the project, design, plans, specs, or timeline. By building up a hierarchy of leadership, you know precisely who your point of contact is to communicate any changes, requests, or problems that may come up during the duration of a project. Everybody is considered

responsible for their specific duties and make sure the message gets transferred to the corresponding parties involved. For instance, the owner may communicate with the architect who will then share the information with the general contractor so that everyone is on the same page. *“Clear and concise communication can either make or break your project”*.

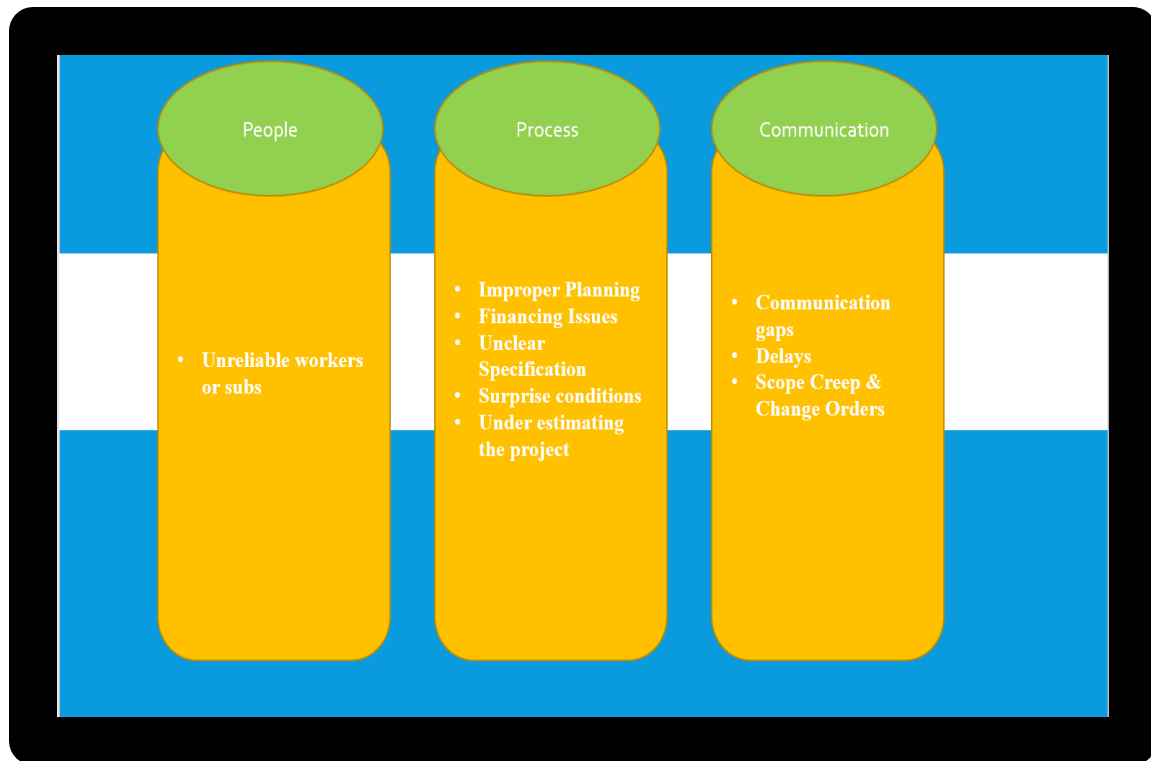
- i) **Improper Planning:** Tight, inflexible schedules are normal in construction projects. If you don't account for surprises or delays, a project can take longer and cause cost overruns. It is critical to constantly monitor project tasks closely to ensure they're catching up with the assigned duration given when planning. Issues can frequently arise, so making sure the details get consolidated into the plan and communicated with the necessary parties (i.e., owner, architect, contractor, etc.) is important.

## **Categorization of project failures**

Categorizing the several project failure factors above into broader categories, helps to focus the assessment and recovery planning tasks around a few broad categories, for which there are numerous assessment tools, recovery planning techniques, and a reasonable amount of assistive literature. Classifying project problems into one or more of these categories becomes a fundamental part of assessing the project's present circumstances, developing a recovery project plan and assembling a team to achieve what is needed to get the project back on track.

Above several project performance factors indicates that they can be classified into three broad categories:

- People
- Process
- Communication



*Figure 1- Categorization of Project Failures*

## **Assessment process of construction project failures**

Every company that employs projects to accomplish its business goals needs to build up a formal evaluation process for failing projects and needs to have trained assets, ready to respond to project emergency requirements. The question emerges as to whether “in-house” or “outside” resources are best for undertaking project evaluation. It is more beneficial to employ resources from outside of the organization where the failing project is operating.

**The project assessment process consists of five distinct phases (ESI, 2005):**

- **Define the assessment charter:** The motivation behind the assessment charter is to set up the authority of the assessment team to explore all parts of the coming up short project, to talk with all project resources, and to access all project intellectual property and project records.
- **Develop the assessment plan:** After the assessment charter is approved, the next step for the assessment team is to develop an assessment plan. The purpose



of assessment plan is to establish what activities the team will execute to achieve the objectives of assessment charter.

- **Conduct the assessment**
- **Analyze data gathered; prepare findings**
- **Report findings to stakeholders**

In addition to this, assessment team needs to focus on thoroughly investigating project variable common to most construction projects:

- Work breakdown structure or project schedule
- Risk management plan
- Deliverable defects
- Human and other resources on project
- Project processes

## **Project control & Management process**

Apart from focusing on areas of assessment shown above, the team needs to review and analyze project control and management process of the failing project has in place right now and determine changes to bring the project back on track. The following controls and management process should be reviewed;

- Monitor your schedule and critical path activity weekly, create a schedule and plan accordingly so that schedule includes some slack time to take measures for unforeseen conditions
- Clear and concise communication, establish a chain of command, hold everyone accountable for their specific duties and make sure messages gets transferred to all parties involved
- Create a sound budget in the initial stage of the project, focus on gross monthly billing curve
- Maintain long-term Subcontractor relationships and repeat business will help to minimize issues as you are already familiar with their work ethic and capabilities

- Develop a contingency plan for unforeseen conditions, develop a risk matrix at the beginning of the job and assign risks to appropriate parties
- Proper Resource Allocation and levelling during a project's life cycle should be provided
- Monthly project update meetings, review of Key Performance Indices (KPI) and taking appropriate actions to lagging KPI indicators
- Create a plan for submittals, closeout, commissioning and material tracking on the project to avoid any schedule delays
- Encourage your owners or clients to do their due diligence at the beginning of the project to avoid scope creep.

## **Early Mitigation Measures**

Project wellbeing is analogous to the health of an individual. There are always signs and symptoms of an unhealthy project. Through proper checkups and corrective actions, most issues can be caught early and resolved. The project manager practitioner can utilize lagging and leading indicators of project health to mitigate project failure risk factors.

Useful lagging indicators in project management revolve around the concept of comparing the as planned condition to the actual performance of the project. Metrics have been developed for both finance and schedule. Some specific examples are the cash curve, payment status, and days ahead/behind. These can be developed as Key Performance Indicators for the organization. Any deviation from the as planned condition will raise alarms and cause a deeper dive and mitigation execution.

Leading indicators that have been successful in prevention of poor performance are submittal and material tracking. Ensuring material/equipment delivery on time prevents delays and financial impacts. Many projects are impacted by lengthy submittal approval. Management should develop a tracking process to abate risk of submittal setbacks. It is critical to understand the lead time of the material or equipment. Collaboratively working with the subcontractor to get the vendor

fabrication/procurement schedule is a useful performance tracking tool to prevent delay.

One of the most powerful tools in mitigation and prevention of project failure are the front-line leaders. These are the project engineers and project managers. This group of influencers should be empowered to make timely decisions with the understanding of the senior leadership's intent and project goals. The individual needs to understand the balance of decision-making authority and when it is deemed necessary to pull in the next level of management. The first-tier leaders will see potential problems developing before others and can take impactful preventative action. Their ability to make sound decisions will guide the success of a project. Continuously training and developing this body should be a priority for an organization because many of the controllable issues related to project failure can be rooted in poor leadership.

Relationship development between all project stakeholders is critical to preventing and dealing with poor project performance. These stakeholders range from the owner's leadership down to the second-tier subcontractor foreman. Good communication and trust are the cornerstones to relationship building. Problems get resolved more quickly when the individuals trust each other and can collaborate. People don't care what you have to say until they understand how much you care. This factual simple statement emphasizes why relationship development is so important. Organizations should encourage its people to get to know everyone they work with on a personal level. Execution of good rapport building will reap benefits beyond any known metric. The relationships developed on today's project will possibly help resolve problems on the next one.

## **Conclusion**

Evaluating and recovering a failing project can be among the most challenging work for a project manager to perform for an organization. Nonetheless, the result can be enormous, since a project brought out of failure can provide significant value to a

firm. The several factors outlined in this paper are critical for assessing a failing project's performance and planning corrective action to make the project successful.

## **Reference**

Computing Technology Industry Association, (2007, March 6) web news release.

Retrieved June 27, 2007

from [http://www.comptia.org/pressroom/get\\_pr.aspx?prid=1227](http://www.comptia.org/pressroom/get_pr.aspx?prid=1227)

Discenza, R. & Forman, J. B. (2007). Seven causes of project failure: how to recognize them and how to initiate project recovery. Paper presented at PMI® Global Congress 2007—North America, Atlanta, GA. Newtown Square, PA: Project Management Institute.

ESI International (2005, February) Rapid Assessment and Recovery of Troubled Projects, a 3- day course taught as part of the ESI Project Management curriculum.

Fleming, Q. W. & Koppelman, J. M. (2005) Earned Value Project Management, 3rd edition, Newtown Square, PA: PMI Press.

Forman, J. & Discenza, R. (2006, October) Tools for Managing Projects: Adding Earned Value Metrics to Digital Dashboards to Report Performance of Active Projects Proceedings of the PMI Global Congress Proceedings – Seattle, Washington

Forman, J. & Discenza, R., (2007, June) survey instrument applied in a Fortune 100 company

# It's No Longer Enough to Simply Be Agile

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## ABSTRACT

A tremendous amount of literature has been published about the merits of agile development practices. But in today's environment, agile development practices are quickly being supplemented with major technology breakthroughs that enhance software quality, improve enterprise performance and provide business resiliency. This paper describes three major breakthroughs; services-based architectures, cloud computing, and DevOps practices. A brief overview of each technology is discussed and how the three technologies working together provide enterprise value. The paper concludes with a discussion on the skills and talents required to implement these technologies.

**Key Words:** agile, cloud, cultural shifts, development, DevOps, elastic computing, information technology, IT skills, operations, organizational structures, pipelines, DevSecOps, software development, software services, testing

This paper is based on empirical observations, current literature, and engineering and project management experiences.

## INTRODUCTION

Since the Manifesto for Agile Software Development was published in 2001, a tremendous amount of literature has been published that documents many agile software development frameworks such as Scrum, Kanban, and Extreme Programming. These software development frameworks have similar characteristics. All potential product features are placed into a feature backlog and prioritized for development, with the highest value features being developed first. Agile teams execute time-boxed work periods, typically called sprints, to develop these features. These sprints typically range from two to four weeks. Each agile team is composed of a small group of multi-disciplined developers that are focused on the continual delivery of valuable software. Within each team there is a Product Owner who is the voice of the customer, prioritizes the feature backlog, and accepts the delivery of each feature. There is also a person that facilitates team meetings and eliminates blocking issues that are inhibiting team progress. Within the Scrum methodology, this person is called the Scrum Master. There is a regular cadence of meetings within each sprint. The sprint commences with a Sprint Kickoff Meeting that determines what features the team will develop within the sprint. There are Daily Standup Meetings where the team reviews progress, identifies any blocking issues, and assigns work to be performed next. A Sprint Completion Meeting is held at the end of the sprint to review with customers and users outside of the agile team the actual delivery of the features that were developed during the sprint. Within the agile team, a Sprint Retrospective Meeting is also held where the team can identify and address potential improvements to team performance.

More recently, frameworks have been developed to scale agile development practices from a single team to multiple agile teams working in parallel to deliver larger systems. The most popular framework is the Scaled Agile Framework (SAFe) which adds additional team resources and process elements to synchronize the alignment, collaboration, development, and integration mechanisms of multiple agile teams to deliver large, more complex systems (Leffingwell and others 2017).

In today's environment, agile development practices are quickly being supplemented with major technology breakthroughs that enhance software quality, improve enterprise performance, and provide business resiliency. This paper describes three major breakthroughs; services-based architectures, cloud computing, and DevOps practices.

## SERVICES-BASED ARCHITECTURES

A services-based architecture, or microservices architecture, “is an architectural approach to developing a single application as a suite of small services, each running its own process and communicating over a lightweight mechanism, often an HTTP (HyperText) resource API (Application Programming Interface)” (Fowler 2014).

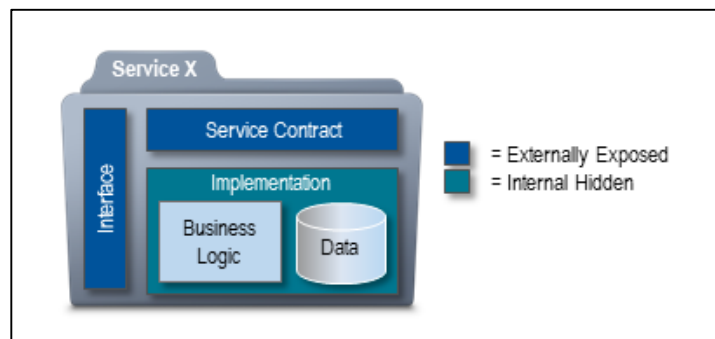


Figure 1: Service Components (Enterprise SOA: Service-Oriented Architecture Best Practices – 2005)

As shown in Figure 1, each service is:

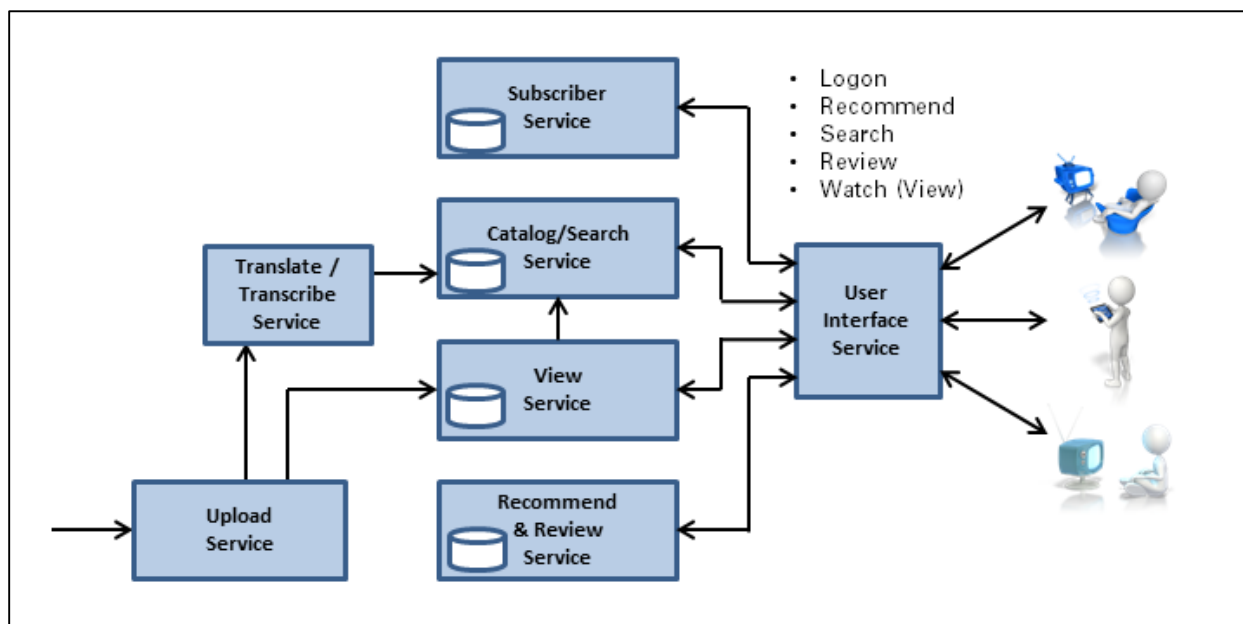
“a software component of distinct functional meaning that typically encapsulates a high-level business concept. It consists of several parts...The service contract provides an informal specification of the purpose, functionality, constraints, and usage of the service... The functionality of the service is exposed by the service interface to clients that are connected to the service using the network...The service implementation physically provides the required business logic and appropriate data. It is the technical realization that fulfills the service contract. The service implementation consists of one or more artifacts such as programs, configuration data, and databases...The business logic that is encapsulated by the service is part of the implementation. It is made available through the service interface.” (Krafzig, Bank, and Slama 2005)

Furthermore, a service must have the following attributes:

- The service is *self-contained* and performs a distinct business or technical function.
- The service is *loosely coupled*, meaning that it has an explicit contract (interface) independent of the technology of the invoking service consumer.
- The service is *transparent*, meaning that the specific location of the service is immaterial to the service consumer, with binding taking place at deployment or runtime.

- The service is *interoperable*, meaning that service interaction can be supported over a wide variety of platforms due to usage of compatible, industry standard communication protocols.
- The service is *composable*, meaning that it can be aggregated as part of a service at a higher level of granularity. (Bieberstein and others 2008)

Figure 2 provides an example of a video subscription site that is a composition of seven services and allows users to log onto the site, receive recommendations on videos to view, and allows the user to search, read reviews, select, and watch videos. This is a very simplistic example when compared to the Netflix video streaming service which provides over 114 million hours of streaming video each day to more than 117 million streaming memberships in over 190 countries and is implemented using 500 software services. (Anonymous2018)



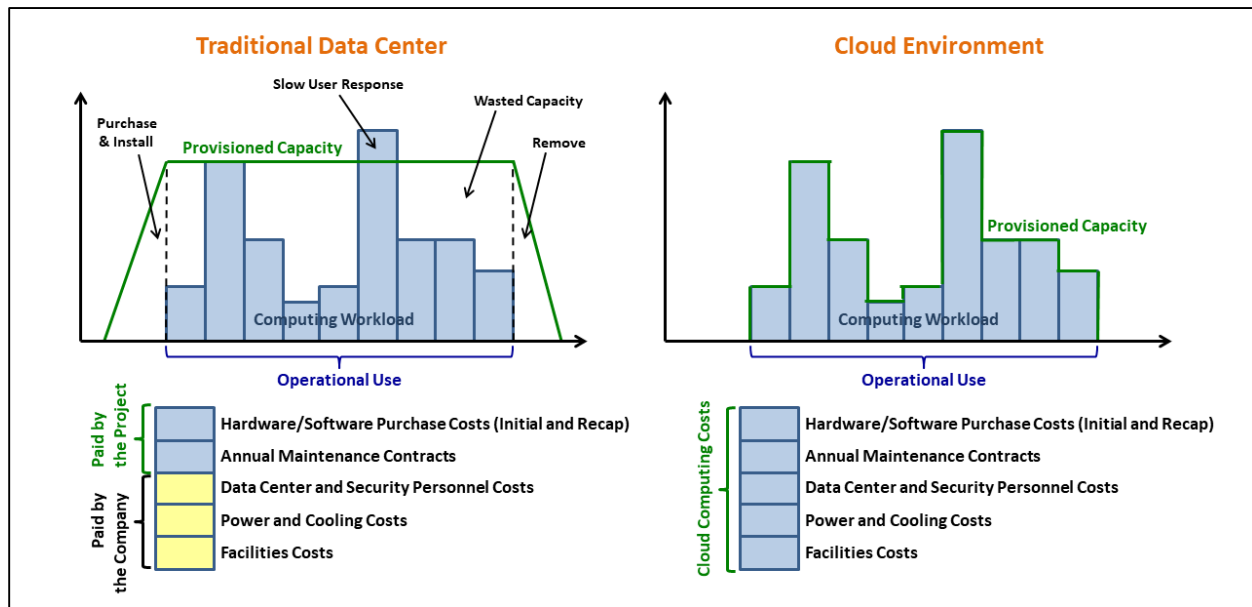
**Figure 2: Video Subscription Site - Service Composition Example**

A services-based architecture provides many benefits. It allows for faster and small deployments as each service can be independently developed and delivered without affecting other services. Each service can follow a single responsibility principle for the service, thus each service can implement the right framework, and use the appropriate technical skills, tools, and development language required for that specific service. It promotes the rapid insertion of new technologies and functionality. Each service can scale independently to meet the performance demands of that service, thus scalability is not required at the full application level, and it promotes greater resiliency, availability, and fault isolation as the loss of a single service may not result in a total loss of the entire application or site. (Tonse 2014)

## CLOUD COMPUTING

The National Institute of Standards and Technology (NIST) defines cloud computing as having five essential characteristics:

- On-Demand Self-Service: A consumer can unilaterally provision computing capabilities without requiring human interaction.
- Rapid-Elasticity: Can be quickly provisioned and released, automatically... commensurate with demand.
- Broad Network Access: Accessible through standard mechanisms to promote use by heterogeneous thin or thick client platforms.
- Resource Pooling: Provider's resources are pooled to service multiple customers using a multi-tenant model.
- Measured Service: Automatically control and optimize resources by leveraging a metering capability. (Mell and Grance 2011)



**Figure 3: Comparing Traditional Data Center Computing and Cloud Computing**

Figure 3 provides a graphical comparison of traditional data center computing to cloud computing. When installing a system in the data center, the project manager must predict the peak demand the system is expected to encounter and then purchase and install enough computing capacity to respond to this demand. The project manager must account in his schedule the time required to define, purchase, ship, receive, install, and configure these computing resources. In most cases, the computing workload demand will be less than the provisioned capacity, thus computing resources are wasted, but there is the possibility that computing workload demand could exceed provisioned capability thus some users may experience slow user response or may not even be able to access the system.

With cloud computing, the rapid elasticity of the cloud allows the system to add or reduce computing capacity in response to user demand. Furthermore, the system can be quickly defined and configured thus allowing for rapid provisioning and deprovisioning of resources without schedule delays. Cloud computing services incorporate technologies that promote the proactive distribution of computing workload across assets located in multiple locations therefore providing high availability and disaster recovery mechanisms with little additional costs.



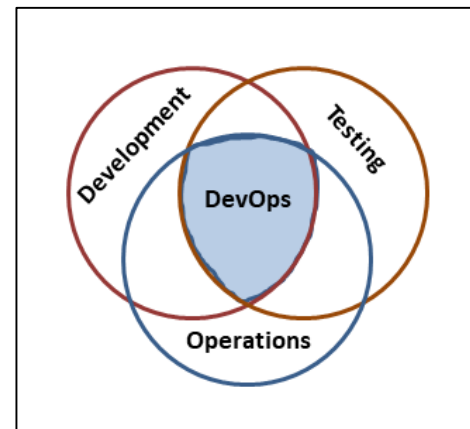
As cloud computing is a measured service, the project manager must be very cost conscious when using the cloud to ensure that computing capability is shutdown when not in use. Cloud computing costs can also appear higher to the project manager but that is generally due to how some commercial companies and Government agencies allocate costs. In the traditional data center model, the project manager may only be required to include the capital expenditure costs of hardware and annual software licensing and maintenance costs in their budget. This is because the data center operator and personnel security labor, power, cooling, and facility costs are separately paid by other areas of the company, whereas all of these costs are included in the cloud computing costs.

## DEVOPS PRACTICES

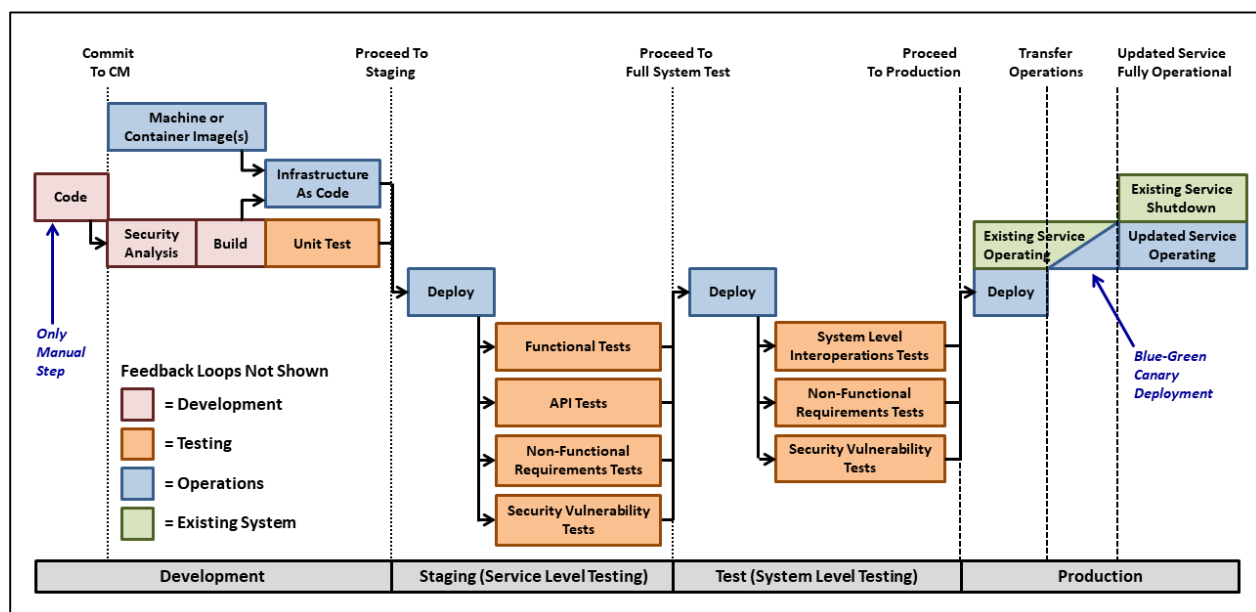
IT organizations are responsible for two major goals which must be pursued simultaneously:

- Respond to the rapidly changing competitive landscape
- Provide stable, reliable, and secure service to the customer

With DevOps, small teams of developers independently implement their features, validate the correctness in a production-like environment and have their code deployed into production quickly, safely, and securely. As shown in Figure 4, DevOps brings together development, testing, and operations all on the same team, a team capable of playing at levels. (Kim and others 2016). More recently, cybersecurity features are also being incorporated to become DevSecOps.



**Figure 4: DevOps is the Successful Integration of Three Disciplines**



**Figure 5: A DevOps Pipeline is the Automated Execution of Software Initially Constructed by the Three Disciplines**

Figure 5 is a notional DevOps pipeline which is executed each time a software developer commits and merges software code updates into Configuration Management (CM). This figure highlights the interactions of the three disciplines; Development, Testing and Operations. Although not shown in this diagram, if any step in the pipeline fails, the pipeline stops, and the erroneous condition is reported. Furthermore, each activity in the pipeline is executed through software. Hardware, Operating System and other Commercial Off The Shelf (COTS) components are provisioned by cloud computing resources using configuration files and scripts using a technique called infrastructure as code. The operations personnel create this code that is then repeatably deployed in the staging, test, and production environments. Testing personnel are responsible for building and executing automated software test scripts and procedures that are progressively executed at the module, service, and system level to verify functional, non-functional, performance, and security requirements.

There is a pipeline for each service in the system. When a developer commits and merges a software update into CM, the pipeline automatically starts. The pipeline automatically completes a security analysis to ensure no new vulnerabilities have been introduced into the software. A software build is then completed, and unit tests are performed. If the code passes unit tests, the pipeline then deploys the entire service to the staging environment where a series of service level tests are conducted. If the code passes service level testing, the pipeline automatically deploys the entire service to the testing environment where it is automatically tested with other services at the system level. If the service passes system level testing, it is automatically deployed to a new configuration in the production environment. The pipeline then has the capability, called a canary or blue-green deployment, to incrementally transfer existing users and workloads from the existing, now legacy, configuration to the new configuration in the production environment. The pipeline monitors the new configuration in operation for some time period and if there are no identified problems, the pipeline shuts down the legacy configuration. When properly executed, the time from a software code commit to CM until the software is operationally executing in the production environment can be measured in minutes to hours and without human intervention. It should be highlighted that the entire DevOps team is responsible for building high quality production, testing, and configuration software that can be repeatably executed in a quick, safe, and secure manner and provides new software functionality that is stable, reliable, performant, and secure.

## **THESE THREE TECHNOLOGIES WORKING TOGETHER**

Using the Video Subscription Site example provided in Figure 2, this section describes five scenarios that demonstrate these three technologies working together.

**Scenario 1 – New Recommendation Service Algorithm is Developed:** In this scenario, the recommendation algorithm is updated to provide a higher weighting score for recently viewed videos. The Recommendation Service is updated, and the associated pipeline is executed that results in a DevOps canary deployment of the new algorithm into operational use without requiring a production outage.

**Scenario 2 – Idle Upload Service:** In this scenario, there are no video files waiting to be uploaded into the system. As this service is implemented in the cloud using a serverless architecture, the Idle Upload Service is shutdown until a new video is received for uploading.

Scenario 3 – Relational Database Security Patch Available: In this scenario, a software patch is available for the COTS relational database. The only service that uses a relational database is the Subscriber Service. This service is updated with the new patch, and the associated pipeline is executed that results in a DevOps canary deployment of the security patch into operational use without requiring a production outage.

Scenario 4 – Higher Demand for Viewing Videos at Night: In this scenario, more users are at home at night and want to watch videos. Using cloud elasticity, five services scale appropriately to meet the variable user demand. As no videos are waiting to be uploaded and processed, the Upload and the Translate/Transcribe Services are shutdown until a new video is received for processing.

Scenario 5 – New “Find Your Favorite Actor” Feature: The organization has decided to add a feature that allows a user to search, find, and locate their favorite actor in one or more videos. The service architecture for adding the new feature is shown in Figure 6. As new videos are uploaded to the site, the video is forwarded to a new Facial/Object Recognition Service that identifies various actors in the video and marks the time location where the actor is viewable in the video. The output of the Facial/Object Recognition Service is passed to the Catalog/Search Service where this data can be searched through the User Interface Service.

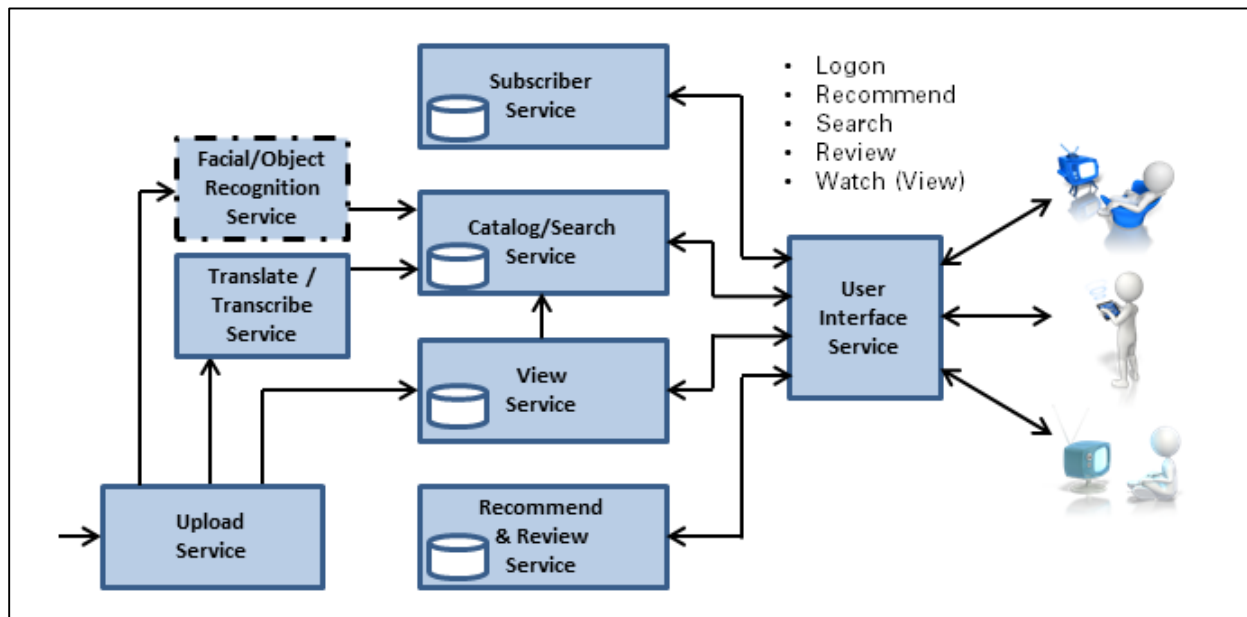


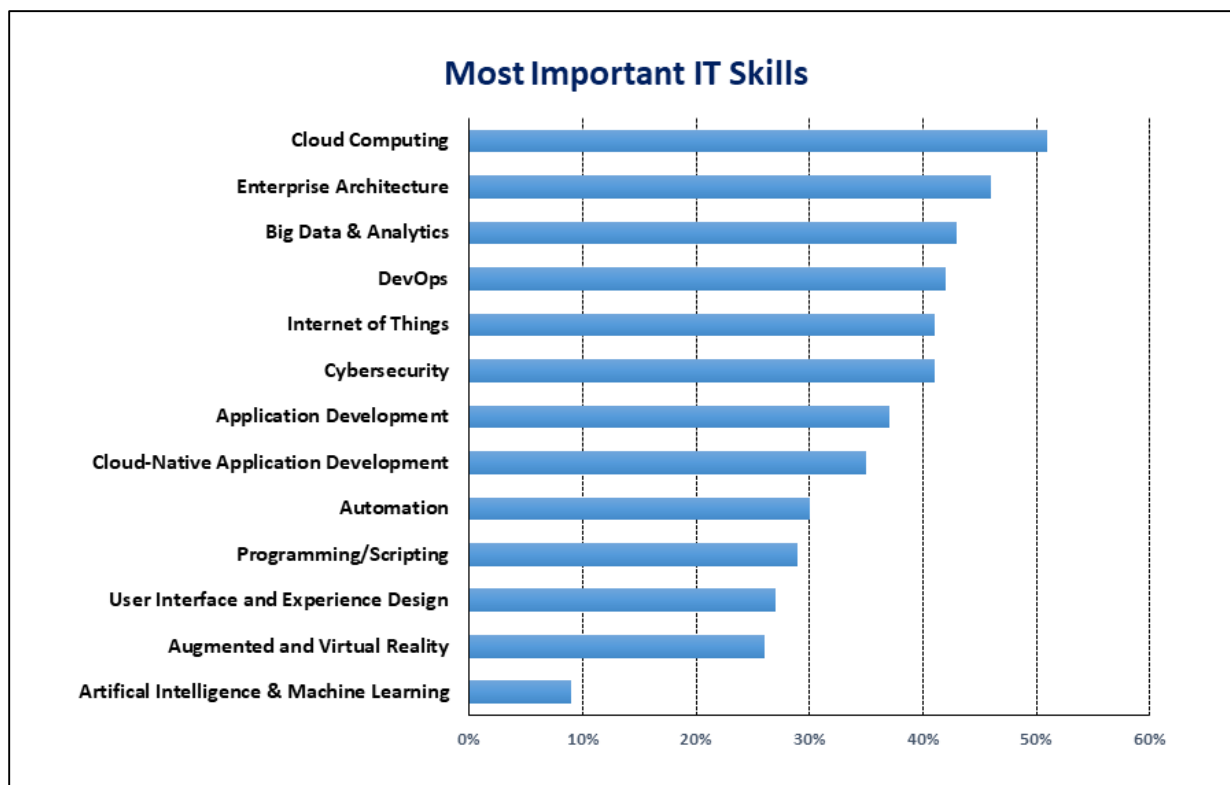
Figure 4: Adding a New Feature Via the Execution of a New Service

The new Facial/Object Recognition Service is implemented using an existing cloud service offered by many cloud service providers. It is executed using a serverless architecture and is shutdown when no videos are waiting to be uploaded and processed. Three existing services require updating. The Upload Service must pass the uploaded video to the Facial/Object Recognition Service. The Catalog/Search Service must be updated to accept the output of the Facial/Object Recognition Service and make the results available for searching. The User Interface Service must be updated to allow users to search for their favorite actor.

Coordination is required between the affected services to move the feature into production. The Catalog/Search Service needs to be deployed first to accept the new data and make it available for search. The Facial/Object Recognition Service needs to be deployed next to provide recognition results to the Catalog Search Service. The Upload Service is then updated and deployed to send new video files to the Facial/Object Recognition Service. Finally, the User Interface Service is updated and deployed allowing users to access and use this new “Find Your Favorite Actor” Feature. Each of these services has their own DevOps pipeline. Thus, the deployment of each service is independent of the other services, provided the sequence of deployment of each service is completed as previously discussed. Each service can use a canary deployment strategy that does not require any outage or down time, from a user perspective.

## TALENT, TEAM, AND CULTURAL CONSIDERATIONS

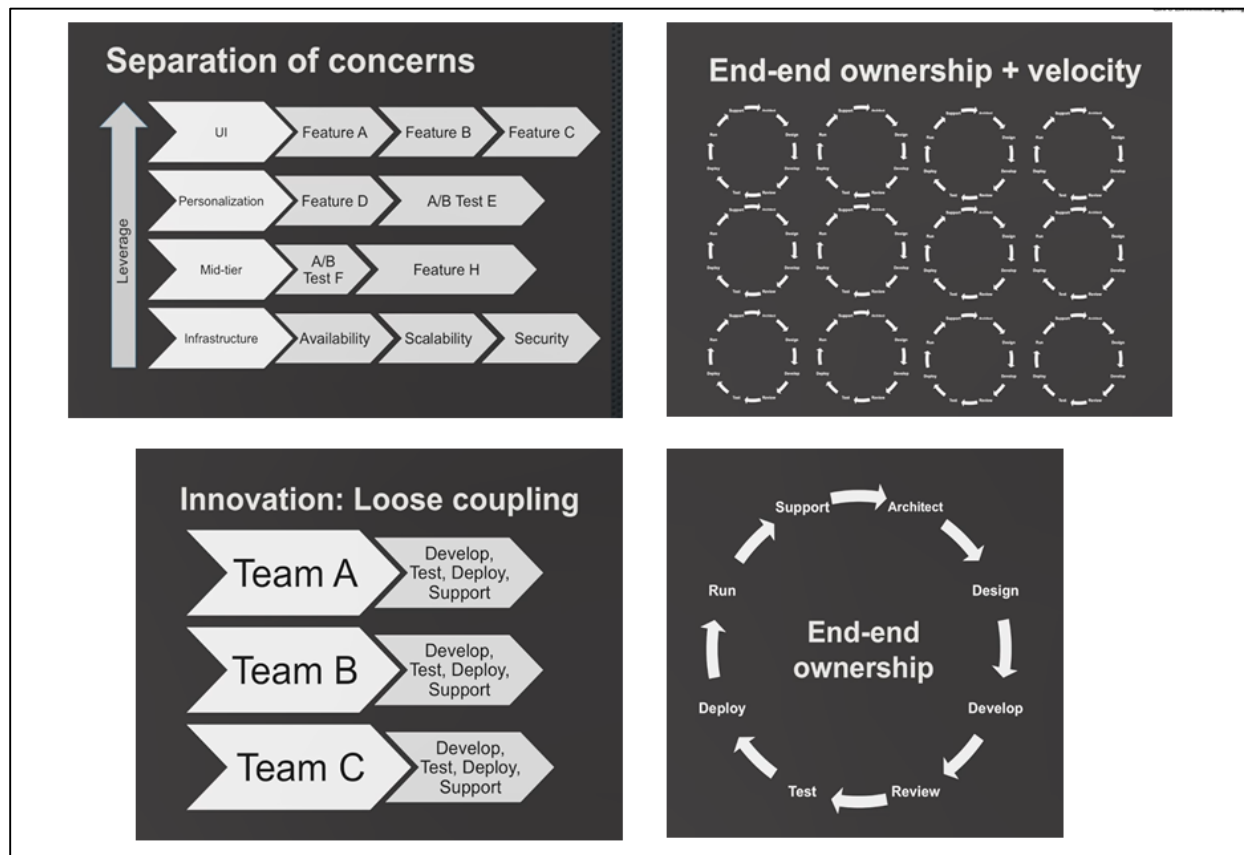
The implementation of these technologies, coupled with agile development practices, provides tremendous benefits but organizations need to consider the impacts to their workforce. A recent study by Cisco, shown in Figure 7, indicates that three of the top four Information Technology (IT) skills in demand are related to cloud computing, enterprise architecture (including services-based architectures) and DevOps practices. The study highlights that many companies will need to retrain and adapt their existing workforce to implement these technologies. (Levy et al. 2019)



**Figure 5: The Skills Required to Execute These Technologies are in the Most Demand (Next-Generation IT Talent Strategies, 2019)**

As shown in Figure 8, many organizations align agile teams to the services they own. Furthermore, agile teams are not only responsible for developing services, they now have end-to-end ownership of the service that includes deploying, operating, and supporting their services in

the production environment. As Netflix says, “You built it, you run it.” Netflix candidly admits this mindset improves the quality of the delivered services as no developer wants to come in late at night, over the weekend, or on vacation to fix a broken service. (Meshenbourg 2016)



**Figure 6: Different Organizational Structures, Responsibilities, and Skills are Required (Microservices at Netflix Scale: Principles, Tradeoffs and Lessons Learned, 2016)**

The combined execution of these technologies is fundamentally a cultural shift and organizations need to assess their willingness to move forward by answering fundamental organizational cultural questions such as:

- Is your organization motivated to attract and retain great talent in the name of continued growth?
- Is your organization “promoting” your best developers into management or technical leadership tracks?
- Are your employees stuck in survival mode?
- Is your organization ready to invest in retraining and retooling its workforce?

## BIBLIOGRAPHY

*United States Securities and Exchange Commission Form 10-K, Netflix, Inc.* 2018. Los Gatos, CA: Netflix, Inc.

- Bieberstein, Norbert, Robert G. Laird, Keith Jones, and Mitra Tilak. 2008. *Executing SOA; A Practical Guide for the Service-Oriented Architect*. Upper Saddle, NJ: IBM Press/Person plc.
- Fowler, Martin. "Microservices; a Definition of this New Architectural Term.", accessed March 30, 2019, <https://martinfowler.com/articles/microservices.html>.
- Kim, Gene, Jez Humble, Patrick Debois, and John Willis. 2016. *The DevOps Handbook; how to Create World-Class Agility, Reliability, & Security in Technology Organizations*. First Edition ed. Portland, OR: IT Revolution Press, LLC.
- Krafzig, Dirk, Karl Bank, and Dirk Slama. 2005. *Enterprise SOA; Service-Oriented Architecture Best Practices*. Upper Saddle River, NJ: Person Education Incorporated.
- Leffingwell, Dean, Alex Yakyma, Richard Knaster, Drew Jemilo, and Inbar Oren. 2017. *SAFe Reference Guide: Scaled Agile Framework for Lean Software and Systems Engineering*. Vol. 2017. Willard, Ohio: Pearson, Education, Inc.
- Levy, Eran, Delaney, Kevin, Hill, Jessica and Buckalew, Lauren. "Next-Generation IT Talent Strategies; how CIOs can Close the Skills Gap and Drive True Business Transformation." Connect Futures - Cisco, accessed March 30, 2019, <http://connectedfutures.cisco.com/report/next-generation-it-talent-strategies/>.
- Mell, Peter and Timothy Grance. 2011. *The NIST Definition of Cloud Computing*. Gaithersburg, MD: National Institute of Standards and Technology.
- Meshenbourg, Ruslan. "GOTO 2016 - Microservices at Netflix Scale: Principles, Tradeoffs & Lessons Learned." GOTO Conferences, accessed March 30, 2018, <https://www.youtube.com/watch?v=57UK46qfBLY>.
- Tonse, Sudir. "AWS Re:Invent 2014 (PFC304) Effective IPC in the Cloud: The Pros and Cons of Micro Services Architectures." Amazon Web Services, accessed March 30, 2019, <https://www.youtube.com/watch?v=CriDUYtfrjs>.

**Managing and Leading Millennials**  
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**ABSTRACT**

Millennials grew up with cell phones, laptops, internet access, and a highly socially-networked world that has become increasingly smaller. Millennials send over 50 texts per day! They grew up being told they are “special” and as a result tend to be confident, entitled, and sometimes even narcissistic. 50% of millennials consider themselves politically unaffiliated, job satisfaction matters more than monetary compensation, and work-life balance is considered essential. So, how do we as project managers engage, motivate, and lead millennials? The answers might surprise you.

In this presentation we will first review studies of worker motivation that have been conducted for decades and then use those findings to consider ideas to truly motivate a typical millennial. We’ll discuss how to apply servant leadership principles to embrace young people, help them grow, and exploit their values on morality and ethics in the work place. Finally, we’ll explain a modern-day management model called **Results Only Work Environment (ROWE)** that is under experiment by employers such as Best Buy, GAP, and even the U.S. Office of Personnel Management (OPM).

**PAPER**

Millennials have grown up with cell phones, laptops, internet access, and a highly socially-networked world. They grew up being told they are “special” and as a result tend to be confident, entitled, and sometimes even narcissistic. 50% of millennials consider themselves politically unaffiliated, job satisfaction matters more than monetary compensation, and work-life balance is considered essential. So, how do we as project managers engage, motivate, and lead millennials? The answers might surprise you.

Steven Covey said “you must first seek to understand, then to be understood”. So, let’s first look at the findings of traditional studies on motivation and morale building. These studies have been around since post World-War II and the findings are generally consistent: a solid team-member is passionate, confident and wants to make a difference. The Happy Carpenter demonstrates this below:





Sir Richard Branson, the English billionaire, business magnate, entrepreneur and philanthropist said “.. If you find people who are fun, friendly, caring and love helping others, you are onto a winner...” You’d think he would look for the most technically competent people on the planet but he understands that people with a passion to improve the common good should serve as the foundation of his workforce. Most of us baby-boomers spent our entire career trying to find our passion and confidence in the work we do. We’ve worked for organizations and employers thinking if we simply work hard and demonstrate commitment we will always have a home. No way Jose!

Now, let’s look at millennials and how they were raised. I’m the fathers of 7 children and 1 son-in-law, all between the ages of 23-31 (4 from my first marriage and 3 step children from my second). We’ve had more than our share of millennial moments in my house! Like many baby-boomer parents, we told our children they were special and unique in their own way. Educators told us that children with a high degree of self-esteem learn faster, better and even enjoy school. We encouraged our kids to embrace school and participate in athletics and other extra-curriculum activities to help build their confidence and prove to themselves that they had skills and expertise. Yes, we have a closet full of trophies!

We weren’t alone, many parents did the same thing, and you know what? **IT WORKED!** Our kids, and young people around the nation entered the work force as free thinkers, confident, passionate, comfortable with technology, and ready to conquer the world!





Sound familiar? Millennials “show up” with all the right attitude traits found in great team members! Why are we all so surprised when we raised them to have those traits! The problem is that we as leaders and managers are simply overwhelmed by millennials. We expect them to earn those traits the hard way, just like we did. We want them to listen, learn and do as their told! This is a recipe for failure because millennials aren’t afraid to “take their ball and go home”. They need to be stimulated at all times.

Don’t fret, all is not lost! We certainly can’t give up the ship because the deck hands think differently than we do. Let’s explore some tips in working with and encouraging our millennial workforce:

- Consider delegating creative activities that they can handle. Let them run with these tasks, set the expectation and encourage them to come back to you with questions. Hold them accountable if they fail but use a coaching style not a dictatorial style.
- If you’re an autocratic leader then be prepared for turnover of your millennial staff. They don’t respond like robots and won’t engage with a manager that dictates. They want to be heard and taken seriously, so listen to them, ask questions, engage with them. Remember their showing signs of a great team member.
- Remind your millennial staff that although you appreciate their enthusiasm and confidence they may have to slow down. Tell them you’d like to “pick up” where their parents and teachers left off. You too can provide them with guidance, learning and opportunities to grow in their careers. Millennials that refuse this offer may have to find another place to work.
- Consider sending them text messages with simple tasks you want them to do. This will save you time and it’s a communications medium they embrace and understand.
- Never allow cell phones into your meetings. Your millennial staff is still competing in a world that values good old-fashioned face to face communications and they have to learn to build relationships this way. 7% of communications is the words we use and the remainder is non-verbal in nature. They may be mis-communicating if their always sending texts.
- Encourage don’t discourage. Celebrate positive approaches to getting work done as well as results.

There are other options being considered to engage millennials, especially in public service. The Office of Personnel Management, Best Buy, and GAP are experimenting with an innovated management model called the **Results Only Work Environment (ROWE)**. “ROWE it is all about fostering a performance-based work culture that is laser focused on results, productivity, and efficiency”. In summary ROWE is a management strategy where employees are evaluated on performance, not presence. Managers focus on results and only results – increasing the organization’s

performance while cultivating the right environment for people to manage all the demands in their lives...including work.”

Whatever approach you buy-into, millennials are our future and I believe they will improve our future. They’re civic minded, environmentally conscious, believe in work-life balance, and committed to making a difference in everything they do. I think we taught them well.

## **REFERENCES**

Covey, S. (1989). “The 7 Habits of Highly Successful People”. Free Press.A

Rouse, Margaret . “Millennials, Generation Y”

<https://whatis.techtarget.com/definition/millennials-millennial-generation>

Thompson, Jody, “GoRowe” <http://www.gorowe.com/>

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Mr. Launi has published numerous works in areas such as software implementation, project planning, and team motivation. PME specializes in providing organizations with the skills, knowledge, and experience needed to improve their project management competency.

## **Managing for Meaningful Outcomes**

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### **ABSTRACT**

Management has been called the technology of human accomplishment, yet traditional management approaches often fail to produce meaningful results. Management technology needs to be reinvented because it remains primarily organization-centric and locked into a largely meaningless input-output model that values efficiency as the highest good. Historically, this approach has been the basis for a vast constellation of organizations in business, government, and nonprofits sectors, but it generally fails to produce meaningful and timely evidence for management decision support, and frequently creates negative side-effects among internal actors and within the environment. Going forward, management technology needs to adopt a more meaningful input-outcome model that values positive organizational effectiveness as the highest good and serves to sustain or improve the health of both the organization and its environment as a holistic system. This is what managing for meaningful outcomes aims to achieve.

### **RECOGNIZING THE PROBLEM**

From 1982-1985, I was based in New Delhi India, working for the World Health Organization (WHO) in the regional office for SE Asia. It was during the UN's International Drinking Water Supply & Sanitation Decade, 1981-1990 (better known as the UN Water Decade). At the time, I was the project manager for WHO/UNDP's Advisory Services Project that was part of the Decade. My job entailed visiting countries in the region to see what was going right and what was going wrong with the Water Decade and helping participating government organizations improve their programs.

Government agencies in participating countries thought they knew what end users needed, since they had been providing water and sanitation services for decades. They said they just needed more funds to build more facilities. But completed facilities were frequently in disrepair, and others were not utilized by end users for the purposes intended due to a variety of reasons.

The goal of the UN Water Decade was to expand the ‘coverage’ of safe water and adequate sanitation in participating countries. The focus on coverage (i.e., access to services) turned out to be an unfortunate choice because the goal typically resulted in a numbers game in each country, where success was measured in rural areas, for instance, by how much of the population was covered with hand pumps & latrines. If rural users were within a few minutes’ walk from a hand pump, they were deemed to have access to safe water supply. The fact that some of the hand pumps were in disrepair and others were not being used for their intended purposes was not easily reflected in the system.

Much of the problem was due to a conceptual gap between the planners and the end users. They didn’t understand each other. The planners were delivering engineering solutions based on their technical training, but the adoption and use of their solutions was hampered in traditional societies by the embedded patterns of thought found in the social and cultural narratives of the past. Later in the UN Water Decade, WHO urged governments to look beyond coverage, to ensure the continued functioning of the completed facilities and their utilization by end users (for the intended purposes).

This example highlights a fundamental problem at the heart of traditional management approaches, that is, what counts as meaningful accomplishment. As we will see, the overall program goal for the UN Water Decade was set at the wrong level (a largely meaningless supply-side output which focused on ‘coverage’), which then drove what was delivered during implementation, and the subsequent evaluation of completed activities. Traditional management does not distinguish between arbitrary output-level objectives and meaningful outcome-level objectives during the objective setting process, and later during program implementation and evaluation. This problem was baked into management science at the beginning and has not been corrected since. Historical examples of this fundamental problem can be found in the *Scientific Management* movement of Frederick Winslow Taylor (Taylor 1911), the Management by Objectives approach pioneered by Peter Drucker (Drucker 1954), as well as some more recent management remedies such as OKRs -- or Objectives & Key Results (Doerr 2018).

## TRADITIONAL MANAGEMENT

This paper is about managing for meaningful outcomes, a new approach to management that offers significant benefits for projects, programs, and organizations more generally, as well as the wider world. It would have made the UN Water Decade much more effective and sustainable.

While management has been called “the technology of human accomplishment,”<sup>1</sup> traditional management approaches often fail to produce meaningful results. As a technology, management needs to be reinvented because it remains organization-

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centric and locked into a largely meaningless input-output model that values efficiency as the highest good.

Early theories viewed organizations as "rational systems"-- social machines of a sort, meant for the efficient transformation of material inputs into material outputs (Scott 1987, 31-50). Organizations were often depicted as largely closed entities separated from the surrounding environment. Inputs arrived at factory gates, engineers determined what technologies to use for processing, and outputs evaporated off loading docks, all in support of built-in assumptions (Suchman 1995, 571).

In the traditional input-output model, an organization extracts resources from its environment as inputs, internally processes the inputs to produce outputs, and returns to the environment the outputs it produces and the waste products it has created. While this model has been the historical basis for organizations large and small, it generally fails to produce meaningful and timely evidence for management decision support, and frequently creates negative side-effects among internal actors and within the environment.

Traditional management is so familiar that it is hard for most people to conceive of anything else. Its features include:

- Top down, command & control [originally designed for repetitive manual work]
- Objectives focused primarily on output production and cascaded down from the top of the hierarchy to the lower levels
- Largely authoritarian & bureaucratic in nature
- Efficiency is the highest good (an isolated and largely closed system)
- Input – output model (organization centric), within management's full control
- Requires objectives to be 'clear,' but virtually any objective is acceptable
- Positive values are largely optional (little self-regulation)
- Intermediation services (balancing supply & demand) are performed by 'the market' utilizing financial & economic benefit exchanges between relevant actors
- Waste products are returned to the environment

In the traditional approach, managers at the top of the hierarchy identify goals and develop strategy, sending directives to the lower levels. This approach conforms to the early Goal Model of organizational effectiveness, wherein an organization is believed to be effective if it accomplishes its stated goals (set by management). Despite its continued widespread use, the Goal Model has been debunked by scholars. Only some goals are relevant to effectiveness, and even when a stated goal is achieved, an organization may not be judged effective (Chandler, 2015). Goals set at the top by the executive team simply make the organization responsible to the top of the hierarchy for its approval rather than to the customers or end users that need to support the organization if it is to be successful. This is not a good place to be.

## **EFFECTIVENESS IS ABOUT ACHIEVING MEANINGFUL OUTCOMES**

For much of my career I was involved in projects and programs in international development, having helped design and implement over 800 initiatives worth more than US\$ 80 billion in countries around the world (not counting the Water Decade).

A few years ago, I began a survey of the literature on organizational theory to see what it had to say about the concept of organizational effectiveness (OE). Based on my international development experience, I thought I knew what effectiveness was in projects and programs, but I was shocked to find that organizational scholars could not identify a verifiable concept of OE, and their field was in disarray. There were at least five prominent models of OE (including the Goal Model), but none could be objectively verified in the field (Cameron 2005). Despite the lack of a verifiable model, scholars agreed that OE was the highest level of organizational performance and was expected to be the capstone concept that brought other aspects of organizational theory together into a unified whole (assuming a verifiable concept of OE could be found).

Currently, organizational effectiveness is viewed by many scholars as an enigma (Cameron 1981) with characteristics of a wicked problem (Zammuto 1982). The main issue continues to be how to define the concept of effectiveness because we need to know effectiveness when we see it. R.L. Kahn wrote in 1977 that “To be effective is merely to have effects. The problem is what effects accord with the concept of organizational effectiveness?” (Kahn 1977). For me, achieving organizational effectiveness is about managing for meaningful outcomes, that is, achieving contextual-specific effects that can be observed directly in the field to provide a relevant and favorable demand-side response.

## **MANAGING FOR MEANINGFUL OUTCOMES**

Management technology needs to put aside the traditional (and largely meaningless) input-output model to adopt a more meaningful input-outcome model that values organizational effectiveness as the highest good and serves to sustain or improve the health of the organization and its environment as a holistic system. This is what managing for meaningful outcomes is all about.

Let me define the two terms that must work together to provide “meaningful outcomes.” ‘Meaningful’ refers to relevant contextual-specific effects observed in the field that can serve as markers for the types of outcome(s) we seek. ‘Outcome,’ although a common English word, has two, somewhat different meanings. One is “the final result, or how a thing turns out.” This is not the one I am using. The second meaning of ‘outcome’ is “an effect caused by an antecedent.” It is this one that I associate with meaningful outcomes, i.e., an effect that results from a stimulus that logically precedes it.

Managing for meaningful outcomes requires a more comprehensive model than the traditional input-output model that has only two levels and acts as a largely closed

system. Since the late 1960s, "open system" theories (Scott, 1987: 78-92) have reconceptualized organizational boundaries as porous and problematic (Suchman 1995, 571). In this context, consider the four-level model (input-output-outcome-impact) available from the 'logical framework' of Results-Based Management (RBM) (Asian Development Bank 2006). It has been used in international development since the 1960's, beginning in USAID. The four levels comprise a hierarchy of goals and results within the model. This hierarchy was originally designed to serve temporary organizations such as projects and programs but has been extended recently in the Outcome-focused Model (OFM) to serve organizations more generally (Chandler 2017, 83). While the new model uses the hierarchy of objectives from RBM, it improves upon it by dividing supply from demand. In the OFM, the supply-side input & output levels are within the control of management, while the demand-side outcome & impact levels are outside the control of management (in the environment). This creates a truly open system model of organizational performance by giving meaning to both environmental context and environmental response.

Managing for meaningful outcomes incorporates a demand-side test of effectiveness for an organization's offerings. For meaningful outcomes (and effectiveness) in temporary or permanent organizations, actors in the environment must be attracted to the organization's offerings (outputs), then initiate the behaviors of uptake, adoption or use (meaningful outcomes). For instance, an agricultural extension project could be judged effective only if the local farmers first adopt and use a new package of farming techniques viewed as key to project success. Without the farmer's favorable response, the results chain fails, and the project is judged ineffective. Of course, it also helps to involve the farmers initially at an early stage of project design to provide feedback on the available options.

In managing for meaningful outcomes, the focus is on the outcome level because the link from outputs to outcomes is the weakest link in the results chain (Chandler 2017, 73). If expected outcomes can be observed in the field, it means that the weakest link is effective, and implies that the entire results chain is viable. The outcome level represents the immediate demand-side effects that can be observed in the field.

Further along the results chain (i.e., input-output-outcome-impact), impacts can be simply thought of as the longer-term effects that are propagated when meaningful outcomes are sustained and spread throughout the environment. Our approach is not called "managing for meaningful impacts," however, because the time lag from the achievement of outcomes until the appearance of impacts is too great (on the order of 5 years) to provide feedback for management decision support. In addition, it is expensive to measure impacts, and I argue that a formal impact assessment is unnecessary in most cases as long as meaningful outcomes are continually monitored and remain favorable.

Of course, the achievement of meaningful outcomes is not certain because outcomes (and impacts) occur in the environment, outside the direct control of management (and causality can be nonlinear, unpredictable, interdependent, and

intertwined at multiple levels in complex environments). Success depends upon the ability of the organization to understand the context for its service to the environment, then experiment to confirm “what works now.” Favorable outcomes are verified by observing emergent behaviors that are induced in the environment in response to the outputs on offer.

Managing for meaningful outcomes has the following features and characteristics:

- Meaningful outcomes are achieved in the environment surrounding the organization (using specific behavioral markers for effectiveness)
- The environment is assumed to be complex at the start, thus causality may be unpredictable & intertwined (results chains involve conjecture)
- Managing for meaningful outcomes is about inducing favorable effects in a system not under management control
- Involves self-regulation of processes in order to uphold positive organizational values and reduce or eliminate negative side-effects
- Intermediation services (which balance supply & demand) are performed by ‘the environment’ (including ‘the market’) utilizing a variety of benefit exchanges (financial & economic, social & psychological, environmental & spiritual) between relevant actors
- Adopting this new management approach requires a major cultural shift to an experimental, self-regulatory, and adaptive culture

Let’s consider a real-world example of managing for meaningful outcomes, this time from a World Bank-financed program that I helped design. Bird Flu in Asia occurs in a complex environment, where wild migrating birds acting as the reservoir for the virus seasonally intermingle with domestic poultry to spread the disease. The goal of the World Bank-financed program was to achieve physical separation between domestic and wild flocks to interrupt the spread of the virus in participating countries. This is an outcome level goal because uptake, adoption or use of cages was expected by domestic poultry producers to achieve program success. If we visit the field during program implementation and find that cages are being used for the containment of domestic flocks, separation between the domestic and wild flocks has been achieved and the intervention can be judged effective. The expected longer-term impact of the program would be that Bird Flu does not return, assuming the outcome-level effects continue to be sustained over time. In this example, the key to success is outlining a results chain that specifies the exact behavior(s) that must be induced on the demand side to qualify as meaningful outcomes, then confirmation of the expected outcomes through direct observation of the key behavior(s) involving cage use in the field once the outputs (i.e., cages) become available.

Why manage for meaningful outcomes?

- A more meaningful way to manage, supported by theory & practice
- Equivalent to managing for organizational effectiveness (the highest level of performance)



- Since effectiveness can now be verified in the field under the new OFM model, it becomes the meta-goal for every organization (no other goals needed at the top, as effectiveness is the highest good -- both in the short term & the long term)
- Meaningful outcomes observed in the field provide timely feedback for decision support (i.e., management of a portfolio of offerings)
- Reduces or eliminates negative side-effects through self-regulation (utilizing positive values) and by accepting responsibility internally for waste reprocessing
- The technology returns primacy to ‘management,’ which had been usurped by ‘leadership’ in recent times
- This is true evidence-based management, where causation is established by experimentation and direct observation of meaningful outcomes in the real world.

Note that organizational effectiveness is judged in the short term by confirming the presence of meaningful outcomes in the field for a portfolio of offerings (i.e., specific behaviors of uptake, adoption or use within the defined results chain for each offering). Longer term measures of effectiveness are reflected at the impact level as meaningful outcomes accumulate over time, allowing for spread effects to take hold throughout the environment (integrating instantaneous outcome-measures of effectiveness over time).

How to manage for meaningful outcomes?

1. Start with... “the meta-goal of the organization is to be effective within its chosen environment” (by achieving meaningful outcomes and sustaining or improving the system as a whole)
2. Develop a portfolio of offerings (one at a time) to serve the environment while conforming to the organization’s core competencies, quality standards, and positive values (Chandler 2017, 132-133)
3. Pilot test to verify the effectiveness of each offering on a small scale by observing the expected demand-side response(s) consistent with its results chain hypothesis (i.e., verify that the meaningful outcomes -- the behaviors of uptake, adoption or use -- are being observed in the field)
4. Utilize observations of outcome-level results in the field to provide management decision support to scale up the production of successful offerings where desirable and feasible

For me, the technology involved in managing for meaningful outcomes is equivalent to the technology of Management by Positive Organizational Effectiveness that I have described in my 2017 book, *Become Truly Great: Serve the Common Good through Positive Organizational Effectiveness* (Chandler 2017). Note that improvements in effectiveness are additive across the portfolio due to cumulative benefit exchanges, but efficiency improvements achieved in individual parts of an organization can come at the expense of the efficiency of the organization as a whole (Chandler 2017, 14).

An often-quoted view among organizational consultants and practitioners is that “efficiency is about doing things right, while effectiveness is about doing the right things” (Drucker 1966). Peter Drucker meant this statement to refer to the effectiveness of executives, not their organizations. When it comes to organizations, efficiency experts proudly declare that efficiency is the domain of doing the right things right the first time and every time. Effectiveness, on the other hand (as discussed above), is something entirely different. It is not about doing anything within the organization, it is about achieving something outside of it (i.e., meaningful outcomes).

Under the new outcome-focused model (OFM) the meta-goal of every organization is the same, that is, to be effective within its environment (while sustaining or improving the system as a whole). The approach focuses the attention of the organization on its external interface and it is encouraged to be in-tune with the immediate and future needs of its environment. The focus on meaningful outcomes improves the way that the outputs are designed and delivered because internal actors come to realize that outputs are waste without the behaviors of uptake, adoption or use associated with the achievement of meaningful outcomes.

## CONCLUSION

A focus on meaningful outcomes offers significant benefits for projects, programs, and organizations more generally, as well as the wider world. The traditional approach to management (still commonly in use) is based on a largely meaningless input-output model where efficiency is the highest good. In such a model, the organization extracts resources from the surrounding environment, internally processes the inputs to product outputs, and returns to the environment the outputs it produces and the waste products it has created. While this model has been historically important, it generally fails to provide meaningful and timely evidence for management decision support, and largely ignores any negative side-effects on internal actors and the negative side-effects that affect the environment. As long as efficiency is the highest good, as in the traditional input-output model, principles of humanistic management and environmental conservation will fall victim on the altar of efficiency. Unless changed, the traditional management model will continue to imperil the world we live in.

Going forward, management technology needs to adopt a more meaningful input-outcome model that values positive organizational effectiveness as the highest good. This would provide meaningful and timely evidence for decision support of a portfolio of offerings, while sustaining or improving the health of the organization and its environment as a holistic system. In the new approach, an organization achieves effectiveness when its outputs induce meaningful outcomes in the environment in line with one or more defined results chains. This approach offers demand-side validation of an organization’s portfolio of offerings (whether in business, government or nonprofit) and thus provides verification of organizational effectiveness (the highest level of performance) by direct observation in the field. This is the first approach to do so. The new approach provides a verifiable concept of organizational effectiveness that

creates a capstone to organizational theory and offers a more unified (and parsimonious) approach to the field.

Traditional management practice can be characterized as “managing for outputs, valuing efficiency as the highest good.” Very little meaning is derived from the successful delivery of outputs alone, however, because the process remains largely disconnected from considerations of environmental context and environmental response. The new approach advocated here can be characterized as “managing for meaningful outcomes, valuing positive organizational effectiveness as the highest good.” It offers a better way to manage by creating a path to more effective organizations, a more meaningful technology for human accomplishment, and a better world.

## REFERENCES

- Asian Development Bank (2006). “An Introduction to Results Management: Principles, Implications, and Applications.” Manila, Philippines.
- Cameron, Kim S. (1981). *The Enigma of Organizational Effectiveness*. Reprint series. National Center for Higher Education Management Systems: Boulder, CO (USA).
- Cameron, Kim S. (2005). “Organizational Effectiveness.” In *Great Minds in Management*, edited by K. G. Smith and M. A. Hitt, 304-330. Oxford University Press: New York, NY (USA).
- Chandler, Charles G. (2015). “Organizational Effectiveness: Replacing a Vague Construct with a Defined Concept.” *Academy of Management Proceedings*, Volume 2015, No. 1: 11023.
- Chandler, Charles G. (2017). *Become Truly Great: Serve the Common Good through Management by Positive Organizational Effectiveness*. Author Academy Elite, Powell, Ohio (USA).
- Doerr, John (2018). *Measure What Matters: How Google, Bono, and the Gates Foundation Rock the World with OKRs*. Penguin Random House: New York, NY (USA).
- Drucker, Peter F. [1954/1982] (1993). *The Practice of Management*. 1993 Harper Business Edition. HarperCollins: New York, NY (USA).
- Drucker, Peter F. (1966). *The Effective Executive*. HarperCollins: New York, NY (USA).
- Khan, R. L. (1977). “Organizational Effectiveness: An Overview.” In *New Perspectives in Organizational Effectiveness*, edited by P. S. Goodman, et al. Jose-Bass: San Francisco, California (USA), 236.
- Scott, W. R. (1987). *Organizations: Rational, Natural and Open Systems* (2nd ed.). Prentice Hall: Englewood Cliffs, NJ (USA).
- Suchman, Mark C. (1995). “Managing Legitimacy: Strategic and Institutional Approaches.” *Academy of Management Review*, 20(3), 571-610.
- Taylor, Frederick Winslow [1911] (1998). *The Principles of Scientific Management*. 1998 edition. Dover Publications: Mineola, NY (USA).

# Multi-Criteria Decision-Making Approach for Selecting Scheduling Technique in Elevated Urban Highway Project

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## ABSTRACT

The construction or rehabilitation of elevated highway projects presents a spectrum of challenges to project practitioners. These challenges place a demand on the multi-criteria decision making (MCDM) abilities of the project management team. Moreover, micro-scheduling of construction activities has been deemed important to the reduction of waste based on the lean paradigm due to the changing dynamics of the construction site. Choosing the project scheduling method that will facilitate value creation for the stakeholders becomes an MCDM problem and entails having a clear understanding of the advantages and disadvantages of the different scheduling methods under consideration. Choosing by Advantage (CBA) is an emerging lean construction MCDM method that has been successfully applied to the Architecture, Engineering and Construction (AEC) industry but with little application in infrastructure projects such as the construction of elevated urban highway projects. Decision makers using the CBA list the attributes and advantages of each alternative and then assign a degree of importance to each advantage relative to the one that is least preferred. The CBA helps to differentiate alternatives based on the decision context and reduces time to reach consensus, and it manages better subjective trade-offs by basing decisions on the importance of agreed advantages. This study contributes to the body of knowledge by applying the CBA in the selection of the micro-scheduling method in elevated urban highway projects.

Keywords: Lean construction, Choosing-by-Advantage, Multi-criteria decision making, project schedule

## INTRODUCTION

The need for new and reconstructed highways is an important consideration for many nations of the world as transportation developments shift from the construction of new highways to the demolition and reconstruction of existing facilities. A large number of reconstruction and rehabilitation work is expected on existing highways either due to existing highway infrastructure nearing or already surpassed their service life (Jeannotte and Chandra 2005; Mahoney 2007) or due to the effect of urbanization placing additional demands on existing highways. Current practice in the construction industry suggests that there is typically budget overrun and schedule slippage during the construction of elevated urban highway projects (Dawood and Shah 2007; Hannon 2007). Addressing the challenge of ageing highways can be a difficult and sometimes contentious issue as there are many options and impacts to consider. To counter these challenges, a considerable amount of time is required to ensure that the level of development (LOD) of the plan can accommodate the micro-scheduling of short duration activities. However, selecting the project scheduling method becomes a multi-criteria decision-making problem because of the different project scheduling alternatives available to the project management team.

## LITERATURE REVIEW

Decision-making methods influence peoples decisions, decisions trigger actions and actions have outcomes and consequences (Suhr 1999). During the construction of elevated urban highway projects, the decision of the project scheduling method to adopt is an MCDM problem and an important consideration in the delivery of the project. The problem, however, is that the literature does not provide much (if any) support to practitioners in this context. According to Arroyo (2014), in practice, decisions such as the planning and scheduling method to adopt are made without a formal method. She further contended that many practitioners responsible for decision-making are not even aware of the available MCDM methods.

Different MCDM are available in the literature and have been successfully applied in different fields. A literature review by Arroyo et al. (2014) revealed that most applications of MCDM within the construction industry are based on Weighting Rating Calculating (WRC) and the Analytical Hierarchical Process (AHP) (Aguado et al. 2011; Akadiri et al. 2013; Bakhoun and Brown 2011). The application of CBA has mainly been in the domain of research on lean construction (Arroyo et al. 2012, 2013; Nguyen et al. 2009; Parrish and Tommelein 2009).

CBA is a decision-making system that facilitates decision-making by comparing the advantages of alternatives. (Arroyo et al. 2013). According to (Arroyo et al. 2015), the CBA system has four principles: (1) decision makers must learn and skillfully apply sound decision-making methods; (2) decisions must be based on the importance of the advantages; (3) decisions must be based on relevant facts; (4) different types of decisions calls for different decision making methods. This method has several benefits over traditional MCDM methods: CBA helps to differentiate between alternatives based on the decision context, reduces time to reach consensus, and manages better subjective trade-offs by basing decisions on the importance of agreed advantages (Arroyo et al. 2018). Arroyo (2014) claimed that the decision-making process of CBA

is more transparent than the AHP that utilises pairwise comparisons between factors to find the best alternative. CBA has been applied to choose the best design options for a reinforced-concrete beam column joint (Parrish and Tommelein 2009) , a ceiling tile in the design stage from a sustainable perspective (Arroyo et al. 2013) , a structural system (Arroyo et al. 2014), a project team (Schottle et al. 2015), an HVAC system for a net-zero energy museum (Arroyo et al. 2016), select fall protection measures (Karakhan et al. 2016), CBA was combined with 4D model to select the best construction flow option in a residential building (Murguia and Brioso 2017). Table 1 presents a glossary of terms relevant to the CBA method (Suhr 1999).

**Table 1: CBA definitions**

Term	Definition
Alternatives	Options to be considered by the method. At least two alternatives are required for a decision to be necessary.
Factor	A property of an alternative that is material to the decision. Factors can be social or environmental but do not include the cost
Criterion	“Want” criterion defines a certain value or set of values that are preferred for a factor. “Must have” criterion specifies values that a factor must have for that alternative to be considered feasible.
Attribute	Quality or characteristics belonging to one alternative.
Advantage	Difference between two alternatives when their attributes are compared

In implementing the CBA method, the following steps adapted from Arroyo (Arroyo et al. 2015) are followed.

1. Identify the alternatives for consideration in the decision process.
2. Define the factors that will help differentiate among alternatives.
3. Define the *must* and *want* criteria for each factor.
4. Summarize the attributes of each alternative.
5. Decide the advantages of each alternative.
6. Decide the importance of each advantage (IofA). The IoA corresponds to a value that is given for each factor for each alternative. The sum of the IofA for all factors represents the total importance of that alternative to the decision maker.
7. Evaluate cost data (if applicable).

In CBA, decisions are based solely on the advantages. The stakeholders access the importance of these advantages by making comparisons among them. The weighing process should be specifically on the importance of these advantages (Suhr 1999).

### **CBA ANALYSIS: SELECTING PROJECT SCHEDULING METHOD**

Nine project managers involved in the highway construction were chosen for the second phase of the analysis and the steps for conducting the CBA applied. Three different planning alternatives were identified in the literature. The Last Planner System (LPS), Critical Path Method (CPM) and Linear Scheduling Method (LSM) were selected. Seven factors were jointly identified in an interactive session with the project

managers that will serve as the basis for differentiating the alternatives. The “must” criterion for each factor on which the stakeholders will base their judgement alternatives was defined.

The attributes of each alternative were obtained from existing literature and validated by the project managers. The least desirable attribute for each identified factor is underlined and used as a comparison to describe the advantage of the alternative based on that factor. The advantage of each alternative was then decided by each respondent by assigning weights to the advantages based on the factors and criteria. The weights for each factor and criteria ranged from 0 to 100. The first author complied and obtained the average weight from the different weights provided by the respondents. The average weight so obtained was thereafter used as the relative weight for each advantage. The importance of each alternative (IofA) was then decided based on the relative weight earlier obtained. The IofA corresponds to the value given to the advantage of each alternative based on each factor by each respondent. The respondents collaboratively agreed on the IofA after some deliberations.

## STEP BY STEP CBA APPLICATION

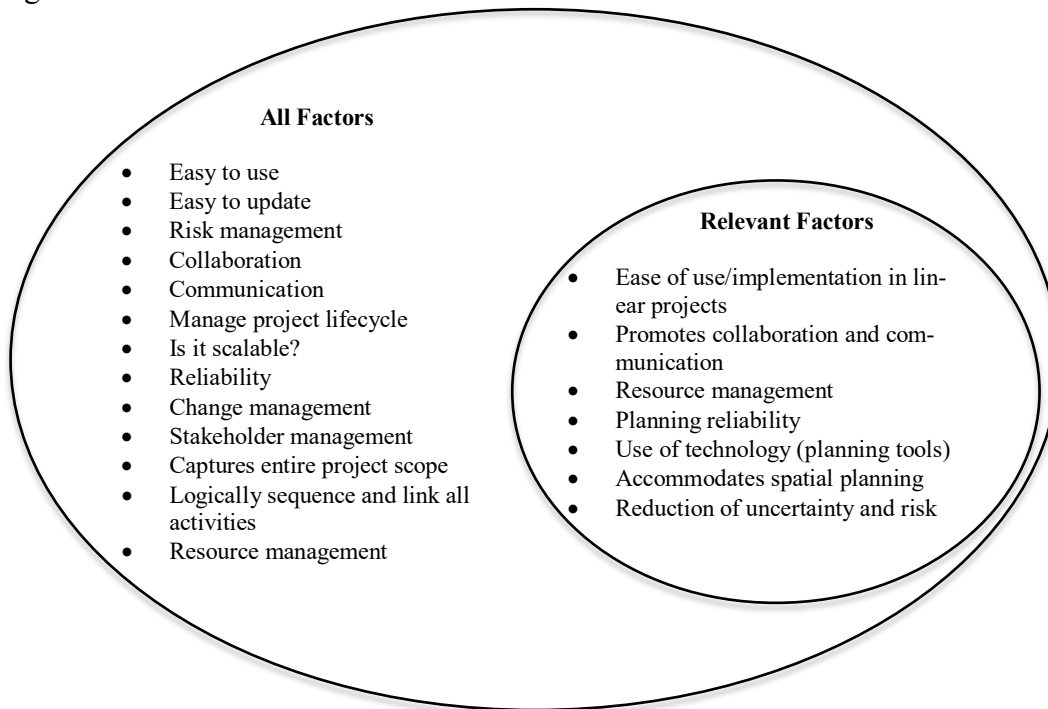
*Step 1: Identify Alternatives.* Three scheduling techniques were selected based on their suitability to linear projects. The alternatives considered are compared based on certain criteria and presented in Table 2.

**Table 2: Project scheduling alternatives**

S/N	Attribute/Alternatives	Last planner system	Critical path method	Liner scheduling method
1.	Reduction of uncertainty and risk	Identifies and assigns responsibility for constraints removal, facilitates reduction of risks and uncertainties.	Does not focus on identification of constraints and their removal. Makes up for this by incorporating float and slack (or modified PERT) in the schedule to account for production and duration uncertainties.	Does not tackle detailed task-level planning or identification of constraints which could have an impact on risks and uncertainties.
2.	A better understanding of project objectives	Breaking production into smaller and manageable flows ensure that project objectives are fully understood by stakeholders.	CPM networks become complicated as the size and complexity of a project increases.	Easy to use and facilitates an understanding of project objectives due to the relationship of time and space inherent in the process.
3.	Ease of use	Easy to use. However, the absence of computer tools makes it cumbersome to apply to large work packages.	Extensive computerization has made the CPM easy to use. However, the user needs a considerable amount to produce valuable information for controlling purposes.	Very intuitive and easy to use and understand. However, the lack of computerization makes it difficult to use in a large and complex project.
4.	Resource management	Address resource availability during the “Making-ready” process by	Addressing key resource availability is a shortfall of this method. It focuses	Does not explicitly consider resource management. Resource allocation/levelling is difficult

		matching workflow to capacity	on calculating the theoretical early start and finish dates, late start and finish dates for all scheduled activities without regard for any resource limitations.	as it lacks resource allocation and levelling capabilities.
5.	Collaboration and communication	A collaborative planning process that facilitates communication in the form of consultations at all stages of the project	Reduced collaboration and communication between stakeholders.	Provides a graphical display of how crews and equipment move through the project over time and therefore facilitates communication and communication
6.	Space planning	The process of “making ready” focuses on the identification and removal of constraints and helps ensure that space-time relationships are considered but does not visualize it.	Does not consider time-space relationship during the planning process	Easy to visualize project schedule to account for time and space constraints. Facilitates space planning.

*Step 2: Define Factors.* Factors that will help the stakeholders differentiate between alternatives were identified. Several factors were considered, and the relevant factors were chosen for the decision-making process (Figure 1). Factors having the same purpose were combined due to their close relationship (e.g. collaboration, communication and stakeholder management). Such merging helps to avoid double counting.



**Figure 1: Identified factors for decision making**



*Step 3: Define the “must” and “want” criteria for each factor.* The project managers agreed on the criteria upon which to base their decision making and then weights were assigned collaboratively. In some cases, the stakeholders did not arrive at a consensus weight for some of the criteria, in this case, the arithmetic mean was obtained, and this was collectively accepted. For example, factor 1 considered the “ease of use/implementation in linear projects”. The stakeholders agreed that the criterion for this factor is “Easier is better” and collectively agreed to ascribe a weight of 50 to this criterion. Column 1 of 2 shows the relevant factors used for the CBA analysis, the “must criterion” for each factor and the weight of the criterion.

*Step 4: Summarise the attributes of each criterion.* The main attribute of each alternative with respect to each factor is summarised. The least preferred attributes are summarised and underlined to highlight them. This provides the basis for comparison between alternatives in describing their advantages of one alternative over another.

*Step 5: Decide the advantages of each alternative.* The main advantage of each alternative based on a given factor and attribute is determined and shown in italics. For each factor, the least preferred alternative will not have an advantage.

*Step 6: Decide the importance of each advantage.* This is done collaboratively and decisions on what weight to ascribe to each advantage are agreed upon. The maximum advantage that can be ascribed to each advantage depends on the weight given to the factor, the values range from 20 to 100. The most important advantage for each factor is agreed upon by all stakeholders as a first step to assigning it the maximum agreed weight. Thereafter, depending on the number of alternatives, the stakeholders next agree on the weight to assign to the second “best” alternative. For instance, in factor 2: “promotes collaboration and communication”, the stakeholders could not reach a consensus on the weight to assign to the second-best alternative. The first author who facilitated the CBA session resolved this impasse by taking the arithmetic mean of the different weights proposed by the different participants and this was adopted as the consensus value for the second-best alternative. The importance of advantage (IofA) for each alternative is summed up at the end of the session and the alternative with the highest IofA value is selected as the most preferred.

*Step 7: Evaluate cost data if applicable.* This step was not ignored as there is no cost data associated with the choice of alternatives. However, if cost data exists, it is evaluated by plotting the IofA score for each alternative against the cost of selecting an alternative.

The summary of the CBA analysis is presented in Table 3.

**Table 3: CBA Implementation**

Factor & Criterion	Last Planner System		Critical Path Method		Linear Scheduling	
1. Ease of use/ implementation in linear projects <b>Crit.:</b> Easier is better <b>Max. Weight:</b> 50	<b>Attr.:</b> Easy to use and based on operational planning		<b>Attr.:</b> <u>Convolutd in complex projects, and ineffective for linear continuous projects</u>		<b>Attr.:</b> Used in linear projects where the majority of the work is made up of highly repetitive activities	
	<b>Adv.:</b> understand the presence of variability in production, human-focused	<b>IofA</b> 35	<b>Adv.:</b>	<b>IofA</b> 0	<b>Adv.:</b> <i>Performs optimally when applied to linear projects</i>	<b>IofA</b> (50)
2. Promotes collaboration and communication during the project execution phase <b>Crit.:</b> Higher is better <b>Max. Weight:</b> 100	<b>Attr.:</b> Planning is done mainly at the project level and is therefore flexible		<b>Attr.:</b> <u>Planning is rigid, and process focused and carried out on a strategic level</u>		<b>Attr.:</b> Planning is carried out on a strategic level and best implemented as an effective management tool at field level	
	<b>Adv.:</b> <i>More collaboration and communication during the execution stage</i>	<b>IofA</b> (100)	<b>Adv.:</b>	<b>IofA</b> 0	<b>Adv.:</b> Collaboration and communication during the execution stage	<b>IofA</b> 60
3. Resource management <b>Crit.:</b> Higher is better <b>Max. Weight:</b> 50	<b>Attr.:</b> The process of “making ready” and constraint removal are tools in resource management		<b>Attr.:</b> Integrated with Network planning tools		<b>Attr.:</b> <u>Does not explicitly consider resource management.</u>	
	<b>Adv.:</b> Enhanced collaboration and communication promotes resource management	<b>IofA</b> 20	<b>Adv.:</b> <i>Facilitates resource allocation, levelling and smoothing</i>	<b>IofA</b> (50)	<b>Adv.:</b>	<b>IofA</b> 0
4. Plan reliability <b>Crit.:</b> Higher is better <b>Max. Weight:</b> 25	<b>Attr.:</b> Planning is done in detail closer to the task execution		<b>Attr.:</b> <u>Planning is comprehensive with long term focus</u>		<b>Attr.:</b> Easy to schedule continuity on linear projects, improving coordination and continuity	
	<b>Adv.:</b> <i>Commitment planning by the last planners increases planning reliability</i>	<b>IofA</b> (25)	<b>Adv.:</b>	<b>IofA</b> 0	<b>Adv.:</b> Improved coordination and continuity and visualization of the time-space relationship	<b>IofA</b> 15
5. Use of technology (planning tools) <b>Crit.:</b> Availability of technology is better <b>Max. Weight:</b> 50	<b>Attr.:</b> Simple and manual planning technique. Planning is carried out in the “big room” collaboratively using big plain boards and stickers.		<b>Attr.:</b> Well-advanced tools available for use, easily adapted to numerical computerization		<b>Attr.:</b> <u>Intuitive and easy to understand but cannot easily be adapted to numerical computerization as readily as network methods</u>	
	<b>Adv.:</b>	<b>IofA</b> 0	<b>Adv.:</b> <i>Availability of technology supporting the implementation</i>	<b>IofA</b> (50)	<b>Adv.:</b> Limited number of computerization implementation platforms	<b>IofA</b> 0
6. Ability to accommodate space planning <b>Crit.:</b> Ability to accommodate space planning is better <b>Max. Weight:</b> 100	<b>Attr.:</b> Pull-based scheduling that facilitates micro-scheduling. Focuses on “how” instead of “what”		<b>Attr.:</b> <u>Focuses on “what” instead of “how”. Emphasizes on the critical path</u>		<b>Attr.:</b> Considers and accurately represents space-time relationships	
	<b>Adv.:</b> Constraint removal techniques facilitates space planning	<b>IofA</b> 50	<b>Adv.:</b>	<b>IofA</b> 0	<b>Adv.:</b> <i>Facilitates the visualization of space-time relationships</i>	<b>IofA</b> (100)
7. Reduction of uncertainty and risk <b>Crit.:</b> Higher is better <b>Max. Weight:</b> 50	<b>Attr.:</b> Produces a predictable and reliable workflow		<b>Attr.:</b> Complemented by EVM and PERT with statistical abilities.		<b>Attr.:</b> <u>The ability to visualize time-space relationships provides some possibilities for risk reduction.</u>	
	<b>Adv.:</b> Project percent complete (PPC) and Variance Analysis (VA) can be used to reduce uncertainty and risk	<b>IofA</b> 35	<b>Adv.:</b> <i>Statistical abilities help planners to get a better idea of time and schedule risk</i>	<b>IofA</b> (50)	<b>Adv.:</b>	<b>IofA</b> 0
<b>Total IofA</b>		<b>(265)</b>		<b>150</b>		<b>225</b>

The results of the CBA analysis show that during the construction of elevated urban highways, the LPS is preferable, subject to the selected factors and criteria. However, changing the factors and the criteria used in the analysis may lead to a different outcome for different types of project.

## **DISCUSSION**

Several issues were identified in the implementation of CBA. These include: (1) Getting relevant stakeholders to gather in one room to make project decisions. To counter this, the project kick off meeting (KOM) can be used to greater effect. (2) Considerable time was dedicated to collecting data. Currently, no research work has compared the three scheduling method used in this analysis. Hence the factors upon which the attributes were defined, and the definition of the attributes took a lot of time. It is important to note that the data collection process is integral to any MCDM method. (3) The stakeholders used for the case study analysis had to be trained in the application of CBA. The method and vocabulary had to be explained and the commitment to training time may present a barrier to first-time users of the method.

## **CONCLUSION**

CBA is an important decision-making method that integrates the perspective of multiple stakeholders. This study suggests the application of CBA in selecting the project scheduling technique to apply in the construction of elevated urban highway projects. The conclusions from the case study that may be generalized are: (1) CBA was helpful in integrating the perspective of multiple stakeholders. (2) CBA facilitated the identification of critical success factors necessary for selecting a suitable project scheduling method for highway projects. Some barriers were identified in the application of the CBA method. The most important barrier was the difficulty in getting the decision makers in one room at the time of decision.

It can be surmised that the application of CBA fosters more collaboration and exchange of ideas during the decision-making process, enhances transparency as decisions are made based on the importance of advantage of agreed factors.

## **ACKNOWLEDGEMENTS**

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## **REFERENCES**

- Aguado, A., Caño, A. del, de la Cruz, M. P., Gomez, D., and Josa, A. (2011). "Sustainability assessment of concrete structures within the Spanish structural concrete code." *Journal of Construction Engineering and Management*, American Society of Civil Engineers, 138(2), 268–276.
- Akadiri, P. O., Olomolaiye, P. O., and Chinyio, E. A. (2013). "Multi-criteria evaluation model for the selection of sustainable materials for building projects." *Automation in Construction*, Elsevier, 30, 113–125.
- Arroyo, P. (2014). "Exploring decision-making methods for sustainable design in commercial buildings." UC Berkeley.
- Arroyo, P., Mourgues, C., Flager, F., and Correa, M. G. (2018). "A new method for

- applying choosing by advantages (CBA) multicriteria decision to a large number of design alternatives.” *Energy and Buildings*, Elsevier, 167, 30–37.
- Arroyo, P., Tommelein, I. D., and Ballard, G. (2012). “Deciding a Sustainable Alternative by Choosing by Advantages’ in the AEC industry.” *20th Annual Conference of the International Group for Lean Construction*, I. D. Tommelein and C. L. Pasquire, eds.
- Arroyo, P., Tommelein, I. D., and Ballard, G. (2013). “Using ‘Choosing by Advantages’ to Select Tile From a Global Sustainable Perspective.” *21st Annual Conference of the International Group for Lean Construction*, C. T. Formoso and P. Tzortzopoulos, eds., 309–318.
- Arroyo, P., Tommelein, I. D., and Ballard, G. (2014). “Comparing Weighting Rating and Calculating vs. Choosing by Advantages to Make Design Choices.” *22nd Annual Conference of the International Group for Lean Construction*, B. T. Kalsaas, L. Koskela, and T. A. Saurin, eds., 401–412.
- Arroyo, P., Tommelein, I. D., and Ballard, G. (2015). “Selecting globally sustainable materials: A case study using Choosing by Advantages.” *Journal of Construction Engineering and Management*, American Society of Civil Engineers, 142(2), 5015015.
- Arroyo, P., Tommelein, I. D., Ballard, G., and Rumsey, P. (2016). “Choosing by advantages: A case study for selecting an HVAC system for a net-zero energy museum.” *Energy and Buildings*, Elsevier, 111, 26–36.
- Bakhoun, E. S., and Brown, D. C. (2011). “Developed a sustainable scoring system for structural materials evaluation.” *Journal of construction engineering and management*, American Society of Civil Engineers, 138(1), 110–119.
- Dawood, N., and Shah, R. K. (2007). “An innovative approach for improvement of communications through visual schedule model in road construction.” *7th International Conference on Construction Applications of Virtual Reality*, Pennsylvania State University University Park, PA, 216–223.
- Hannon, J. J. (2007). *Emerging technologies for construction delivery*. Transportation Research Board.
- Jeannotte, K., and Chandra, A. (2005). *Developing and implementing transportation management plans for work zones*. US Department of Transportation, Federal Highway Administration, Office of Transportation Operations, Washington, D.C.
- Karakhan, A., Gambatese, J., and Rajendran, S. (2016). “Application of Choosing by Advantages Decision-Making System to Select Fall-Protection Measures.” *24th Annual Conference of the International Group for Lean Construction*.
- Mahoney, K. M. (2007). *Design of construction work zones on high-speed highways*. Transportation Research Board.
- Murguia, D., and Brioso, X. (2017). “Using ‘Choosing by Advantages’ and 4D Models to Select the Best Construction-Flow Option in a Residential Building.” *Procedia engineering*, Elsevier, 196, 470–477.
- Nguyen, H. V, Lostuvali, B., and Tommelein, I. D. (2009). “Decision Analysis Using Virtual First-Run Study of a Viscous Damping Wall System.” *17th Annual Conference of the International Group for Lean Construction*, Y. Cuperus and E. H. Hirota, eds., 371–382.
- Parrish, K., and Tommelein, I. D. (2009). “Making Design Decisions Using Choosing

- by Advantages.” *17th Annual Conference of the International Group for Lean Construction*, Y. Cuperus and E. H. Hirota, eds., 501–510.
- Schottle, A., Arroyo, P., Bade, M., Schöttle, A., Arroyo, P., and Bade, M. (2015). “Comparing Three Methods in the Tendering Procedure to Select the Project Team.” *23rd Annual Conference of the International Group for Lean Construction*, O. Seppänen, V. A. González, and P. Arroyo, eds., 267–276.
- Suhr, J. (1999). *The choosing by advantages decision-making system*. Greenwood Publishing Group.

## **Organizing Teams Around Emerging Technology**

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### **ABSTRACT**

Federal agencies have a mandate to adopt emerging technologies in a government-wide effort to streamline processes and generate cost savings. An agency's ability to fulfill its mission is increasingly driven by how well it can leverage its data and implement new technologies. However, as federal agencies begin to strategize on where and how to prioritize data-centric decision making, they are discovering most data is siloed. Before emerging technology can be implemented in systems, cultural alignment on how to share data and implement emerging technology is needed.

The purpose of this paper is to guide leaders on how to build alignment on key initiatives within emerging technology and data sharing. The framework will illustrate how teams can effectively manage and implement modernization transformations. With a proper framework for organizing teams, leaders can collaborate on implementation opportunities and challenges while building alignment to achieve successful transformation.

### **INTRODUCTION**

The federal government is moving towards an effort to leverage emerging technologies and modernize their data and systems in order to encourage efficiency and transparency. The emphasis on data sharing is an opportunity for every department, agency, and office to realign its organizational structures. Despite the opportunities for cost savings and data sharing, agency data is siloed and members are reluctant to migrate towards transparency with their data.

One of the issues lies in the cultural underpinnings of the federal government and the traditional viewpoint of data as a source of power. Encouraging a culture of greater collaboration with a strong governance and communications structure will allow for federal agencies to adapt to the changing environment of modernization. The U.S. Department of Health and Human Services (HHS) **BUYSMARTER** model provides evidence of a successful framework with a three-phased approach that instigated a cultural shift towards data sharing and transparency across the Department.

### **FEDERAL MANDATES**

In an effort to encourage the efficient use of taxpayer dollars, federal agencies are leveraging emerging technologies to modernize existing legacy systems. Recent changes in executive priorities have re-emphasized the adoption of emerging technologies nationwide. The government has sought to identify and offer a transparent perspective of its spending, expanding access to government data, and piloting emerging technologies to achieve mission-delivery outcomes. The White House Executive Order on Maintaining American Leadership in Artificial

Intelligence (AI) provides the foundation for a national plan to boost investment in AI.<sup>1</sup> Agency strategic plans are prioritizing investments in emerging technologies including blockchain, AI, and machine learning. These directives push for strategic investments in emerging technologies, yet do not provide agencies with additional resources for a smooth transition. Agencies are asked to successfully pilot and implement these technologies into their existing workflows in order to achieve cost savings under the guise and pressure of budget cuts. As these agencies begin to launch and expand AI initiatives in service of their missions, it is imperative to prioritize better collaboration and social cohesion on data sharing practices.

## **FEDERAL AGENCY DATA**

Federal agency IT modernization has historically signified a movement from a large monolithic system to a newer, more expensive large monolithic system with no data access points. Despite widespread interest in adopting a transparent approach to data sharing and systems development, agencies remain siloed.<sup>2</sup>

This new method of data sharing is an area of growth for the federal government. Technology is allowing agencies to access, analyze, and distribute data in real time. To be successful in the new era of data sharing, agencies need to be aligned in their governance, principles, and communications. It is critical for agencies to develop a standardized data governance, accountability mechanism, and communications structure to understand and manage the migration away from siloed systems.

## **DATA PERCEPTIONS**

The resistance to shift from siloed to transparent and collaborative systems in the federal government is rooted in the culture surrounding the government's approach to data. Culture is the most significant determinant of how a group will behave and respond to transformations. It is explicitly found in organizations, through documentation such as handbooks or charters, or implicitly, such as unstated behaviors or responses. With transformation efforts, the risk is found in understanding the balance between the explicit and the implicit behaviors and practices of an organization. Due to the cultural behaviors related to data sharing, federal agencies have a skewed view of their internal operations.

The lack of a data sharing culture is due to the implicit understanding of data as a source of power. Data sharing is viewed a method of demonstrating loyalty between leaders and as a method of promoting the interests of the single agency, instead of the federal government as a whole. Such behaviors are worsened by the reality of constrained resources across agencies; the act of sharing data can arguably take away from the mission-critical work of organizations and is thus a sensed loss of power. There is also an existing fear of misrepresenting data and a reluctance to critique a fellow agency for unsatisfactory data sharing practices. Constructive feedback conversations on differentiating data sets are implicitly viewed as a personal attack

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<sup>1</sup> Exec. Order No. 13859, 84 Fed. Reg. 3967 (February 11, 2019)

<sup>2</sup> *Report to the President on Federal IT Modernization*. U.S. CIO Council, 2017.

instead of a healthy criticism. The implicit and explicit cultural attitudes towards data sharing in the federal government are rooted in a traditional viewpoint of data as a source of power.

## CULTURE

Behaviors  
We Tolerate and Advocate

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Behaviors  
We Do Not  
Tolerate

CULTURE

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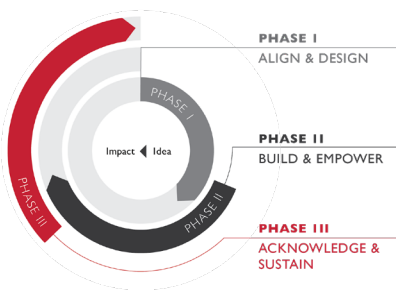
Before wide-spread data sharing can take place, federal agencies need to create and foster a collaborative culture. Culture is the line a group draws between the behaviors it embraces and the behaviors it does not tolerate. Culture also determines how and if an organization's goals are achieved. It influences whether strategies are implemented as planned, if money is spent as the budget authorizes, and whether or not potential threats are mitigated before their detrimental implications. It is important to make culture explicit at the beginning of any change or transformation initiative and to recognize all behaviors and practices influence culture. When aligning on organizational issues, most agencies overemphasize the technical components for change management initiatives and neglect social or cultural issues. In order to adequately migrate towards a transparent culture, agencies need to establish processes for understanding their current state of data sharing and develop strong governance and communications processes to facilitate sharing. Cross-agency leadership needs to be prepared to manage data insights and communications across their agencies. There is an opportunity for leaders to map the data ecosystem of their organizations in order to create a clearing for productive knowledge sharing.<sup>3</sup>

## IDEA TO IMPACT

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<sup>3</sup> "Culture." *The Primes: How Any Group Can Solve Any Problem*, by Chris McGoff, John Wiley & Sons, 2012.





In order to shift from a siloed to a collaborative culture in regards to data sharing practices, organizations need to focus on the environmental aspects and group dynamics involved in complex multi-stakeholder initiatives. Complex challenges including power dynamics and cultural understandings of data can be addressed while organizations work to prioritize initiatives to tackle in service of a long-term vision. Social complexity and organizational culture are powerful forces that can derail any transformation effort. This three step Idea-to-Impact (i2i) model is grounded in a strong understanding of the “voice of the customer.”<sup>4</sup> The i2i is comprised of the following three phases, along with a number of cross-cutting techniques that occur throughout the phases:

1. Align and Design
2. Build and Empower
3. Acknowledge and Sustain

**Phase One: Align and Design.** In order to move towards a transparent and efficient organizational culture, senior leaders across the enterprise need to align on their vision, intent, and desired outcomes. Leaders identify and clarify the fewest, most critical actions to tackle - along with elements of change management, communication, and risk management when planning movement towards adopting data sharing practices. The Align and Design stage achieves the following outcomes:

- Improved understanding of the most important stakeholders and/or customers
- Clarity on how power works in the system or organization
- Team and stakeholders are aligned on: 1) how the current organization performs, 2) a compelling case for change, 3) a vision for the future, and 4) a strategy to achieve the vision
- Initial baseline measures and early success stories

**Phase Two: Build and Empower.** Building program awareness and soliciting support from cross-functional stakeholders across the enterprise will ensure data sharing practices and systems development objectives can be achieved. Stakeholders from the leadership to the program level should be informed, engaged, and enrolled when moving towards a transparent and collaborative culture. Due to the rapid pace of emerging technology initiatives, it is key to identify resources or support structures to enable successful implementation. This phase achieves the following outcomes:

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<sup>4</sup> <https://theclearing.com/who-we-are/idea-to-impact/>

- Stakeholders understand the organization's vision and champion the effort
- Clients make progress toward their critical initiatives, guided by project management
- New ideas are rapidly prototyped and field tested
- Measurement of success and impact
- Elimination of wasteful activities and reinvestment in innovation
- Decreased risk on high priority change efforts

**Phase 3: Acknowledge and Sustain.** Adequate communication and education across the enterprise and with industry partners will support the successful implementation and growth of initiatives in emerging technology. Re-assessing and re-configuring organizational elements and resources will help to support the implementation process. The communication of realized value and return on investment (ROI) of data sharing practices will also help to manage skeptics. The Acknowledge and Sustain phase achieves the following outcomes:

- Strengthened reputation and relationships with key stakeholders and/or customers
- Demonstration of sustained high performance measured against baseline
- Increased interest in the mission, program, or initiative and improved capability to recruit talent
- Staff and stakeholders are outfitted to adapt to new trends and maintain high performance
- Staff are acknowledged for contributions, leading to continued support and buy-in

## CASE STUDY: HHS **BUYSMARTER**

The Department of Health and Human Services (HHS) **BUYSMARTER** initiative demonstrates the successful use of the i2i framework in service of promoting a data-oriented organizational culture. HHS' acquisition function is complex, fragmented, and inconsistent across HHS, which led to overspending on goods and services. In order to manage these redundancies, HHS embarked on a process called *ReImagine HHS*, under which **BUYSMARTER** was identified to address HHS' \$24 billion annual spend on goods and services. **BUYSMARTER** is building the Department's capacity to collectively negotiate for better value, improved terms and conditions, and the appropriate levels of inventory, without compromising mission or requirements for mission-critical goods and services, quality, or speed. Additionally, **BUYSMARTER** is improving the customer experience, leveraging e-commerce platforms and cognitive intelligence tools to make HHS employees' jobs easier. **BUYSMARTER** has the potential for HHS to achieve significant cost savings of at least \$720 million on an annual basis once fully operational.<sup>5</sup>

The visionary approach from leadership across HHS, cross-functional stakeholder support, and a robust communications strategy is contributing to the success of the **BUYSMARTER** initiative across HHS. Through *ReImagine HHS*, leadership identified acquisitions as a targeted area for improvement. They identified key stakeholders to engage from the onset: the Heads of Contracting Activity (HCAs) from each Operating Division. Recognizing the need for early wins, **BUYSMARTER's** project management organization (PMO) conducted an initial baseline analysis of HHS' contracting data to identify the spending discrepancies for

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<sup>5</sup> *The BUYSMARTER Journey: Our Successes Thus Far*. HHS.gov U.S. Department of Health & Human Services, 2018, [www.hhs.gov/sites/default/files/hhs-buysmarter-journey.pdf](http://www.hhs.gov/sites/default/files/hhs-buysmarter-journey.pdf).

targeted goods and services. In order to adequately gather the data and leverage the PMO-designed AI algorithm tasked with analyzing the contracting data, **BUYSMARTER** engaged subject matter experts from across HHS to gather the requirements for the targeted goods and services. This building and executing on the targeted Integrated Process Teams (IPTs) achieved its objectives of demonstrating the discrepancies between agency spend on the same goods and services. Through achieving the early successes of the IPTs by leveraging Phase One of the i2i model, **BUYSMARTER** received significant support from across HHS.

In an effort to further encourage transparent data sharing practices, **BUYSMARTER** prioritized the development of long-term relationships across HHS. To date, the initiative has assembled more than 200 contributing agency stakeholders that are involved in the future of federal acquisitions, creating a new model where an entire Department within the federal government works together and operates collectively. This supports HHS efforts to build sustainable working relationships across HHS. **BUYSMARTER** has engaged major internal agency stakeholders such as NIH, FDA, CDC, and CMS, along with external agency stakeholders including OMB and GSA. Agencies in their current state are willing to collaborate and consolidate contracting data in service of their missions. By engaging all agency stakeholders and leadership as collaborators and implementers of the **BUYSMARTER** model, there was a cultural shift that resulted in more data sharing in service of the initiative's outcomes.

## CONCLUSION

Efforts to modernize data across the federal government present newfound challenges rooted in pre-existing cultural opinions on the value and role of data. Historically, data was viewed as a source of power that advantaged one agency over the other. Spurred by federal mandates to adopt a transparent and collaborative model, agencies are in the process of culturally shifting towards data sharing. By shifting cultural attitudes and leveraging emerging technologies such as AI, agencies will efficiently achieve their mission outcomes. Utilizing a three-phased approach under the i2i methodology, stakeholders will effectively champion and disseminate data sharing initiatives across their departments. The **BUYSMARTER** initiative demonstrates the importance of stakeholder engagement, strategic communications efforts, and a strong governance model when moving towards a transparent and technologically-oriented model across a department. Successful transformation efforts leveraging emerging technology are thus contingent on shifts towards a data-driven culture.

# **Post-disaster project management**

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## **ABSTRACT**

The management of post-disaster response is becoming an important aspect of modern project management. The increasing severity and variability of storms and many other natural hazards such as wildfires is calling increasing attention to this issue. This paper summarizes organizational approaches to project disaster management.

## **INTRODUCTION**

The project management aspects associated with post-catastrophe situation are similar in many respects to any other project management task. Nonetheless, there are important differences as well. Following the Indian Ocean tsunami disaster of December 2004, PMI through its global operations center and international developments specific interest group collaborated to develop PM approaches for post-disaster reconstruction activities.

Disaster response and recovery projects are common within large development organizations, such as the World Bank, Inter-American Development Bank, Asian Development Bank, and related entities. Modern project management approaches can be adapted to serve these needs.

Gilbert White (Figure 1) is famous for having written (White 1942), “Floods are 'acts of God,' but flood losses are largely acts of man.” The degree to which disasters become catastrophes depends in large measure on our response to them, and that response in large measure lies in project management.

## **COMPONENTS OF PROJECT MANAGEMENT RESPONSE**

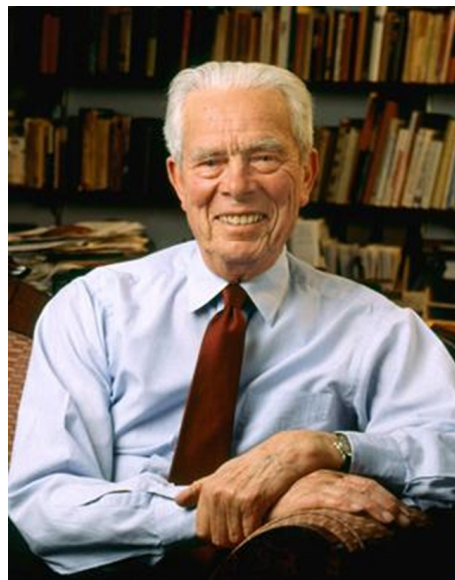
The principal components of disaster project management comprise (Figure 2),

- Planning,
- Prevention,
- Preparation,
- Initiation,
- Response,
- Recovery,
- Reconstruction, and
- Close out

**Planning** for disaster means knowing how react before, during and after an event, and knowing the hazards that could affect where people live, work, go to school, and undertake other daily activities. It is important to appreciate populations with access and functional needs.

**Prevention and preparation** anticipate the occurrence of a yet to be characterized catastrophic event. Prevention normally means those activities and plans which mitigate either the probability of catastrophic events occurring, or the associated consequences should they occur. Prevention activities which lower the probability of a catastrophic event include such things as land-use planning or retreat from at-risk geographies or situations. Mitigation activities which lower associated consequences include such things as improved evacuation planning or design permitting to provide for more disaster resilient structures.

**Project initiation** is as in any other project. The goal is to define the effort at a high level and to establish the administrative and police case to be addressed: why is the effort being done, and what is the social, economic, and public value to be delivered? What is the feasibility of the disaster response, and who are the stakeholders to be affected or require involvement?



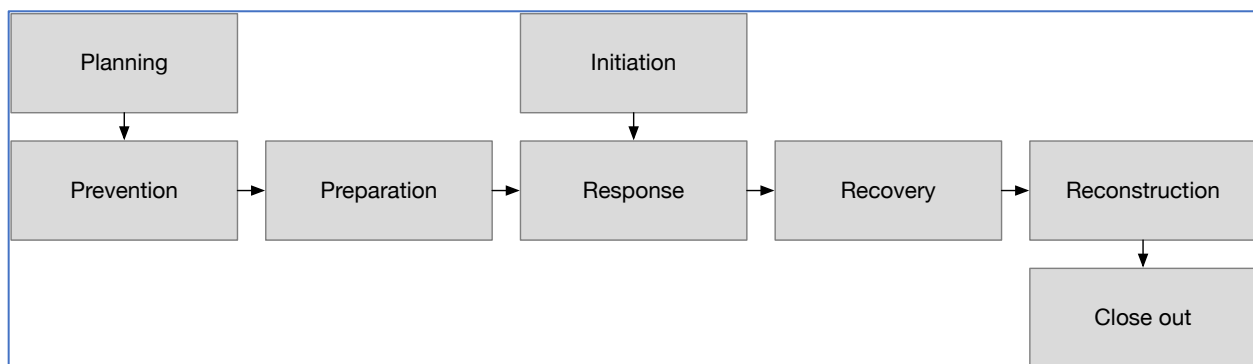
**Figure 1. Gilbert F. White (2011-2006) was a prominent American geographer, referred to as the "father of floodplain management" and the arguably the major environmental geographer of the 20th century". White is known for his work on natural hazards, particularly flooding and the importance of sound water management (Westcoat 2006).**

**Response** involves the deployment of assets in response to the catastrophe and to the development of communication plans or operation management approaches including operations management. This also should include the continuation of vital services such as housing, provisioning, and medical services.

**Recovery** involves plans and activities to return to normal operations. This involves among other things repair and relocation considerations, the reestablishment of transportation and communication infrastructures, and the acquisition of additional resources as necessary.

**Reconstruction** is the longer-term enterprise of returning to the community and its infrastructure to pre-catastrophe conditions and providing for improved resilience relative to the earlier condition of the physical landscape.

**Close out** is again as in any other project. It should be planned for as early as possible even though it is often the last major process of a project's life. Unlike many projects the post disaster reconstruction effort may last for a prolonged period after the initial responses completed. This reality needs to be accommodated as the project hands-off the continuing effort to other entities.



**Figure 2. Components of disaster project management**

## **PROJECT CHARTER**

Once the disaster has occurred and the need for responses identified, a project initiation phase is underway. Once authorization is made first need is to create a project charter, or project initiation document. This is similar to any other project.

The project charter lays out the purpose, scope, and requirements of the effort. It should include details such as the key participants, stakeholders, and project team; the scope, objectives, and goals; administrative and financial constraints. The project charter provides a foundation for defining project decisions and ensuring they are in line with goals.

The project charter should be no more than one page. Its goal is to achieve a consensus the participants stakeholders such that the objectives, resources, and constraints of the project are clearly communicated to all. In the disaster response situation, it is important to the project charter lay out a timeline activities and desired deliverables.

## **STAFFING THE POST-DISASTER PROJECT TEAM**

After the attack of 9/11, the need for communication and coordination during a response was identified. Homeland Security Presidential Directive-5 was issued which tasked responding agencies of government to develop a National Incident Management System and a National Response Plan (Chartoff and Roman 2019).

The National Response Plan consolidated the plans of federal agencies into an all-hazards response. This was superseded in 2008 with the National Response Framework. While the National Response Framework is the plan, the National Incident Management System is implementation of the plan and includes command and control initially adopted by fire agencies. Healthcare, for example, uses the hospital incident command system that establishes a standardized framework for command, communication, and coordination.

The incident command center aids interaction with outside agencies with the goal of improving coordination. The framework follows five project management functions:

The **command staff** includes the incident commander and staff. This includes a public information officer to disseminate information to the media, a liaison officer to coordinate with external agencies, a safety officer to ensure safety of personnel and monitor hazards, and technical specialists who are a subject matter expert depending on the specific situation.

The **planning staff** collects and organizes information and resources and is responsible for creating an Incident Action Plan.

The **logistics staff** supports the incident response with food, supplies, and transportation to meet objectives.

The **operations staff** organizes tactical objectives and responds to the incident.

The **finance staff** tracks expenditures and provide funds for costs and claims.

Most States and local jurisdictions provide for the position of emergency program manager. At each level of government, laws define the responsibility and authority of emergency managers and management programs. It is important to recognize how emergency management works at respective governmental levels, and to coordinate plans with official community plans. Coordination of knowledge, resources and expertise between government officials and the private sector is a basic principle of emergency management.

## HEALTH AND SAFETY OF THE TEAM

Disaster recovery involves occupational hazards. Often these hazards are exacerbated by the conditions of the local environment as a result of the natural disaster. While individual workers should be aware of these potential hazards, project managers are responsible for minimizing exposure and protecting team members. This includes identification and thorough assessment of potential hazards, application of appropriate personal protective equipment, and the distribution of information to enable safe performance.

Potential assaults to the project team may include,

- Physical exposures
- Flood-associated injuries
- Earthquake-associated injuries
- Chemical exposures
- Hazardous material release

- Biological exposures

## PHASES OF DISASTER MANAGEMENT

FEMA's approach to emergency management has focused primarily on preparedness. Community preparedness for disasters requires identifying resources and expertise in advance, and planning how these can be used in a disaster. However, preparedness is only one phase of emergency management. Current thinking defines four phases of emergency management: mitigation, preparedness, response, and recovery (Table 1). FEMA training programs provides support for each phase.

**Table 1. FEMA's four phases of emergency management: mitigation, preparedness, response, and recovery involves preventive measures to reduce vulnerabilities. Preparedness builds capabilities to manage the impact of hazards. Response is an action to reduce adverse impacts during the disaster. Recovery involves actions to restore areas affected by the disaster.**

Mitigation	Preventing future emergencies or minimizing their effects	<ul style="list-style-type: none"> <li>• Includes any activities that prevent an emergency, reduce the chance of an emergency happening, or reduce the damaging effects of unavoidable emergencies.</li> <li>• Buying flood and fire insurance for your home is a mitigation activity.</li> <li>• Mitigation activities take place before and after emergencies.</li> </ul>
Preparedness	Preparing to handle an emergency	<ul style="list-style-type: none"> <li>• Includes plans or preparations made to save lives and to help response and rescue operations.</li> <li>• Evacuation plans and stocking food and water are both examples of preparedness.</li> <li>• Preparedness activities take place before an emergency occurs.</li> </ul>
Response	Responding safely to an emergency	<ul style="list-style-type: none"> <li>• Includes actions taken to save lives and prevent further property damage in an emergency situation. Response is putting your preparedness plans into action.</li> <li>• Seeking shelter from a tornado or turning off gas valves in an earthquake are both response activities.</li> <li>• Response activities take place during an emergency.</li> </ul>
Recovery	Recovering from an emergency	<ul style="list-style-type: none"> <li>• Includes actions taken to return to a normal or an even safer situation following an emergency.</li> <li>• Recovery includes getting financial assistance to help pay for the repairs.</li> <li>• Recovery activities take place after an emergency.</li> </ul>

## COMMUNICATIONS

Communication is critical during any emergency, and thus planning for communications prior to an event is critical. Confusion in the communication network and its protocols can result in emergency events escalating.

Once an event has occurred a comprehensive assessment evaluating the level of impact and its logistical implications should be undertaken. Following assessment, the appropriate plan or



response to be activated depends on pre-established criteria within the emergency plan. The steps necessary should be ordered to ensure critical functions are operational as soon as possible. The critical functions are those that makes the plan untenable if not operationalized.

The communication policy must be well known and rehearsed, and stakeholders must be alert. All communication infrastructure must be as prepared as possible, with all information on groupings clearly identified.

## **CLOSE OUT**

Unlike many projects the post disaster reconstruction effort may last for a prolonged period after the initial responses completed. The recovery phase starts after the threat to human life has subsided. The goal is to bring the affected area back to normalcy as quickly as possible.

## **REFERENCES**

- Chartoff, S. E., and Roman, P. (2019). *Disaster Planning Univ of Connecticut*. University of Connecticut, Hartford.
- Westcoat, J. L. (2006). “Gilbert Fowler White (1911-2006), wisdom in environmental geography.” *Geographical Review*, 96(4), 700–710.
- White, G. F. (1942). “Human Adjustment to Floods: a geographical approach to the flood problem in the United States.” PhD, University of Chicago, Chicago.

**Project Manager Transition:  
A new skill set for managing large and complex projects**

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**ABSTRACT**

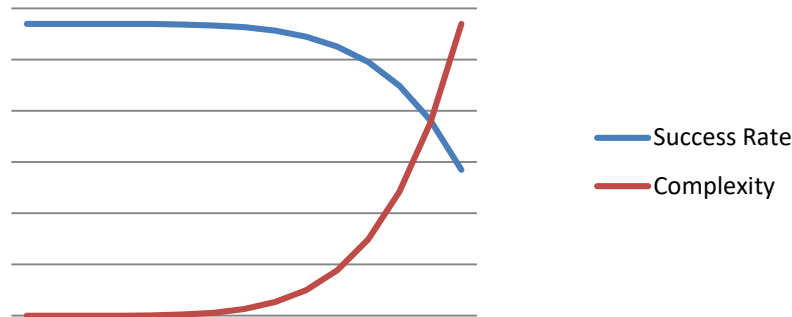
As projects grow in size their level of complexity grows exponentially. History has shown that many project managers struggle to deliver larger and more complex projects while others transition successfully.

Project managers typically follow a similar initial career trajectory; learn key techniques and tools, deliver small projects under supervision. Over time they are trusted with larger and larger projects as they demonstrate success with the smaller ones. Progress continues until the individual starts to struggle and supervisors limit coaching to reiterating the basic tenets of project management. Why do only some project managers continue their success with large and complex projects? What do those who are successfully with large project do differently?

Successful managers of large and complex project transition to executive level management, leaving behind those colleagues who continue to focus on project administration. Specifically they; loosen their grip on project detail, there is too much in a large project. They organize autonomous but accountable work streams. They focus on where challenges are most likely to occur, recognizing that organizations are an integrated web of sub goals. They also anticipate there will be constant changes develop plans that are flexible. All these skills enable the successful project manager to reduce the time spent on tactical project administration and so they can spend their time working strategically to preempt potential issues.

**THE CHALLENGE OF SUCCESSFULLY MANAGING LARGE PROJECTS**

Over the last 30 years I have observed hundreds of project managers and thousands of projects. The majority of these efforts have been well organized and delivered successfully. However, an analysis of these projects has shown that the success rate declines as the projects get large and more complex. Literature that describes big project failure is widely available and makes compelling reading. Examples such as: Mars Climate Orbiter<sup>(1)</sup>, Denver Airport Baggage Handling System<sup>(2)</sup>, and Westpac CS90<sup>(3)</sup>. To be fair, there are many large, complex projects that are delivered successfully. So, this raises a question, why do some project managers transition to large projects successfully while so many others begin to flounder as complexity increases?



**Figure 1: Success rate diminishes as complexity increases**

### **THREE STAGES TO STRUGGLING WITH LARGE PROJECTS**

Typically, a project manager's journey starts at a junior level. A personal choice of career direction combined with an organizational need to guide discrete bodies of work through successful delivery. The individual will receive training in core project management techniques. The training may be anywhere from in-house coaching to full certification from an organization such as the Project Management Institute.

#### **Stage 1: Managing small simple projects**

Initial assignments will encompass small projects, likely self-contained within a single part of the organization. The enthusiastic new project manager will create a detailed Work Breakdown structure often with tasks down to durations of an hour, predecessors for every task and a constantly updated percent complete field. This is all good. The supervisor of the new project manager constantly emphasizes managing the detail.

The initial projects are all a success with the new project manager on top of every detail. I equate this to juggling with two tennis balls, it needs some coordination but is not too difficult.

#### **Stage 2: Managing more complex projects**

As the project managers' reputation for success grows so does the complexity of the projects they are asked to manage. Projects will grow in size and complexity. The projects will include resources from other organizations, may involve more complex technology and will generally have more moving parts. The project manager continues to utilize the core techniques and seeks to stay on top of the detail to ensure everything happens per the plan.

Project managers are still successful, but it is becoming much harder. The project plan needs to change frequently to account for better understood requirements and stretched due dates. There are more relationships to manage some of which become contentious. Staying on top of the detail becomes a time sink. Supervisors tend to reiterate by the book techniques focused on managing the detail.

I equate this to juggling 3 balls, with the occasional superstar managing 4 or 5. Even the skilled juggler begins to find their limit.

### **Stage 3: Tackling large and complex projects**

With the success on smaller projects the project manager is asked to take on larger higher profile initiatives. Detail plans are created but they take a lot of time to maintain with constant updating as things move and shift. A lot of the project manager's time is spent chasing and understanding status, communicating status and reacting to concerns. The project manager tries to monitor all elements of the project but struggles as there are so many stakeholders and moving parts. Inevitably one or more teams are always late with their deliverable. That team's prioritization of the project seems to have shifted since early commitments to the effort.

At this point the project manager who is new to large and complex projects is working harder than ever but experiencing failure with no real understanding of the cause. As this happens they see other senior project managers calmly managing smooth projects. What are they doing differently?

## **PRINCIPLES FOR MANAGING LARGE AND COMPLEX PROJECTS**

Foundational project management skills and techniques remain important irrespective of the size of the project. However, other executive management attributes become critical for the successful managers of large and complex projects.

### **1. Heisenberg Principle<sup>(4)</sup>: Loosen grip on project details**

The Heisenberg Uncertainty Principle states that you can never simultaneously know the exact position and the exact speed of an object, the act of measuring a particle's position changes its momentum.

This principle also describes one of the challenges of managing large and complex projects. As discussed above, complexity grows exponentially as the size of a project grows.

The effort to measure the status (or position) of a project accurately takes an increasing amount of effort. With a project that is small, the effort should be minimal. However, as projects grow in size and become exponentially more complex, the effort to measure the status accurately takes an increasing amount of time. This can be the project manager's finite availability of time which has an opportunity cost. Alternatively, the status measurement effort could be delegated to the resources actually doing the work in which case they have less time to do the work. Either way, trying to accurately measure the status of a large/complex project will slow it down. The reduction of momentum can lead to failure to deliver on time, on budget, with quality or full features.

Successful managers of large projects have learned that they cannot know exactly what is happening across a project. They loosen their grip on the details and enable the

project to build momentum. To be successful they need to manage two things:

- 1. How to recognize and head off potential issues, which is discussed in the bullets below; and
- 2. How to provide senior stakeholders with confidence that the project will be delivered on time. Senior level stakeholders must also have the managerial maturity to not micro-manage to the detail.

Successful management of large and complex projects requires executive leadership rather than tactical management to detailed plans.

## **2. Autonomous but accountable work streams**

As Project Managers cannot measure every detail of large projects, they need to delegate to leaders who can oversee logical sub-components of the work or work streams. The work stream(s) must be able to function autonomously where the leader has the autonomy to make decisions but is firmly accountable to the broader project or program.

If you have ever observed a popular ski hill on a busy winter weekend, you will have noticed it full of skiers. The interesting thing is that all the skiers' function independently without crashing into each other or skiing off the side of the hill. Where there is an occasional crash, the other skiers automatically adjust as the fallen skier gets up and continues on their way.

Now imagine a ski hill where the manager wants to control each and every skier - Shouting "Skier one, go; Skier one, turn; Skier two, go; Skier two, turn; Skier one, turn; Skier three, go". It would not be long until a command could not get to a skier in time! A micro management solution to this would be to place managers on each side of the hill who could relay imminent issues to the newly promoted senior manager at the top. Soon a coordinator would be needed to take the messages from the hill side. The approach would be very expensive to operated, would have very low capacity and would likely be no fun what-so-ever to ski.

The ski hill represents an excellent analogy for the need to have autonomous, but accountable project work streams. Like the skiers, the work stream leads know the overarching operating norms and governing rules and can react quickly to any incident. They only need to escalate an issue that will likely impact the broader project or program. The large program lead needs to define the rules, manage exceptions and utilize most of their time to focus on strategic issues facing the project.

## **3. Focus on where challenges are most likely to occur**

A manager of a small to medium sized project, trained to manage the detail, will likely split their time evenly between the components of a project. So, if there are 4 elements the project manager would allocate 25% of their time to each. As the size of project they manage grows, say to 10 elements they would allocate 10% of their time to each. Being

spread so thin they would likely miss the warning signs as one element sinks into trouble.

A useful way to look at this would be a fire department on the edge of town. The neighborhoods are well served with fire hydrants however the district includes a dry woodland that does not have access to water. In that situation the fire department would likely focus more on preventative measures for the woodland such as positioning a water tanker nearby and taking various steps to raise fire awareness during the dry months. The manager of large project will act in a similar way.

The successful manager of large projects must assess each element of the project. The assessment criteria would include previous experience of the team or manager, knowledge of other organizational priorities, an understanding of the complexity of each element, and an understanding of how interconnected a given element is to the overarching project or program. Once the assessment has been done the manager of large projects will focus on the work stream likely to have issues. In a project with 10 work stream that could be 5% of their available time on each of 9 work streams and a full 55% focus on the potential trouble spot. I like to call this asynchronous focus.

#### **4. Recognize interconnected sub-goals**

At the start of a project it is usual to gather key stakeholders and establish commitment to the project team. I like to utilize the tools from Lencioni's 5 dysfunctions of a team<sup>(5)</sup>. The inexperienced project manager will likely leave it at that having checked the box for Project Kick-off Meeting,

The role of manager of large projects is a more challenging one because their projects will likely include a greater number of partners and those partners will come from a greater number of organizations, both internal and external. Each of the team members actually reports to a line manager whose performance is ultimately assessed based on the goals given by their line manager. The project manager ultimately can only influence behavior. The commitment provided by the project team members will always be subject to the prioritization of that individual's line management. This can show up as missed project work stream deadlines as the project team members have their priorities adjusted to meet their line organizations shifting priorities.

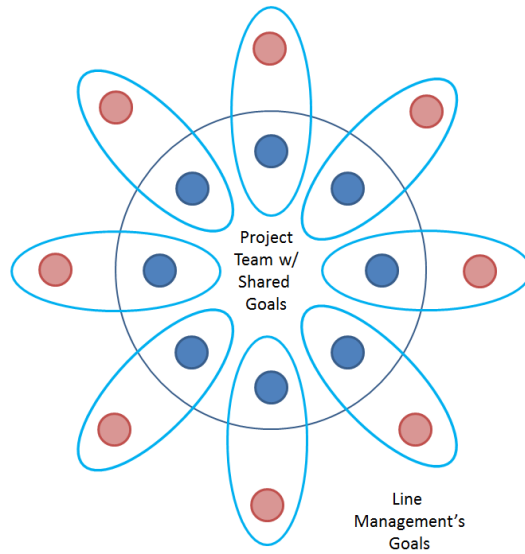


Figure 2. Project goals vs. Line Management goals

Shifting stakeholder priorities are more likely to be an issue in large project as there are typically more work streams and those work streams will sit throughout an organization and likely to 3<sup>rd</sup> party organizations.

The successful manager of large projects needs to recognize the fact that project team members will be members of multiple teams. Time will be invested to establish relationships with the senior management of work stream leads. Strong relationships will enable the project manager to have an improved understanding of the dynamics of the organization and be better positioned to advocate for their project. Appropriate insight and influence will enable the project manager to head-off any potential shifts in priorities or if needed socialize the impact to the project from the changes.

## 5. Anticipate changes with flexible plans

General Eisenhower was quoted<sup>(6)</sup> as saying “Plans are worthless, but planning is everything”. Mike Tyson said it more colorfully<sup>(7)</sup> “everyone has a plan until they get punched in the mouth”. However, Sun Tzu articulated <sup>(8)</sup> it most eloquently “Those who are victorious plan effectively and change decisively. They are like a great river that maintains its course but adjusts its flow... they have form but are formless. They are skilled in both planning and adapting...”

Creating a project plan is usually the first activity in any endeavor. Project managers are taught to identify and breakdown every task, estimating the resources required and elapsed time. All the tasks are sequenced, slack time may be built in (but this is usually the first casualty of initial management reviews). As projects get larger, the inter-connected nature of the work creates enormous complexity in the plan. Then as suggested by Eisenhower, Tyson and Tzu, things change.

A task turns out to be harder than thought or a resource is not available as planned. The plan needs to change and be updated. The challenge is that in large projects, the volume of changes drowns the project manager who is not able to keep up (and certainly can't spend the required time on strategic items, leading to further changes in the future).

So what do successful managers of large projects do? First, they recognize that over time every project is fluid and will need to adapt to unknown events. Given they know the plan will change, they create a plan from the start that guides the project rather than dictates every detailed action.

Second, the lead project manager can modularize the plan. Key milestones are established. The interfaces between work streams are identified. Within a given work stream leaders are allowed to make quick decisions as long as they do not move beyond established guide rails. The local work stream leader is best placed to adapt to changes within their accountability and take local action to prevent a change impacting a program milestone or an interface with other work-stream/components.

A simple example of this is change control. On a \$10m project changes involving less than \$10k are not significant and a work stream lead should have the authority to self-approve and report. Many small changes will cancel each other out so there is no need to react to every single one.

## **ADDITIONAL PRINCIPLES FOR MANAGING LARGE AND COMPLEX PROJECTS**

While there isn't room here, there are five additional principles that are important for project managers to transition successfully to managing large and complex projects.

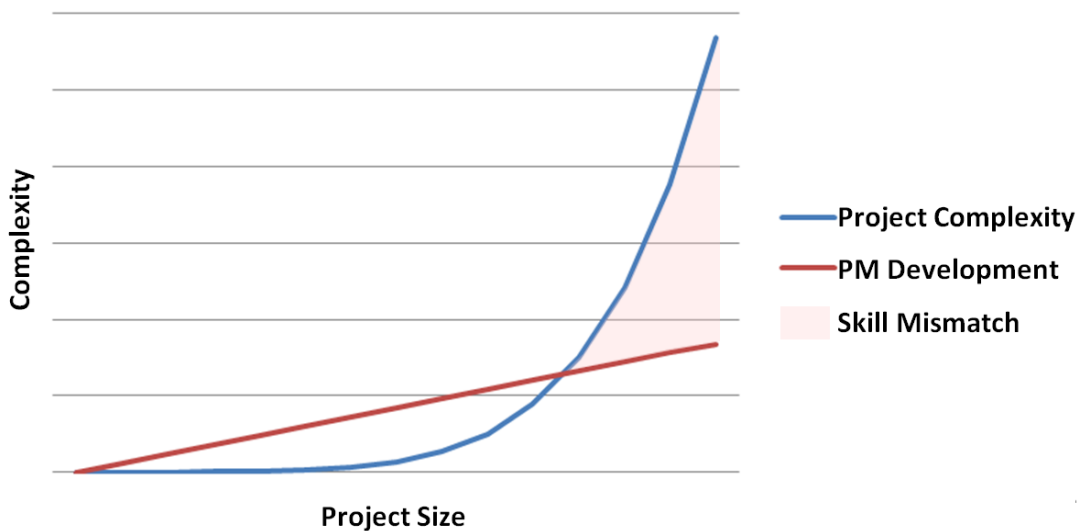
- **Match Communication to the Audience**  
Proactive communications tailored to the audience will minimize time spent reacting to requests for clarification.
- **Optimize the output**  
Move focus from micro-managing project spend to optimizing the output. Cost and value are different.
- **Many levers to pull**  
Delivery of maximum value in a complex and dynamic environment requires a balance of elapsed time, cost and functionality.
- **Lead leaders**  
Invest time in developing followers into leaders.
- **Enable coexistence of project management methodologies**  
There are many approaches to managing projects. Success with large and complex projects requires the ability to apply the best methodology for each situation and integrate methodologies seamlessly.



## TRANSITIONING TO SUCCESSFULLY MANAGE LARGE PROJECTS

As projects grow in size their level of complexity grows exponentially. If a project manager's skills grow in a linear fashion, they will eventually reach the point where they are not equipped to be successful.

Most people can juggle 2 balls, a good juggler can manage 3, 4 or even 5. A great juggler may even manage to keep 10 balls in the air. However, as a technique for keeping balls in the air juggling will eventually fail. Failure may come at any point, but we know for sure juggling won't keep 100 or 1,000 ball in the air.



**Figure 3. Gap between PM development and Project Complexity**

Five principles have been identified that a project manager will need to master if they are going to successfully deliver highly complex projects.

1. Loosen the direct grip on project detail, complexity grows exponentially, and it is not possible to micromanage once a project reaches a certain size.
2. Organize into autonomous but accountable subgroups/work streams create structure at the interfaces
3. Analyze the project environment and focus where issues are most likely to occur.
4. Understand that even committed project team members will also have direct line managers. Know the demands placed on each of them to ensure there are no surprise shifts in priority that can impact the project.
5. Build project plans that are flexible, the business environment is dynamic. Avoid falling into a tactical role as project plan administrator.

In conclusion, we teach project managers to manage detail. Frequently individuals who are good at managing the details get promoted and reinforce behavior that delivered success with medium sized projects. However, to be successful with large complex projects and programs a project manager needs to become a strategic thinker, developing techniques that free up time. Time is required to get ahead of tactical issues clearing the path for project teams to deliver effectively.

## REFERENCES

- (1) Mishap Investigation Board. (2013) “Mars Climate Orbiter: Phase 1 Report” Nimble Books LLC (November 20, 2013)
- (2) US Government Accountability Office (2013). “ New Denver Airport: Impact of the delayed Baggage System” BiblioGov (June 27, 2013).
- (3) Glass, R.L. (1998) “Software Runaways Lessons Learned from Massive Software Project Failures”, Prentice Hall
- (4) Jha, A (2013) “What is Heisenberg’s Uncertainty Principle?”. [www.theguardian.com](http://www.theguardian.com) (Nov.10, 2013)
- (5) Lencioni, P. (2002) “The Five Dysfunctions of a team: A Leadership Fable” Jossey-Bass (April 11, 2002)
- (6) Garson (2017) “Plans are worthless, but planning is everything’ [www.quoteinvestigator.com](http://www.quoteinvestigator.com) (Nov. 18, 2017)
- (7) Moynagh, P. (2015). “Mike Tyson- “everyone has a plan until they get punched in the mouth.” <http://www.fewzion.com.au> (Jul. 7, 2015).
- (8) Tzu, S., Cleary, T.(Translator), (2005)). “The Art of War”, Shambhala Publications (Jan 11<sup>th</sup>, 2005)



# Re-Engineering the **Owner/Contractor Relationship** for More Predictable Project Outcomes

## THE FORMULA:

IMPROVED ALIGNMENT > INCREASED TRANSPARENCY > AUTHENTIC TRUST





# Although historically the energy industry was able to absorb cost overruns, that is no longer the case.

“ For oil and gas companies, an austere economic forecast has challenged the balance sheets and shareholder dividends, leading to cuts in project spending and increased focus on productivity and cost control. To achieve the strategic benefits from capital programs, owners are increasingly shifting their focus from accelerated program execution to delivering value for money through effective and efficient program management ... leading to the need for rigorous planning, execution and control through the project life cycle.

– Mastoid Jafri, *Faithful & Gould*

“ We cannot expect that a higher oil price will offset a cost overrun. We cannot rely on suppliers and service providers to offset low product price ... Given low oil and gas prices, we need to find dramatic reductions in project cost; given the volatility in oil and gas prices, we need to be much more predictable in our estimates of project costs and time to first oil ... The key point is that capital projects now present a major business risk that project investors need to manage.

– Dick Westney, *head of the Westney Consulting Group*



In short, as Westney points out, **there is now a focus on certainty of project outcomes.**

# Why are Predictable Outcomes So Difficult to Achieve?

A wide range of factors come into play when it comes to managing a capital project from concept to full-time operation. Common challenges that must be addressed include adequate project shaping, the size and duration of the project, the degree of contract complexity, environmental and logistical issues, and ensuring the availability of the skills and experience required to bring in a project as planned and budgeted, safely, etc.

Prior to project kick-off, the focus of discussion and decision-making for leaders in the owner and contractor organizations revolves around some of the issues above, and other technical aspects of project management and delivery. However, planning for the non-technical aspects of project management and delivery – i.e. team and leader on-going development and on-going coaching - are rarely part of the FEL process.

As team effectiveness professionals in the global energy industry for 25+ years, we've observed first-hand that project leaders and stakeholders frequently overlook - or significantly underestimate - the amount of investment (time and money) needed to design and engineer the human capital resources on a project to deliver reliable, value-adding performance that contributes to project success.

**This paper examines how a project's human capital resources – leaders and teams – can be fully leveraged and deployed in ways that improve project alignment, increase communication transparency, and create a trust-based project culture.**

**We believe there is a simple formula that can be used to improve project outcomes:**



# STRATEGY #1 Establish Initial Alignment Across the Project Organizations

**A PROJECT'S CULTURES  
IS SHAPED BY THE  
PEOPLE AT THE TOP.**

The success of a project depends on a combination of factors, not the least of which is the degree of alignment that exists between senior leaders in the owner and contractor organizations, and the dynamics of their interpersonal relationship.

## STEP # 1: ALIGN SENIOR LEADERS IN THE OWNER AND CONTRACTOR ORGANIZATIONS

### Relationship Management “101”: The “soft” skills are the “hard” skills!

It's a fact that an adversarial culture has hung over the construction industry for many years. And, although the atmosphere is improving, old mindsets and behaviors can still be triggered by negative surprises, the appearance of coercive tactics, or the withholding of key information by either party.

#### SOLUTION:

Prior to project kick-off, schedule an off-site team building session for senior project leaders in both organizations, facilitated by a neutral third party. Be sure they talk about their relationship during the session first, and the technical issues are discussed second'

#### Discussion Topics That Facilitate Relationship-Building:

- Both parties describe what type of relationship they would like to have going forward, e.g. open, collaborative, honest, confidences protected, etc.
- What each party needs from the other in order for the project to succeed?
- A discussion of what could go wrong in the relationship down the road and how to prevent it - or deal with it- if it happens?
- Test for agreement that both parties will commit to putting “difficult” issues on the table, before they become costly and damaging to the project.
- Publish session notes and distribute to participants.



## STEP #2: PREPARE FOR PROJECT KICK-OFF

### Team Misalignment



WHEN TEAMS HEAD OFF IN DIFFERENT DIRECTIONS, THE PROJECT EXPERIENCES SUCCESSES OFF-SET BY FAILURES.

Ensuring that all the arrows are going in the same direction and at the same target begins with the **Project Charter**. This document is developed by project leadership and is typically introduced to the rest of the project team at an all-hands project kick-off meeting.

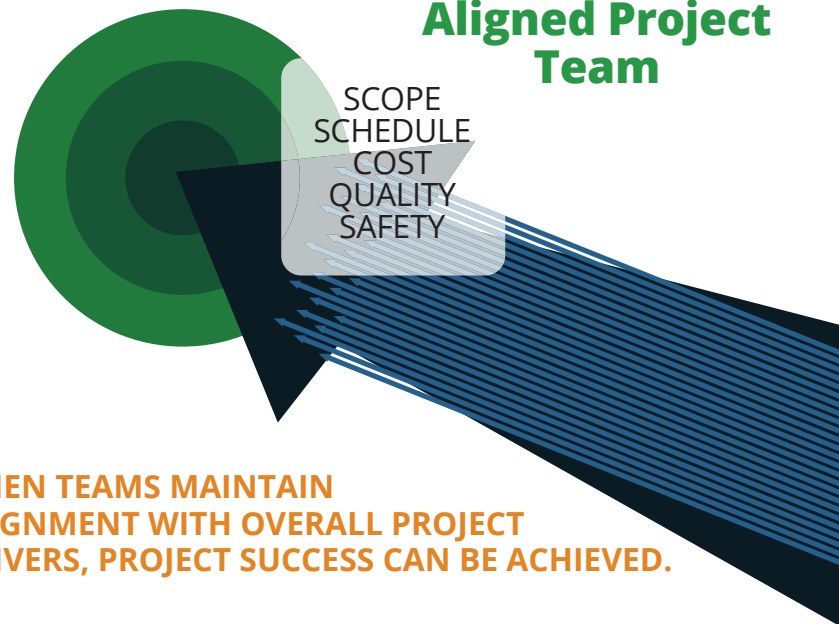
The charter defines the business case for the project, and contains key information such as the project objectives, scope, and key people and teams that will be working on the project. A high-level schedule with key milestones is usually included as well.

### Additional elements frequently included in the Charter:

- **A Governance Model.** It informs the team about key stakeholders and who and how financial and resource allocation decisions will be made as the project moves forward.
- **Roles & Responsibilities.** Key roles, responsibilities, and accountabilities are over-viewed. They must be updated at key transition points as the project progresses.
- **Interface Management.** This process formally tracks information exchanged between owner and contractor counterparts, and is essential for effective project execution.

Effective project management has been described as the art of managing the trade-offs and compromises that must be made to keep things moving toward a successful conclusion. To maintain alignment across the project, team members need to understand the five project drivers and how each one can impact their work priorities at any given time in the project life-cycle.

### Aligned Project Team



WHEN TEAMS MAINTAIN ALIGNMENT WITH OVERALL PROJECT DRIVERS, PROJECT SUCCESS CAN BE ACHIEVED.



## STEP #3: PROJECT KICK-OFF SESSION

**Holding a full-team Kick-Off Session is a good way to begin to align the full project team at both the Relationship and Task Levels.**

### **BEST PRACTICE:**

The initial owner/contractor alignment session should provide opportunities for team members to get to know each other's interests and professional backgrounds, as well as to have some fun together. The second purpose of the event is for project leaders to present and review the Project Charter, and encourage people to ask questions and request further clarification about any issues on their minds about project.

A successful project launch begins the process of defining the owner/contractor relationship at both **the project leadership level** and **the functional/discipline levels**. Neglecting to pay adequate attention to establishing strong alignment at this time can set the stage for communication breakdowns, unclear priorities or interpersonal conflict down the road.





# TWO TOOLS THAT HELP PROJECT TEAMS MAINTAIN ALIGNMENT:

1

## ESTABLISH COMMON MEETING & COMMUNICATION PROTOCOLS THAT SUPPORT MANAGING SCHEDULES, MEETING DEADLINES, KEEPING THE TEAM CURRENT ABOUT PROJECT PROGRESS:

- Regular and predictable communication should be established for specific focus items and audiences such as technical reviews, project status updates, schedule alignments, stewardship meetings, and team development initiatives.
- Meeting protocols should include the purpose of the meeting or communication, expected outcomes, attendees including SME's, and meeting time-frames (start/stop).
- Meeting management guidelines and best practices for face-to-face and virtual meetings should be standardized and circulated across the project.

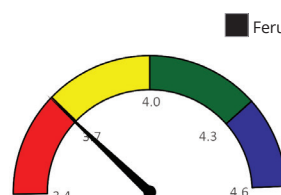
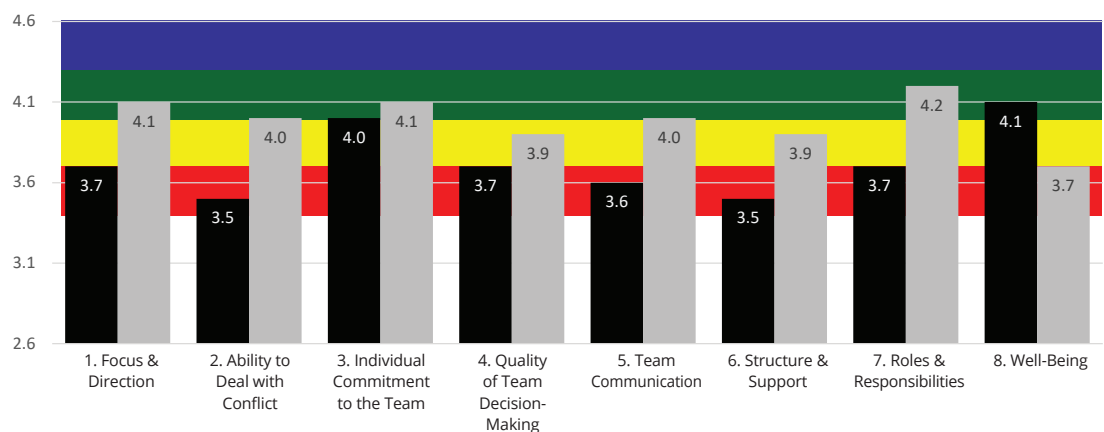
2

## MEASURE & REPORT THE STATE OF TEAM ALIGNMENT ON A REGULAR BASIS

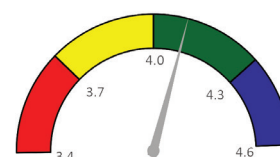
- There are 8 dimensions for measuring team alignment:
  1. Clarity of Focus & Direction
  2. Ability to Deal with Conflict
  3. Individual Commitment to the Team
  4. Quality of Team Decision-Making
  5. Quality of Team Communication
  6. Structure & Support
  7. Clarity of Roles & Responsibilities
  8. Team Well-Being.
- (SEE PROJECT TEAM ALIGNMENT CHART BELOW)
- Survey results are typically reported for the total project team and also broken out by sub-teams
- Sub-teams meet to review their results, celebrate their strengths, and identify actions to address high priority improvement needs.

## PROJECT TEAM ALIGNMENT™ SURVEY COMPOSITE - XYZ PROJECT

View the full case study at [terconpartners.com/pta](http://terconpartners.com/pta)

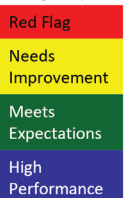


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### LEGEND:



## STRATEGY #2 Increase Communication Transparency Between Owners and Contractors

### COMMUNICATION: OWNERS & CONTRACTORS

The concept of transparency has frequently been associated with the social responsibility and regulatory compliance. In the project environment, it can be argued that increased transparency in the communication between owners and contractors has become a strategic imperative for achieving predictable outcomes on projects.

**TRANSPARENCY IS DEFINED AS “COMMUNICATING IN WAYS THAT MAKE IT EASY FOR OTHERS TO KNOW WHAT YOU’RE THINKING AND/ OR WHAT ACTIONS YOU’VE TAKEN OR PLAN TO TAKE, AND WHY.”**

- On projects, communication transparency means that as a team performs its work in one part of the project, **members also consider what other teams may need to know that they know**, and then share it in order to improve overall project performance.
- The good news is that on projects where transparency is practiced by owner and contractors, tangible benefits are being produced including:



**FASTER PROBLEM  
SOLVING**



**HIGHER QUALITY  
SOLUTIONS FOR  
DIFFICULT PROBLEMS**



**INCREASED  
TRUST**

# Ground Rules for Transparent Communication & Productive Meetings

## HERE'S WHAT TRANSPARENT COMMUNICATION LOOKS LIKE WHEN SENIOR LEADERS IN THE OWNER AND CONTRACTOR ORGANIZATIONS COMMIT TO IT:

- Project leaders have full access to the information they need to make decisions in the best interests of the project.
- Leaders make their intentions and actions visible
- “Bad news” is shared early, followed by joint problem-solving efforts.
- Leaders agree to disagree without rancor or retaliation.
- Mistakes are acknowledged and the lessons learned shared.
- Leaders agree not to criticize each other outside of their meetings.

## AT THE FUNCTIONAL AND DISCIPLINE TEAM LEVELS, THE SAME GENERAL PRINCIPALS APPLY:

1. Be willing to engage in honest and open communication.
2. Share what you know when it could help another team or team member.
3. Raise “red flags” and difficult issues when the project will benefit from it.
4. Admit mistakes openly and what has been learned from them.
5. Find ways to help others be successful.



# There are three reasons why increased transparency is still a tough sell in some parts of the industry:

1

## **"SILOED" THINKING.**

Technical teams have a long history of working in highly focused, self-contained work units, and identifying closely with their own technical specialty or function.

2

## **DISCONNECTED DECISION-MAKING.**

The absence of robust communication channels across the project organization can set up a situation where one team may have no idea what the potential impact of a decision they're making will be on another team – until it's too late! The associated costs may be sizeable and completely avoidable.

3

## **A LOW PRIORITY PUT ON COLLABORATION & JOINT PROBLEM-SOLVING.**

A strong message must be sent from the top and reinforced again at all team levels that collaborative problem-solving and problem-prevention is everyone's job:

*"We're all in this together!"*

“

*The more knowledge team members have about the status of the project, the easier it is to make good decisions... if transparency is lacking, problems can easily lurk beneath the surface."*

”

– Richard Tregaskes, *Faith+Gould*.

# How Transparent Communication Makes Project Outcomes More Predictable

## 1. IT IMPROVES THE CLARITY OF GOALS & PRIORITIES:

In a project committed to transparent communication, leaders share current information about the relative priorities between schedule, cost, and quality at different times in the project life cycle. Then priorities are established and decisions made that ensure that everyone is pulling in the same direction.

## 2. SYNCHRONIZED THINKING & ACTIONS ARE PRODUCED.

When the context for decision-making is commonly understood, owners, engineers, contractors and suppliers up and down the chain of command are making decisions based on the same criteria.

## 3. COST MANAGEMENT IMPROVES.

Recent research indicates that up to a 50% reduction in re-work is possible when the pool of information available to decision-makers expands, and there's a strong commitment to "no surprises".



**50%**  
**REDUCTION**  
IN RE-WORK IS POSSIBLE

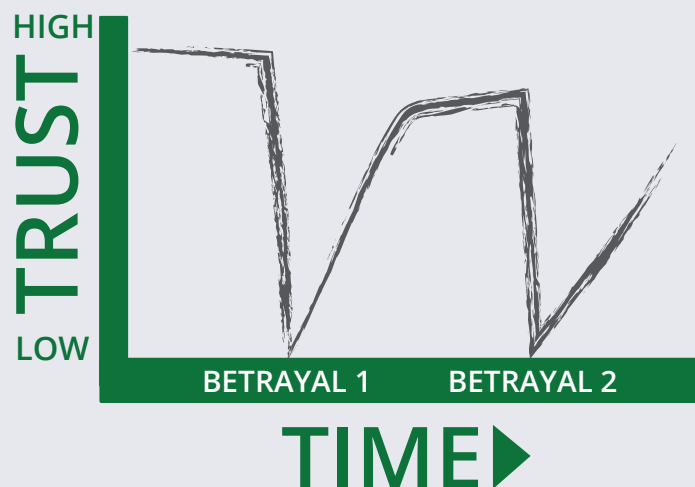
## STRATEGY #3 Establish a Trust-Based Project Culture



### Five Things You Need to Know About Trust:

1. **TRUST** has been found to influence virtually every aspect of project management. In the owner/contractor relationship it's essential for project success,
2. **IT'S HARD TO ESTABLISH AND MAINTAIN TRUST ON PROJECTS BECAUSE:**
  - Projects are fast-paced and relatively short in duration
  - Projects bring people together from different organizations and cultures who may never have worked together before, and may never again.
  - Projects are primarily populated with people who have a low preference for “soft skills and social niceties”.
3. **TWO WAYS LOW TRUST NEGATIVELY IMPACTS PROJECT PERFORMANCE:**
  - **Interpersonal conflicts** develop that often linger unresolved, and can eventually cause split alliances within teams or between teams.
  - **Communication breakdowns** can occur causing deadlines to be missed, schedule delays, and/or re-work.

### WHEN TRUST IS BROKEN





**4. LAYING THE FOUNDATION FOR A TRUST-BASED RELATIONSHIP BETWEEN OWNERS AND CONTRACTORS IS AN ESSENTIAL STEP IN ACHIEVING PREDICTABLE OUTCOMES.**

**Trust can best be measured on four dimensions.**



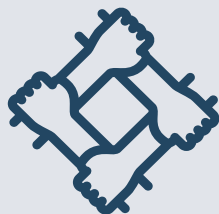
**COMPETENCE**

Does the individual or team have the skills, abilities, knowledge, and experience to deliver what's required?



**COMMITMENT**

Willingness to do whatever it takes to complete a task or achieve an objective. Strong work ethic and focus on getting the job done right.



**COMMUNICATION**

The content and delivery of messages is clear and timely, with information delivered in the correct format to meet the receiver's needs.



**COLLABORATION**

Individuals and teams work supportively with each other. They're open to other's ideas and feedback and look for win/win solutions to problems.

## A useful tool for measuring and reporting trust levels between project owners and contractors is The Team Trust Index™

### OWNER'S FEEDBACK: COMMUNICATION



### CONTRACTOR'S FEEDBACK: COMMUNICATION



**BEST PRACTICE:** Results are reviewed in a joint meeting with the participating owner and contractor teams. Specific issues/behaviors that contributed to each team's self-ratings - and the ratings given to the other team - are discussed in detail. A plan forward is agreed to: 1.) reinforce identified strengths of the combined team, 2.) close current gaps, and 3.) focus on actions that will strengthen trust in all four dimensions.



## 5. LOW TRUST ALWAYS ESCALATES PROJECT COSTS.

“When trust is low in a company or relationship, it places a hidden “tax” on every transaction, every communication, every interaction, every strategy, and every decision > bringing speed down and sending costs up.

– Stephen M.R. Covey, *The Five Dysfunctions of Teams*. 2012.

### TELL-TALE SYMPTOMS OF LOW TRUST ON TEAMS

DELAYS IN DECISION-MAKING	“Data wars”; reduced risk-taking; lowered commitment to implementation
UNDER- COMMUNICATION	Withholding information, going around others, failing to get clarification about assignments and/or agreements during meetings.
CONFLICT AVOIDANCE	The “real” issues doesn’t get surfaced. In addition, people often try to avoid arguments by informing each other of things at the last minute when it’s too late to make changes.
PEOPLE ARGUE FROM EXTREME POSITIONS	They use lots of “absolutes” with each other – “You always...”, “You never...”
PEOPLE JUMP TO CONCLUSIONS	They don’t test their assumptions for correctness or validity. They don’t examine or share their stories to get the truth.

### SOLUTION:

Make skill development training in and coaching in conflict management available to project managers and team leaders. A significant skill gap in this area exists across all industry sectors – fossil fuels, renewables, and power, according to a 2017 study conducted by the Center for Creative Leadership. **(The Leadership Challenge in the Energy Sector: What’s missing when it comes to leadership talent?)**

# The Five Value-Adding Business Benefits of High Trust on Projects:

- 1. CLIENT RELATIONSHIPS ARE MORE OPEN AND MORE POSITIVE.**
- 2. TIME TO MARKET IS ACCELERATED.**
- 3. RISK PREMIUMS IN CONTRACTING ARE REDUCED.**
- 4. TOTAL PROJECT COSTS ARE REDUCED.**
- 5. MORE EFFECTIVE COMMUNICATION OCCURS ACROSS THE PROJECT.**
- 6. IMPROVED RESILIENCY IN RESPONDING TO UNFORESEEN CHALLENGES AND SET-BACKS.**

*Hartman, F.T. The Role of TRUST in project management. Presented at PMI® Research Conference 2000.*

*At its simplest, **Trust** is a catalyst for a project to be more-focused, more efficient, and more nimble.*

## MANAGING COSTS AND MAKING PROJECTS MORE PREDICTABLE



Managing costs and making projects outcomes more predictable are a strong focus in the energy industry today, and in many others.

Without intending to diminish the importance of technical experience and technical skills, this paper has suggested that “transactional skills” – leading, coaching, establishing trust, communicating transparently and resolving conflict – when they are skillfully applied, significantly impact project success.

Therefore, we recommend the following steps in order to fully leverage those resources:

1. Include planning and budgeting for human capital development in the early stages of project planning.
2. Conduct owner/contractor relationship building prior to or during project kick-off. Agree to review commitments and the state-of- the- relationship on a quarterly basis - even if there are no apparent “problems”.
3. **Develop a Maintenance Plan** that ensures that the project’s human capital resources remain up and running and properly functioning throughout the project life cycle, e.g.
  - Provide leader and team coaching on an as-needed basis.
  - Support Team Building Sessions for individual teams and/or cross-functional and cross-discipline teams
  - Provide opportunities for skill-building in the leadership, teaming and transactional skills noted above
  - Conduct periodic “Pulse Surveys” for the purpose of:
    - Ensuring the project team stays aligned to the ebb and flow of the critical objectives across the project life-cycle
    - Keeping leadership in touch with the challenges and successes individual teams and team members are experiencing
    - **Best Practice:** Include contractors in pulse surveys as well as members of the owner team for a full project team perspective.

# MISSED DEADLINES? COST OVER-RUNS? COMMUNICATION BREAKDOWNS?

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# Responsibility for Minimising Construction Material Waste

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## ABSTRACT

Construction activities generate residual materials which are known as construction wastes. In cases where the producer takes no responsibility, the project may be affected due to the proliferation of waste on site. For successful delivery of any construction project, effective waste minimisation is vital. However, the discourse on who should be responsible for minimising waste continue to ravage the industry. This study attempted a review of the roles and responsibilities of construction professionals viz-a-viz their liabilities and actual practices. A total of 730 questionnaire were administered to building construction professionals in Lagos, Nigeria to determine who should be responsible. Data were analysed using relative importance index (RII) and according to the results, architects were ranked first while project managers/site managers and contractors/developers were ranked second and third respectively. One of the limitations of this study is that it forms part of an ongoing research to develop a circular economy framework for minimising construction waste. In conclusion, the study recommends collaboration of all stakeholders in ensuring efficient waste minimisation at all stages of construction.

**Keywords:** Construction industry, construction waste, minimisation, Nigeria, responsibility

## BACKGROUND

According to the Waste Framework Directive 2008/98/EC (European Commission, 2008), waste is any substance that the owner does not need anymore and intends to dispose. Similarly, Omole and Isiorho (2011) described construction waste as left-over from a production process that can be utilised in creating other components or materials. Though waste is inevitable on construction projects, it can be effectively minimised. Several waste minimisation measures have been identified in the literature. For example, WRAP (2009) revealed five design strategies for minimising waste. These are design for material optimisation, design for off-site construction, design for use and recovery, design for waste-efficient procurement, and design for deconstruction and flexibility. Likewise, Greenwood, Jones, Snow, and Kersey (2003) identified factors including just-in-time delivery, materials stock taking, procuring materials with fewer packaging, careful storage and avoiding over-ordering of materials as potential waste minimisation measures at the procurement phase. In addition, Lu and Yuan (2013) observed that if off-site construction techniques such as prefabrication and pre-casting are employed during construction, waste could be reduced.

Recently, there have been claims directed towards waste management methods. Firstly, they are end of pipe solutions to waste (Ajayi, 2017). Secondly, they cannot prevent waste generation rather, they can only divert waste from landfills. Lastly, one of the options of waste management (i.e. recycling) consumes energy and emits carbon dioxide (Chong & Hermreck, 2011; Saraiva, Borges, & Filho, 2012). These are clear distinctions from waste minimisation. Responsibility for waste management has been discussed in the literature. For instance,

Osmani, Glass, and Price (2006) indicates that architects should take responsibility to minimise waste through designs while contractors should ensure effective waste management. In addition, Sapuay (2016) recommended that contractors should produce waste management plan and encourage sorting and segregation activities on site. From these studies, it is clear that contractors are responsible for waste management. However, responsibility for minimising construction material waste is unclear.

In Nigeria, waste minimisation is a challenge for the construction industry. Efforts have and are still being made to minimise waste. For instance, site waste management plan was identified by Oladirin (2009) as one of the potential measures for minimising waste in the Nigerian construction industry. Likewise, Adeagbo, Achuen, and Oyemogun (2016) revealed that waste could be minimised if a policy framework is introduced at the conceptual stage. Despite these efforts, the discourse as to who should be responsible for minimising waste continue to ravage the industry. It is against this backdrop that this study seeks to identify people or entity that should be responsible for waste minimisation. The structure of this paper follows a review of the roles and responsibilities of construction professionals. Second, the research method and approaches were presented. Third, the results were presented, justified and discussed. Lastly, conclusions and future research were highlighted.

## **ROLES AND RESPONSIBILITIES OF CONSTRUCTION PROJECT TEAM**

The roles in construction cut across the entire duration and phases of projects. According to Warwick Institute for Employment Research (WIEC) (2010), the roles can be divided into craft, technical, and professional and managerial roles. Craft roles encompasses trades occupations such as wood, exterior, interior, specialist, and plant. Technical roles provide support for construction professionals based on their practical knowledge and techniques. For instance, an estimator provides technical support for the quantity surveyor. Other technical support roles include architectural technician, computer aided design operative, construction technician, plant technician, and roof technician (WIEC, 2010). Professional and managerial roles require higher education qualification and training. These roles include design, surveying, management, and planning while professionals and managers involved consists of architects, civil/structural engineer, quantity surveyor, construction manager, senior executive, town planner, facilities manager, site supervisor, and project manager (WIEC, 2010). While the expertise of some professionals are required at the pre-construction or actual construction phases, some are required throughout the phases. For example, architects' role encompasses all phases of construction while contractors/developers are involved at the actual construction phase.

Some studies have described the responsibilities of construction workforce. For example, the British Standard Institution (1985) formally defined and clarified roles in construction. Scott and Assadi (1999) studied the responsibilities of construction supervisors and civil engineers in keeping site records. Similarly, Bröchner (1994a, 1994b) reviewed responsibilities for site investigation while Jaynes (1994) examined client's role in the success of construction projects. In addition, Price (1994) reviewed the roles and responsibilities of sub-contractors in the construction processes. In support of Price's study, Murdoch and Hughes (2000) described roles involved in the processes. Furthermore, Ndekugri and Rycroft (2000) highlighted the responsibilities of some stakeholders including contractor, planning supervisor, sub-contractors, designers, architect, quantity surveyor, suppliers, clerk of works, and employers. These studies provided information about the roles and responsibilities of project team members, but offer little or no view on minimising construction waste.

In the context of this study, the roles and responsibilities of 11 construction stakeholders including operatives are highlighted in Table 1.

**Table 1: Roles and responsibilities of construction workforce**

Project Player	Key Responsibility	Construction Phase		
		Pre	During	Post
<b>Architect</b>	The professionals concerned with the design, material specification, and building aesthetics.	✓	✓	✓
<b>Project/Site Managers</b>	Those responsible for the day-to-day activities on a building project from its inception to completion.	✓	✓	✓
<b>Contractors/Developers</b>	Those responsible for the construction and completion of building projects as well as the management of sub-contractors.		✓	
<b>Builders</b>	The professionals responsible for building construction management and maintenance.		✓	✓
<b>Quantity Surveyors</b>	The professionals responsible for cost control, estimation, procurement, and calculation of material costs and work done.	✓	✓	✓
<b>Labourers</b>	Those responsible for carrying out tasks set by supervisors		✓	✓
<b>Client(s)</b>	An individual or a group that engages all other professionals and commissions the project.	✓	✓	✓
<b>Engineers</b>	The professionals concerned with the structural stability and strength of buildings.	✓	✓	✓
<b>Government</b>	Agencies responsible for ensuring compliance to building codes and regulations.	✓	✓	✓
<b>Sub-contractors</b>	Those responsible for completing part or all of a project as allocated to them.		✓	
<b>Material Suppliers</b>	Those responsible for supplying diverse types of materials as required for the project.		✓	

According to Elms and Brown (2012), professionals have to accept these responsibilities because they underpin their decisions. Furthermore, Klein (1995) categorised responsibility into four, which are causal responsibility, legal responsibility, moral responsibility, and role responsibility. Causal responsibility as described by Elms and Brown (2012, p. 186) is the “*responsibility of doing something*”, which arises from a decision made by an individual or a group. For example, a client might want a spiral staircase, the design team and contractors will take the responsibility to provide it. Legal responsibility is the right of an individual or a group to pronounce or make a binding decision. For instance, the client has the responsibility, authority, and ownership to make decision (Elms & Brown, 2012) while those employed by the clients have the responsibility to act in the interest of the client. Moral and role responsibilities are related because they inform the way one should act and can be referred to as personal and professional roles respectively (Elms & Brown, 2012). Moral (personal) responsibility implies the ability of professional to make good decisions while role (professional) responsibility entails decisions that align with the ethics of the profession. Based on the categories of responsibility, it is important that construction professionals act responsibly.

## METHODOLOGY

The study was conducted to identify those responsible for minimising construction waste. A survey research design was adopted because it allows data collection from a sample (representative) of a larger group (Flower Jr., 2013). To collect data, a descriptive cross-sectional survey through the use of questionnaire was employed. The suitability of questionnaire survey for collecting large amount of data (Noam, 2008) justifies its adoption in this study. The opinions of building construction firms in Lagos, Nigeria were sought. The survey questionnaire was randomly administered online (email & web-based) to 730 firms identified from Vconnect (an online register of firms in Nigeria – [www.vconnect.com](http://www.vconnect.com)). The questionnaire consists of closed-ended questions which require respondents to rank the multiple choice answers.

The data collected was analysed using the Relative Importance Index (RII) analysis. For each response, the RII calculates the summative weighing frequency score. The RII was calculated using the equation below:

$$RII = \sum \frac{w}{A*N}$$

Where w = weight (1, 2, 3, 4, 5...), A = highest weight, and N = Total number of responses. criteria:

## FINDINGS AND DISCUSSION

Overall, 700 questionnaires were emailed while 30 were administered face-to-face. A total of 464 were returned while only 243 (33.3%) were duly completed and found appropriate for this study. For construction management study, response rate of 20 – 30% have been reported as the norm (Takim, Akintoye, & Kelly, 2007; Dulaimi, Ling, & Bajracharya, 2003). As a result, the response rate obtained in this study is considered appropriate. The demographic data shown in Table 2 indicates a cross-section of respondents' professions with the majority being architects followed by quantity surveyors and project managers respectively. The majority of respondents are educated and experienced which enhances the credibility of their responses. The characteristics of firms surveyed are represented in Table 3. Privately owned small scale construction firms constitute the majority. These firms have been operating for more than 21 years and are majorly specialised in new builds.

**Table 2: Respondents Profile**

<b>Respondents' job description</b>		
	Frequency	Percentage
<i>Urban planner</i>	1	0.4
<i>CEO</i>	14	5.8
<i>Manager</i>	7	2.9
<i>Project Manager</i>	40	16.5
<i>Architect</i>	88	36.2
<i>Engineer</i>	25	10.3
<i>Contract/Quality Manager</i>	2	0.8
<i>Quantity Surveyor</i>	53	21.8
<i>Builder</i>	11	4.5
<i>Technician</i>	2	0.8
<b>Level of Educational</b>		
<i>Ordinary National Diploma</i>	2	0.8



<i>Higher National Diploma</i>	30	12.3
<i>Post Graduate Diploma</i>	10	4.1
<i>Bachelor Degree</i>	78	32.1
<i>Master Degree</i>	120	49.4
<i>PhD</i>	3	1.2

**Table 3: Organisations' characteristics**

<b>Ownership Status</b>		
	Frequency	Percentage
<i>Privately owned</i>	161	66.3
<i>Partnership</i>	38	15.6
<i>Government owned</i>	18	7.4
<i>Public Limited Company</i>	26	10.7
<b>Age of Organisation</b>		
<i>1 – 5 years</i>	48	19.8
<i>6 – 10 years</i>	58	23.9
<i>11 – 15 years</i>	39	16.0
<i>16 – 20 years</i>	34	14.0
<i>Above 21 years</i>	64	26.3
<b>Size of organisation</b>		
<i>Up to ₦50million (Small)</i>	114	46.9
<i>₦51 - ₦500million (Medium)</i>	60	24.7
<i>Above ₦501million (Large)</i>	69	28.4
<b>Area of project specialisation</b>		
<i>New build</i>	208	85.6
<i>Maintenance/repair</i>	17	7.0
<i>Renovation</i>	14	5.8
<i>Demolition/deconstruction</i>	4	1.6

The respondents were asked to rank the three main people or entities who should be responsible for minimising construction material waste. It appears that all stakeholders involved in building construction are responsible. However, based on the result presented in Table 4, architects, project managers or site managers, and contractors were ranked 1st, 2nd, and 3rd respectively. This result implies that the onus of material waste minimisation is on these three while the least person responsible is the material supplier. Test statistics was applied to these rankings to test the significance of the result (see Table 5). The value of Kendall's coefficient of concordance (W) obtained was 0.760 at 95% confidence level. A p-value of 0.022, indicate that there is significant degree of agreement between respondents as per the rankings for minimising construction material waste.

**Table 4: Stakeholders responsible for minimising construction waste in the NBCFs**

<b>Stakeholders</b>	<b>Rank (1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup>)</b>			<b>W</b>	<b>RII</b>	<b>Rank</b>
	<i>1</i>	<i>2</i>	<i>3</i>			
<b>Architect</b>	54	25	17	229	0.314	1
<b>Project Managers/Site Managers</b>	38	42	29	227	0.311	2
<b>Contractors/Developers</b>	31	25	32	175	0.240	3
<b>Builders</b>	19	38	33	166	0.228	4
<b>Quantity Surveyors</b>	27	22	24	149	0.204	5
<b>Labourers</b>	23	20	30	139	0.191	6

<b>Clients</b>	18	16	23	109	0.149	7
<b>Engineers</b>	8	13	22	72	0.099	8
<b>Government</b>	13	11	4	65	0.089	9
<b>Sub-contractors</b>	1	21	18	63	0.086	10
<b>Material Suppliers</b>	6	10	11	49	0.067	11

**Table 5: Kendall's Coefficient of Concordance Test of Agreement**

<b>Kendall's Coefficient of Concordance</b>	
<b><math>\chi^2</math></b>	7.600
<b>df</b>	2
<b>Asymp. Sig.</b>	0.022
<b>Kendall's W<sup>a</sup></b>	0.760

The finding of this study reflect the fragmented nature of the construction industry where there is disunion about who should take responsibility for specific actions. Although, waste management measures have been considered as contractors' responsibilities (Osmani, Glass, & Price, 2006), it is clear that there is no consensus about who should be responsible for minimising waste. There has been criticisms around the roles played by architects in minimising material waste. Previous studies (Osmani et al., 2008; Faniran & Caban, 1998; Ekanayake & Ofori, 2004) have traced the generation of waste to design and recommended that architects should be proactive in minimising it. They are to design buildings for reuse and recovery, offsite construction, material optimisation, waste efficient procurement, deconstruction, and flexibility (WRAP, 2009). If Nigerian architects can design out waste and adopt the strategies recommended by Ajayi (2017), material waste generated should reduce and more sustainable buildings could emerge. This finding aligns with that of Osmani et al. (2006) that architects need to prioritise waste minimisation design practices. However, it should be noted that waste minimisation is not the sole responsibility of architects (Osmani et al., 2008) but all project players including material suppliers and government which were least ranked in this study. In addition, the finding aligns with previous studies (Ajayi, 2017; Osmani et al., 2008; Ola-Adisa, Sati, & Ojonugwa, 2015; Liu, Osmani, Demian, & Baldwin, 2015) that have recommended that architects take proactive measures by adopting waste minimisation measures at the design phase.

Project/site managers and contractors/developers were ranked after architects, which implies that they are also responsible for minimising waste. Previous studies (Begum, Siwar, Pereira, & Jaafar, 2007; Yeheyis et al., 2013; Coffey, 1999) have indicated that waste management should be part of project management and that project managers should develop waste management strategies especially at the planning stages. This finding suggest that project managers through their managerial roles and skills can contribute to waste minimisation by ensuring appropriate planning of construction processes and activities. This align with the findings of Alwi, Hampson, and Mohamed (2002) that identified important roles of construction project managers in minimising waste.

According to Enakayake and Ofori (2000), to control waste is to prevent its occurrence. This implies that waste minimisation should start from the planning phase. Architects, project/site managers, and contractors should thus be responsible for minimising material waste. This could be achieved in different ways including low waste design, specification of low waste materials, effective site planning, and adoption of modern method construction methods. A study by Ajayi (2017, p.202) clearly identified different strategies for designing out waste, which are: "*error free design, early involvement of contractors, design standardisation, adequate design coordination, and design freeze*". The onus of waste minimisation lies on

architects being the designers whose drawings the contractor/developer interprets into actual construction. The implication of the finding for practice is that waste minimisation should be considered at phases of construction and by all project stakeholders including operatives. In addition, it highlights the need to clearly specify in the contract document, the roles and responsibilities of all parties involved in construction.

## CONCLUSION

Waste management is one of the challenges of the construction industry. This issue has been the discourse of many studies where the causes, sources, types and management measures have been identified. This study is one of the few that have been undertaken on who should be responsible for minimising waste. The roles and responsibilities of construction professionals were reviewed and a questionnaire survey of 243 building construction firms was used to investigate responsibility for minimising waste in the Nigerian construction industry. The results indicate that architects, project/site managers, and contractors/developers should be responsible for waste minimisation. There was significant agreement between respondents about these professionals being responsible. The study indicates that waste can be minimised at the planning stage. Therefore, architects specifically should consider waste minimisation measures. More so, project/site managers and contractors/developers should be proactive and use their managerial skills and experience for effective site planning. It can be concluded from the study that all project stakeholders including operatives, material suppliers and government should also be responsible for minimising waste. Collaboration of all project stakeholders at all stages of construction would contribute to efficient waste minimisation. This study forms part of an ongoing research to develop a circular economy framework for minimising construction waste. Using a quantitative approach, the study has investigated responsibility for minimising waste. Future studies should adopt a qualitative approach and data may be collected in other countries.

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## REFERENCES

- Adeagbo, D.O., Achuenu, E. & Oyemogun, I.M. (2016). Construction Material Waste Management Practices in Selected Construction Sites in Abuja, Nigeria. *FUTA Journal of Management and Technology*, 1(2), 96-104.
- Ajayi, S., (2017). *Design, procurement and construction strategies for minimizing waste in construction projects* (Doctoral dissertation, University of the West of England).
- Alwi, S., Hampson, K. D., & Mohamed, S. A. (2002). Waste in the Indonesian construction projects.

- Begum, R. A., Siwar, C., Pereira, J. J., & Jaafar, A. H. (2007). Implementation of waste management and minimisation in the construction industry of Malaysia. *Resources, Conservation and Recycling*, 51(1), 190-202.
- British Standards Institution (1985) *BS 6100: Glossary of building and civil engineering terms*. London: British Standards Institution.
- Bröchner, J. (1994a) Pre contractual investigation and risk aversion. *Engineering, Construction and Architectural Management*, 1(1), 91-101.
- Bröchner, J. (1994b) Risk, inspection and responsibility for data: contract design for maintenance and construction. In: *CIB W70: Strategies & Technologies for Maintenance & Modernization of Building*. Tokyo 26-28 October 1994. CIB 1013-1020.
- Chong, W. K., & Hermreck, C. (2011). Modeling the use of transportation energy for recycling construction steel. *Clean Technologies and Environmental Policy*, 13(2), 317-330.
- Coffey, M. (1999). Cost-effective systems for solid waste management. *Waterlines*, 17(3), 23-24.
- Dulaimi, M. F., Ling, F. Y., & Bajracharya, A. (2003). Organizational motivation and inter-organizational interaction in construction innovation in Singapore. *Construction Management and economics*, 21(3), 307-318.
- Ekanayake, L. L., & Ofori, G. (2004). Building waste assessment score: design-based tool. *Building and Environment*, 39(7), 851-861.
- Ekanayake, L.L., & Ofori, G. (2000). Construction material waste source evaluation. In: *Proceedings of the Second Southern African Conference on Sustainable Development in the Built Environment: Strategies for a Sustainable Built Environment*, Pretoria, South Africa.
- Elms, D. G., & Brown, C. B. (2012). Professional decisions: the central role of models. *Civil Engineering and Environmental Systems*, 29(3), 165-175.
- European Commission. (2008). Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives. *Official Journal of the European Union*, 312, 3-30.
- Faniran, O. O., & Caban, G. (1998). Minimizing waste on construction project sites. *Engineering, construction and architectural management*, 5(2), 182-188.
- Fowler Jr, F. J. (2013). *Survey research methods*. Sage publications.
- Greenwood, R., Jones, P., Snow, C. and Kersey (2003). Construction Waste Minimisation: Good Practice Guide. *Centre for Research in the Built Environment*, Cardiff University.
- Jaynes, G.L. (1994) Avoiding legal pitfalls of construction clients in Malaysia and abroad. *The International Construction Law Review*, 11(3), 353.
- Klein, M. (1995). *Responsibility*. In: T. Honderich, ed. *The oxford companion to philosophy*. Oxford: The Oxford University Press, 771-772.
- Liu, Z., Osmani, M., Demian, P., & Baldwin, A. (2015). A BIM-aided construction waste minimisation framework. *Automation in construction*, 59, 1-23.
- Lu, W., & Yuan, H. (2013). Investigating waste reduction potential in the upstream processes of offshore prefabrication construction. *Renewable and Sustainable Energy Reviews*, 28, 804-811.
- Murdoch, J., & Hughes, W. (2002). *Construction contracts: law and management*. Routledge.

- Naoum, S. (2012). *Dissertation research and writing for construction students*. Routledge.
- Ndekugri, I., & Rycroft, M. (2012). *The JCT 05 Standard Building Contract*. Routledge.
- Ola-Adisa, E., Sati, Y. C., & Ojonugwa, I. I. (2015). An Architectural Approach to Solid Waste Management on Selected Building Construction Sites in Bauchi Metropolis. *International Journal*, 67.
- Oladiran, O. J. (2009). Innovative waste management through the use of waste management plans on construction projects in Nigeria. *Architectural Engineering and Design Management*, 5(3), 165-176.
- Omole, D. O., & Isiorho, S. A. (2011). Waste management and water quality issues in coastal states of Nigeria: The Ogun State experience. *Journal of Sustainable Development in Africa*, 13(6), 207-217.
- Osmani, M., Glass, J., & Price, A. D. (2006). Architect and contractor attitudes to waste minimisation. In: *Proceedings of the Institution of Civil Engineers: Waste and Resource Management* 159 (No. WR2), pp. 65–72.
- Osmani, M., Glass, J., & Price, A.D.F. (2008). Architects' perspectives on construction waste reduction by design. *Waste Management*, 28(7): 1147-1158
- Price, J. (1994) *Sub-contracting*. Basingstoke: Macmillan.
- Sapuay, S. E. (2016). Construction waste–potentials and constraints. *Procedia Environmental Sciences*, 35, 714-722.
- Saraiva, T. S.; Borges, M.M.; Filho, A.C. (2012). The Importance of Recycling of Construction and Demolition Waste. *Proceedings of PLEA2012 - 28th Conference, Opportunities, Limits & Needs towards an environmentally responsible architecture*, Lima, Perú 7-9 November 2012.
- Scott, S. and Assadi, S. (1999) A survey of the site records kept by construction supervisors. *Construction Management and Economics*, 17(3), 375-382.
- Takim, R., Akintoye, A., & Kelly, J. (2004). Analysis of measures of construction project success in Malaysia. In *Proceedings of the 20th Annual ARCOM Conference in Heriot Watt University, Association of Researchers in Construction Management*, Edinburgh, 2 (1-3), pp. 1123-1133.
- Warwick Institute for Employment Research (2010). Roles in Construction. Retrieved 25 February 2019 from <https://warwick.ac.uk/fac/soc/ier/ngrf/lmifuturetrends/sectorscovered/construction/sectorinfo/roles/>
- WRAP (2009). Designing out waste: A design team guide for buildings (online). Retrieved from <http://www.modular.org/marketing/documents/DesigningoutWaste.pdf>
- Yeheyis, M., Hewage, K., Alam, M. S., Eskicioglu, C., & Sadiq, R. (2013). An overview of construction and demolition waste management in Canada: a lifecycle analysis approach to sustainability. *Clean Technologies and Environmental Policy*, 15(1), 81-91.

# **Stepping Safely into the Unknown – Project Management in a VUCA Environment**

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## **ABSTRACT**

Currently, the biggest item on top of any CEO's to-do list is creating, shaping and transforming their organization's culture to be more responsive to permanent change. CEO's talk about the values of integrity, trust, empowerment and leader development as essential within the new damaging environment of VUCA Management. This paper will guide you through the hazards of working within this ever-changing environment to understand how to prepare, how to manage the impact of the continuing change and how to safely negotiate a passage out again. He will demonstrate how the project professionals can reinforce these values through personal example and by ensuring they cascade throughout the organization. By delivering this change through effective leadership this will help to shape and reinforce the future business culture. In the ever-changing world that we now live and work in, disruption is as great as it has ever been, meaning we are seeing all aspects of VUCA within our own environments.

## **OVERVIEW**

Katrina, Wilma, Irma and Maria. To some these seem to simply be names of innocent girls, but to others, these names leave chills down the spine with memories of fear and destruction. In 2017, two of these names were hurricanes that tore through the Islands of the Caribbean, leaving behind their trail of devastation, this was especially true about the British territory of Anguilla.

The island of Anguilla sits to the East of Puerto Rico and on the tip of the arc of the Caribbean cluster from the Dominican Republic as the most easterly island to Barbados at its most southerly point. This makes it very susceptible to the elements of the weather and in this short period in late 2017, this was demonstrated as never before for the citizens of this long forgotten paradise island.

The United Nations Office for the Coordination of Humanitarian Affairs (OCHA) reported that over 90 percent of structures on hard-hit islands were damaged or destroyed. Hurricane Irma, one of the most powerful storms ever recorded in the Atlantic, ripped through Anguilla with Category 5 strength. Impacting the island with sustained winds as high as 185 mph, this caused catastrophic damage to numerous island businesses and homes as the storm continued toward the U.S. mainland.

The winds lasted 37 hours, making Irma the longest-lived storm of such intensity

anywhere around the globe for at least the past 50 years.<sup>1</sup>

With an almost immediate response from the UK Government and from an island-wide rallying talk by its Governor, Tim Foy OBE, the recovery programme was rapid and although not ideal in places, highly impactful with its tremendous efforts of the British Armed Forces in the shape of the Royal Marines and with the islanders pulling together to get the island functioning and safe as quickly as possible.

Now, over eighteen months later, the island looks to be its idyllic self again, but with the Governor's aims for greater economic development and public safety as his driving strategy for the period of his incumbency, are there lessons we can learn from the event and towards managing post disaster recovery in the future when we walk into the VUCA Dimension of Project Management?

## **POST DISASTER VUCA DIMENSION MANAGEMENT**

The term VUCA and the art of VUCA Management was first introduced by the US Marines, upon their arrival in the Middle East in 1991. It was given this name due to the new, original nature of the extreme conditions and the nature of warfare, that they previously had not observed or been involved in. The term described the ever-changing conditions that were found in both Afghanistan and Iraq.

Today, the term has evolved into mainstream business, but other than the nature of the business itself, very little has changed. In a world where it is believed that it becomes smaller every day, the VUCA dimension also looks how the world spins a little faster as well. Today's business world also offers extreme conditions, just like the US Marines discovered, however, just of a different nature.

In this ever-changing world, we have a totally new environment to contend with, where laws, rules, norms, technologies and techniques, behaviours, values and the economy are nothing like they were only a few years ago. What people used to almost guarantee or depend on to be developing and growing their business, these days, no longer exists with an environment of ever shifting sands to try and grow and develop. Put quite simply, the world as we know it, will never be the same again.

So, knowing that it is called VUCA is one challenge, understanding the four elements in a little more detail, allows us to learn how to manage this dimension so much more.

*Volatility*, something that is simply characterised by or subject to rapid or unexpected change and lack of stability. In simple terms, things that are changing continuously, weather that be the weather conditions, the financial stability of a nation, or a change in the terms of an agreement that had previously been in place, such as Brexit between the United Kingdom and the rest of the European Union nations. What is currently true and dependable, may simply not be or in extreme conditions, may not even exist tomorrow. Products and services that are an absolute success today can become worthless or be removed within the same financial year.

*Uncertainty*, an indefinite that is not reliable or constant and becomes unpredictable in its nature. The lack of ability to foresee what major changes might come introduces a higher

likelihood and impact of risk around your working environment. Within a disaster zone, the unpredictability of the behaviours of the people, or the next phase of weather can make it almost impossible to make progress. In the modern world of finance and technologies, it is impossible to predict with certainty how markets will evolve. A secure stable asset within a community or fixed values in the economy and on the stock exchanges around the world can collapse and disappear overnight. Add to that, the factor which was discussed earlier, that the world seems such a smaller place these days than in the past, then due to the nature of globalization, a relatively small impact in one environment, such as within the world of finance with its financial products when it comes to changes in taxation laws etc. and how they may have huge worldwide consequences, described best as the butterfly effect.<sup>2</sup>

*Complexity*, a whole or a complete item, made up of convoluted or interrelated parts. Whether this is an endless number of weather patterns, or the solution development around a wiring or tunnel system which needs to be unraveled to be better understood, with early warning signs of success and failure. With the ever increasing numbers of systems, technologies and methodologies being offered to help resolve problems in the modern world and with the constantly new instruments and regulations to deal with, we are now, as a society in danger of become technology dependent. So many argue that technology is making life simpler, however when it is looked at closely, this is not always the case. One of the greatest methods of problem solving and solution development, is simplicity. This does not in any way mean not using technology to help and assist us, but instead to leverage the technology in our favour and to understand what the systems and tools are actually doing for us, before we blindly trust them. This is becoming more prevalent as we consciously control AI & future technologies and its impact on organizations and individuals so that they do not control us. These days, even with a world where we seem to have more experts than ever before, the world is moving and changing in ways that no one has predicted or seen before.

*Ambiguity*, a communication or environment that leaves doubt and with a capability of being read or misunderstood in multiple ways. In a world today where we have more information than ever before and we are bombarded with news and data, it becomes so much harder to decide what is relevant, what comes from a reliable source and how this information or data changes our views, behaviours or values towards situations and circumstances. Red meat and milk are good for you, or are they. Depending upon the research that you read there are arguments both ways. In a world of social media, how does the freedom of information exchange across cities or the globe influence what you are trying to achieve or perhaps ignite a new problem? Through the term of the current President of the United States, we have been introduced to a new phrase, 'Fake News', but who determines and what determines these days what is real and what is fake? Old certainties, the trust points that we used to rely on have disappeared, because of the volume and unpredictability of what we hear and say, leading to many leaders avoiding taking positions or decisions until they know more, when the problem is that they already have too much. In this ever-expanding environment of information management, it becomes increasingly more difficult to find clarity.

## **UNDERSTANDING VUCA**



Now we have a clearer understanding of the term VUCA, it is important to start to determine what it really is and how it should best be managed, for the VUCA Dimension and VUCA Management is much more than just a simple new phrase. VUCA is in essence, a contextual aberration, meaning that although wrong to the naked eye, under closer scrutiny, the aberration can seem reasonable, even rational, when it is placed into a certain context or environment.

This does not mean therefore that the aberration does not exist, just that to view it and to work within it, the people involved require a different way of thinking and behaving and to be open to change, with greater regularity and greater impact. In September 2017, at UT Dallas, I introduced a new concept to project management and from there, it has been developed and experimented by many larger organisations than my own, Innovation Project Management. (iPM). We look further into iPM later in the paper, however for now, it just leaves me to say that iPM and VUCA Dimension Management are and will further, become the future shape of Business Management in our ever changing world.

With the accelerating rate of change (volatility), lack of predictability (uncertainty), interconnectedness of cause and effect forces (complexity) and an ever stronger potential for misreads (ambiguity), the development of ideas beyond the norm will gradually become the new shape and the new norm of modern life.

## **VUCA PREPARATION – PRE PROJECT ASSESSMENT**

A firefighter never enters a burning building before they know what they are entering. This is what they are taught from the first day and it stays with them forever. In a world where disasters and change can happen at a moment's notice, being as well prepared before you start, has always been the best advice and when stepping into the VUCA Dimension, this could never be more true. Although this may take time, it is essential that it is carried out before releasing any resources into the environment. The aim of the early assessment to reduce any situation of being 'mission blind'. It is fine saying that you are entering into a volatile situation, but what volatility and how much volatility?

If uncertainty to project managers means risk, then what are the sources and causes of the uncertainty and just how much risk is it we are taking and what is our tolerance towards risk? Hearing that a situation is complex is meaningless, unless you know what it is that makes the situation complex, is it the goals, the procedures or the people? Finally, what information do we have and what exactly are we missing or mis-understanding that makes it seem ambiguous and why?

The most commonly recognised framework that has been used for disaster management in the past, is the Faulkner Framework.<sup>3</sup> This approach was developed in 2001 and has been used to establish a safer environment particularly in the tourist industry for Disaster and Emergency Management. Faulkner uses six steps to navigate the management of potential and actual hazards and the foreseen dangers within an environment. Although there are six steps to the framework, the focus of the framework is predominantly around repair and recovery post disaster or emergency. As part of the VUCA Dimension the design of my framework, built within the VUCA preparation assessment, has a greater focus on preparedness and planning before the deployment of any resources or actions to maximize the impact of those working within the dimension and to minimize the

casualties suffered during the operations.

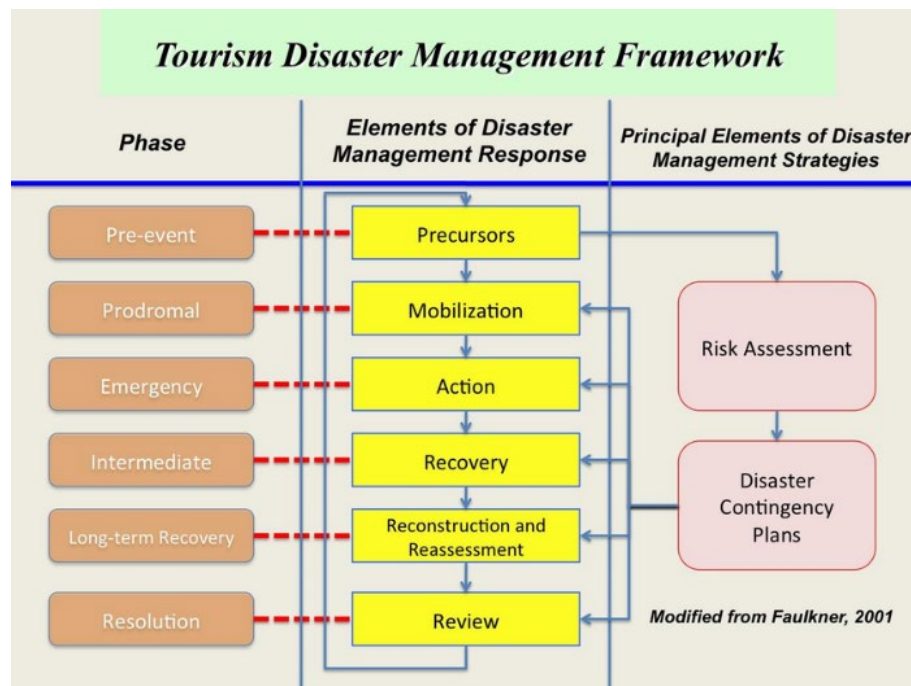


Figure 1- Tourism Disaster Management Framework (Modified from Faulkner, 2001) <sup>4</sup>

## VUCA DIMENSION FRAMEWORK – STEP ONE - PURPOSE

No one does anything without reason, so the idea of entering into a dimension that can cause so much turmoil, means that the understanding of why you are entering becomes even more prevalent. Step One of the VUCA Dimension Framework (Reeson 2019), is the purpose, or reasoning for entry into such an explosive environment. Within this first step of the process, gaining a full clarity of the scope of work and objectives to be completed should be attempted, even if the approach of how you will actually achieve those goals is not known at the time. Understanding what has to be done and what control mechanisms you are putting in place for the organisation and your team, allows for a greater robustness and trust for those involved and those impacted.

The greatest challenge of this step is to be able to envisage the end goal state, the ideal solution to the problems that you are likely to incur and the most effective resolutions to the many issues and risks that lay in waiting. However, having the vision is one thing, being able to articulate the corporate or organizational values and cultures that you stand for and for those that you may be entering into, is a further challenge. Having carried out the pre-project assessment, you should by now have a clearer indication of the context or the environment that faces you and so translating it into tangible activities and balancing this against the risks and issues within this validated approach becomes the driving factor to convince those involved that you can achieve the goals planned for within the step.

To generate the positivity in the operational tasks, the VUCA leader needs to create, to shape and to transform their team, so that they all recognise this is not a normal or routine operation, but instead something completely new, each and every time. By relaying this

understanding to the team members and those either directing the operations or to be supported during the operations, this develops and establishes the right culture amongst all those involved with a belief that success is within them. The danger that you have to be aware of at this point is that as the VUCA leader, you have to set the right tone, mindset and responsibility.

By establishing and embedding the confidence and trust within the team, you are improving the chances of success, but be wary at this point not to become too confident so as to have the team believe that no matter what the danger, they cannot fail. It is through the recognition of failure, that we improve our self-awareness around what it will take to be successful. With the culture, values and right tone set, the team and the organisation behind the team, can now become more responsive to regular and unexpected change.

## **VUCA DIMENSION FRAMEWORK – STEP TWO - RESOURCING**

The successful delivery within any VUCA dimension, needs the right people. That seems simple to say, but it is true. The old adage of the right person, doing the right thing at the right time never is stronger than within the VUCA dimension. However, identifying and then developing the right people, does not come easily and requires the development of the right talent, for the right tasks, in a timely manner with evolved leader mindsets.

One element that is crucial to success, is that those involved must be a team, where their combined force of all their elements are greater than any one singular entity. One major difference between a standard team and a VUCA prepared team, is the leader's willingness for empowerment and shared responsibility. By empowering the team resources more than within a routine environment, this will allow the resources to make decisions as and when necessary and not simply wait for one person to drive the operations forward. With this additional responsibility, this offers the opportunity for the team resources the room they need to adapt and grow into the roles that they have been deployed in.

This ability to share the decision making and the responsibilities appropriately amongst everyone, establishes and then develops further team integrity and the essential behavioural value of trust. However, this only takes the team and its ability so far and there is a further step within resourcing that must be clearly understood, by the management, the leadership and the team. Everyone working within the VUCA dimension must be prepared to mix and match their skills, resources and knowledge to ensure that the response rate aligns with the rate of change. Within this aspect of resourcing of the team, comes the strength of adaptability, not so that you are just strong and skillful within your own discipline, but that each team member can alter and adjust to secondary and tertiary roles as the changing environment demands it.

By designing and shaping the team members, this allows the leaders to build their team values around the vision and mission goals which were solidified and then approved in Step One. This allocation of the right resources, to deliver the change to the VUCA circumstances, allows the team to leverage the use of its technology, understanding what benefits can be gained with their use, but avoiding the dangers of believing that technology provides the only solution, leading the team to become technology dependent.

The final aspect of the second step, is to understand that no one person, has the answer to

every question and so by establishing a learning environment for the team to share best practice and to have the opportunity to voice their views around different challenges, this leads to the whole team proactively managing the VUCA change.

To close the step, it is also important to remember one last and crucial fact, when stepping into such a dimension, people react and change dependent upon their circumstances and emotional acceptance of the change and although this paper does not cover the important aspects of Emotional Intelligence, it is important enough to briefly mention how people react and then respond in an ever-changing environment.

As the leader of the VUCA dimension's operations, it is essential that you can first understand yourself, your strengths and weaknesses, and your needs and emotional triggers to be able to consciously navigate yourself as well as those that are inside the team. What requires constant review and reinforcement, is a set of emotional and social skills that can influence the way perform. These signs and skills are shown as the way we:

- ✓ Perceive and express ourselves
- ✓ Development and maintain social relationships
- ✓ Cope with challenges
- ✓ Use emotional information in an effective and meaningful way

The VUCA dimension and the circumstances and actions that take place within it, impact on three key levels and it is paramount that the appropriate person at the right time is reviewing how these levels are changing inside and as a result of the operational tasks. The three levels that require constant review and supervision are:

- ✓ Organisation level and how the structure is holding up against the strain of the rapid change and fluctuating circumstances
- ✓ Task level and how the work that you are committed to has and is changing and how the team carrying out the work is adapting to the change
- ✓ Personal level, effecting the values and the cultures of those involved and how they are now changing due to the environment and the results of the operation

### **VUCA DIMENSION FRAMEWORK – STEP THREE - ACHIEVEMENT**

As everyone knows, a plan is only as good as it is executed. So a strong, robust plan before entering the VUCA dimension, is a key attribute towards success. However, how do you plan for so much uncertainty and for a leap of faith into the unknown?

By establishing simulations of the various scenarios that the management and team are predicting and then practicing them in a safe environment before they are executed, allows a clearer understanding of what might have to be done to deliver success within the environment but also creates and develops a comradery within the team that is so under valued by so many people that do not understand the importance of high performance in a team.

One specific difference between a normal 'safe' environment and that of the VUCA dimension, is knowledge management and the provision of time and space to ask

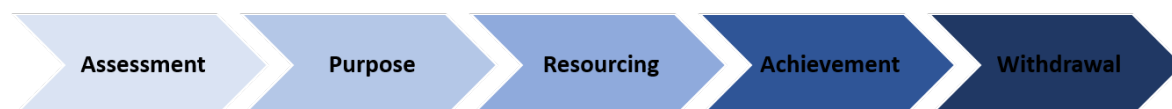
questions that challenge the status quo. All too often, within the normal environment, we record of lessons and then feed them into our tasks and projects at pre-approved times or reviews weeks or months apart. The VUCA dimension does not offer the luxury of pre-approved reviews with great distances between them. No, within the VUCA environment, the team and management learn their lessons and then immediately implement them as fully as possible to maintain traction with the deliverables. One very key role that the VUCA leader has to play whilst the delivery of the tasks is being carried out, is the regular reinforcement of the mission and a reminder to the whole team of the purpose and reasoning for this commitment that they established in Step One.

This is best achieved by creating a drumbeat, a message that maintains focus and reminds the management, the team and all other involved of their responsibilities and expectations. Having now creating an environment where your team is progressing with their tasks, be ready to change at all times. Just as you feel that progress is being achieved and you can start to see the next milestone or deliverable, your VUCA environment promises you one thing, that nothing will stay as it seems. With this heightened situational awareness of constant change, it means that as the VUCA leader it is more important than ever that you ensure the right people are positioned in the right place at the crucial time.

The final element to managing this environment, is two-fold. Firstly, where we had previously mentioned emotional intelligence and lessons learned, within the Achievement stage, (Step Three), it is imperative that regular performance reviews are carried out, not simply for the drive of the project, but more importantly, for the well-being of the resources. Understanding and preparing for the well-being of your team, means that you require to plan for the second element for operational momentum, succession planning. The understanding of who fills who's shoes at a moment's notice is part of the continuous development of the team as individuals and as a group. With no succession planning and preparation, the loss of one key role can lead to a single point of failure and a rudderless team.

## **VUCA DIMENSION FRAMEWORK – STEP FOUR - WITHDRAWAL**

No entry plan is successful without an exit. Selecting to go into a VUCA environment and knowing what you were trying to achieve within it is one aspect of success. Delivering a safe and structured withdrawal is equally as important to the plan. Dependent upon the situation, clearly situations can change, but what the VUCA leader and their team should be looking to carry out is a managed and measured removal from the environment.



*Figure 2 - VUCA Framework (Reeson 2019)*

The withdrawal should be steady and proportionate to the task, not instant or sudden, leaving the environment either panicking or back in the chaos that ensued before your arrival. It is very important within the withdrawal plan, to make the necessary decisions around what assets and resources need to be withdrawn, when and what needs to be left behind permanently to create the stability you were trying to achieve initially. The environment you depart, should be left in a stronger, better condition than on your entry.

The timing of the withdrawal will have a lot to do with the alignment of your achievements with the originally planned goals and aims. Leaving the environment, should also involve having created and being able to maintain a robust governance structure to be managed by those remaining to ensure a sustainable future with no power vacuum. As with all the steps of the framework, but more so here than anywhere else, the management, leaders and teams professional ethics will come under greater scrutiny than any other time. It is by behaving ethically and managing professionally the handover to the new owners of the environment and by transferring responsibility to them in a manner with strong decorum, that the lasting message will create the legacy of change. As the last resources are then deemed by those that now have taken over responsibility, as redundant to the services of the environment, they can be redeployed and then final closure can occur.

## **CONCLUSION – CREATING AN INNOVATIVE SOLUTION**

Disasters and emergencies will continue to exist throughout the globe and this is not something that can be changed, as it is part of nature and the ever-changing planet on which we live. However, managing how we handle such dangerous and fatal events needs to change and a process of education needs to be put in place that allows everyone to believe that, should such dangers come to them, that they are suitably equipped and competent to handle the situation and to minimise the damage and restrict the loss of life.

To handle such future events, there needs to be a current and post event governance structure in place, designed with fluidity and flexibility in mind, to allow for the team to meet the needs of the environment. With the governance established, there requires a blend of tactical short-term goals which lead towards and meet the strategic aims and long-term success to create a sustainable solution for the environment.

With the development of the talent around inter-changeable assets, this leads to a team that can change to the needs of the VUCA dimension and can alter their roles and responsibilities instantaneously, adapting to the ever-changing circumstances. These assets should provide operational reinforcement to the strategic aims and tactical goals by driving the tasks forward, both effectively in what they change and efficiently in how they change them. Finally, the VUCA leadership should retain one key skill for all future operations, their endless ability to change and change again whilst under pressure, but based on sound thinking, integrity, a collaborative mindset and a cool level head.

All too often we hear of innovation and what it can do to help an environment or an industry, but we never seem to use innovation. It is only through necessity or desperation

that new ideas get generated, when the time to really think through a solution is at its lowest. Innovation should not be a last resort, but instead something that we do through choice to develop and grow opportunities. It is not until the realisation of innovative thinking, is truly appreciated and then implemented that business in general, or projects and recovery programmes can truly see its full potential.

In closing, should you look to drive forward and look to deliver VUCA Innovation and in itself, Innovation Project Management, there are four main drivers that you have to consider:

- ✓ Health, safety and well-being of those inside the dimension, both working to resolve the issue and those living inside that require the support and aid
- ✓ Efficiency Management of the processes and procedures by used in the dimension to ensure that those that are managing or delivering the change do so uses best practice
- ✓ Digital – Physical Integration of skills and abilities to maximise every opportunity by leveraging technology and utilising it in a way so that it helps and brings value to the current situation
- ✓ Sustainable Solution Development to create lasting changes as long-term goals leading towards greater stability and a higher quality of life for all living and working within the environment

To achieve such success, the *VUCA dimension*, requires a *VUCA solution*. The environment needs to change *Volatility* through *Versatility*, to reduce *Uncertainty* by developing *Understanding*, to remove *Complexity*, by demonstrating *Creativity* and to eliminate *Ambiguity* through constant *Adaptability*.

## REFERENCES

- <sup>1</sup> Direct Relief (2018). “Hurricane Irma – One Year On.”  
<https://www.directrelief.org/2018/09/hurricane-irma-one-year-later> (Sep. 5, 2018)
- <sup>2</sup> Edward Lorenz (1972) “Does the flap of a butterfly’s wings in Brazil set off a tornado in Texas?” American Association for the Advancement of Science
- <sup>3</sup> Faulkner B (2001) “Towards a framework for tourism disaster management”
- <sup>4</sup> Agustan A, Kauser D, Kriswati E (2015) “Linking Interpretations with Amenities: Educating Visitors in Volcanic Environments”  
[https://www.researchgate.net/publication/294823765\\_LINKING\\_INTERPRETATIONS\\_WITH\\_AMENITIES\\_EDUCATING\\_VISITORS\\_IN\\_VOLCANIC\\_ENVIRONMENTS](https://www.researchgate.net/publication/294823765_LINKING_INTERPRETATIONS_WITH_AMENITIES_EDUCATING_VISITORS_IN_VOLCANIC_ENVIRONMENTS)  
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## Successful Project Management in a Low Authority Environment

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### Abstract

A frequent complaint by project managers is that they do not have the authority to do their job. Project managers are expected to elicit top performance from all members of the project team, often in an environment of high responsibility and low authority, coupled with the use of borrowed resources in a matrix organizational structure. This paper will explain how to strengthen your ability to effectively work with project teams and other stakeholders to achieve project success without formal authority. This paper will explore the difference between a leader and manager, the sources of power available to all project managers, the role of emotional intelligence, and how personality styles impact the application of leadership and management. Also covered in this paper are suggested methods for getting results and dealing with conflict in an environment of low authority.

### Leaders versus Managers

Let's start out by clarifying the difference between a leader and a manager. A **leader** is someone who influences and inspires people. A leader will motivate, bring out the best in others, and get people to work together to achieve a common goal. A **manager** is a person who is responsible for directing and controlling the work of others. A manager will organize, control, balance priorities and make sure the work gets done. Developing and championing a new idea is leadership, while implementing the idea is management. A quote that nicely summarizes the difference between managers and leaders is "managers do things right while leaders do the right things" (Hitt, 1998, p. 5.).

So are leadership or management skills more important to be a successful project manager, or are they equally important? The projects undertaken by a company or organization should align with the corporate vision and strategy, which is typically determined by middle and top management. This level of management also decides on the projects that will be done to support the strategic plans. Note that project managers are responsible for getting these projects successfully done by directing and controlling the work of others. Key responsibilities for project managers include organizing, coordinating, resolving issues and conflicts, and communicating. These descriptors are all about *managing* the project. You will frequently see in the job description for a project manager a statement about "leading the project team." However, the reality is that most of what project managers do is simply not leadership. While having a project manager who is a good leader is highly desirable, the manager function is more critical

in order to successfully implement the project. The project team may look at the sponsor, some other key executive, or even a respected team member as the person providing the leadership. This isn't something that gets listed in the role and responsibilities for a project, but the project manager should consider for a project whether the team sees her/him as a leader; or if that will come from another source. Don't take this as a personal insult since leadership is situational.

## **The Role of Power**

The dictionary defines power as the capacity to do something, and includes the control and influence over other people and their actions. In a notable study of power conducted by social psychologists John French and Bertam Raven in 1959, power was divided into five separate and distinct forms: coercive, reward, legitimate, referent, and expert (MindTools, ¶1-5). Although the French and Raven list is frequently cited, listed below is a composite list more specific to the different types of power that are relevant to project managers (Changing Minds, ¶1, 2, 4-8):

1. **Positional Authority** – This covers the power people have from being in defined positions. Positional authority refers to the specific powers given to a person based on their position in an organization, such as president of a country, Chief Executive Officer (CEO) of a company, or a general in the military. Your supervisor may be another example since this person often has the ability to make decisions that impact you such as raises, promotions, and work assignments. It's important to note that not all positions, despite their formal title, have an accompanying amount of significant power. For example, the Vice-President of the United States has a very high position, but very little actual power. In some companies, your supervisor may decide on your raise, while in other companies the supervisor makes a recommendation, but it's the next level up that has the authority to make the final decision. In some organizations, a project manager may be given specific positional authority, such as signing contracts, approving invoices, and negotiating change orders with a client, while in others this power may be retained by upper management.
2. **Knowledge** – This power can be either technical or social. Technical knowledge can include such things as knowing how to prepare a schedule using specific software, or knowing the technical details of a financial software package being purchased for your project. Knowledge can also be socially related, such as being an expert on the use of social media or having specialized training in communications or team building.
3. **Skill** – This power, which is closely related to knowledge, is the ability to *do* something rather than just know it. For example, having extensive knowledge of team building will not help a project manager unless that person has the skill to use this knowledge when working with a project team.
4. **Obligation** – If a person feels obligated to you, this is a source of power. A sense of obligation can be created when you do a favor for someone and that

person feels a duty to repay that favor. People also can feel obligated to follow rules (such as project team roles and responsibilities), or they can feel a responsibility to meet a commitment they made. You can build this type of power by the favors you do, by the help you give people, and by building a sense of team commitment.

5. **Trust** – The definition of trust is confidence in and reliance on your good qualities, especially fairness, truth, honor, or ability (MSN Encarta). The trust of others has to be earned by your actions over time; this is done by consistently showing integrity and respect for others. People develop confidence and belief in you and what you can do based on your actions; this in turn gives you the power to ask for things without them wondering whether you may take advantage of them or have ulterior motives.
6. **Self-Determination** – You decide what you say and do. You decide on your actions. You can show initiative and challenge the status-quo, or go along with established procedures, no matter how irrelevant they may seem. For example, let's look at the case of a project manager with plans to contract the development of a new software application for his company. He wanted to use a cost reimbursable contract with a not-to-exceed cap and a cost incentive for finishing below a target price. This project manager was told by the buyer handling professional services the contract type he described was not an option – he could use a fixed price or cost reimbursable contract which were the company standards. The project manager could have simply capitulated and follow the guidelines, but instead he got corporate purchasing and his management involved and argued his case – and won.
7. **Emotional Intelligence** – In addition to the power sources listed above, project managers looking to be really effective in a low authority environment have another tool at their disposal: emotional intelligence (EI). Emotional intelligence is the ability to recognize and manage your own emotions and to effectively deal with the emotions of other people. In the article, *What Makes a Leader*, Daniel Goleman (author of the best seller *Emotional Intelligence: Why It Can Matter More Than IQ*) makes the point that there is a direct link between a company's success and the emotional intelligence of its leaders (Goleman, 1998, p. 94). In fact, he states that EI is twice as important as technical skill and IQ for job success!

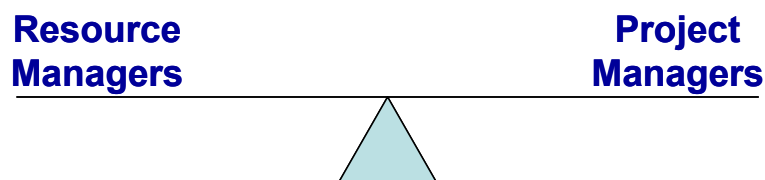
### **Positional Power**

A frequent comment often heard from project managers is “if only I had more power.” The belief is that with this additional power the various project problems would all just go away. Many people relate effective management and leadership with having positional power which gives them authority. However, consider *The Office*, a popular American comedy television series that aired from 2005 to 2013, with Michael Scott as the regional manager of the Scranton branch of the Dunder-Mifflin Paper Company. For people who watched this show, it is very obvious that while Michael has positional

authority in his role as regional manager, he is not recognized by most of his employees as either a leader or as an effective manager.

The upshot is that having positional authority alone does not make a person either a good leader or manager. A frequent complaint by project managers is that they don't control the project resources, and team members get pulled for production emergencies or other work. The belief is that having authority over the project resources would solve the problem. But consider this: do most project managers really want to act as supervisors for team members, and conduct performance appraisals, address career planning, and handle the many personnel issues that come up? It would be a major distraction and reduce the amount of time the project manager can focus on the project. In addition, if a production emergency does occur within the company that requires one or more of your project resources, are you really going to put your project above the greater immediate needs of the company? The answer is probably not if you have any career aspirations.

Another interesting point about positional power is reflected in a confidential survey conducted of project managers and resource managers at a large corporation. The simply question asked was regarding the balance of power, and whether the project managers or resource managers had more power (refer to Exhibit 1). The results were surprising – the resource managers felt that the project managers had more power, yet the project managers felt that the resource managers had more power. This result occurred for two reasons. The first was a lack of clearly defined responsibilities. The second was that many people just assume that they don't have power; they forget about their power of self-determination. Sometimes it's better to take the initiative and assume you have the authority and responsibility to make decisions. Remember the saying that it's often easier to ask forgiveness than it is to seek permission.



**Exhibit 1: The Balance of Power**

The comment by project managers about having more power also doesn't really get at the root cause of their dissatisfaction. When interviewing project managers regarding what specific powers they really need to be more effective, what most often is revealed is really a need for more support from their management. Unfortunately, many middle and upper managers will express support for project management, but their actions don't demonstrate that support. A perfect example of this is a large corporation where project planning was done by the book and a project budget of \$55 million was determined. The client manager insisted that the project should only cost \$48 million, based on no specific expertise except his "expert" opinion. The project organization management provided no support to the project manager and he was told by his

management to “make it work.” Unfortunately, they neglected to give him a magic wand or a bag of potions. There were no scope reductions – the client wouldn’t entertain any suggestion of that – and the project ended up at \$54 million and the project manager was removed from the company due to the project “failure”. Obviously the management in this company really didn’t support project management.

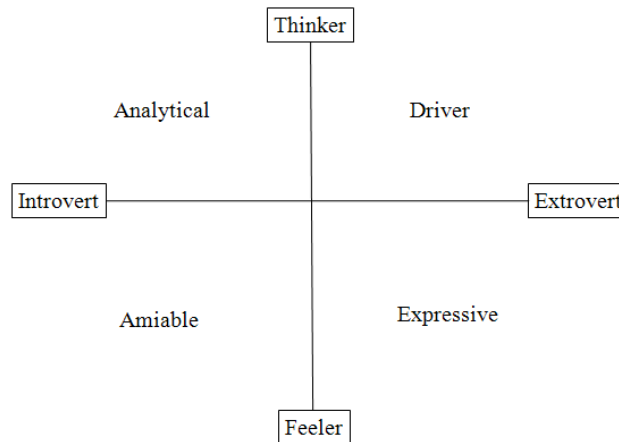
In the past, corporations used to focus on positional power and authority. What is becoming more common is a shift from power based on formal authority to other types of power such as knowledge, skills, trust, obligation, self-determination and emotional intelligence. Project managers need to stop using lack of authority as an excuse for project problems since in reality they can draw on these other sources of power. The ability to innovate, create, apply new knowledge, and build trust should occur at all levels of the organization, but especially on the front line where project managers are working to successfully deliver projects. However, these other sources of power are not bestowed on a project manager; they have to be *developed* by the individual.

### **The Power of Emotional Intelligence**

An often overlooked source of power is emotional intelligence. According to Daniel Goleman, there are five components that make up emotional intelligence: self-awareness, self-regulation, motivation, empathy, and social skill (Goleman, 1998, p. 95). As with other managerial skills, EI can be learned. Critical to developing your EI is having a good knowledge of personality styles. The better you understand personality styles (both your own and others), and the better you are at adapting your personality style to that of others, the more successful you will be as a project manager in your dealings with project team members and other stakeholders.

There are numerous personality theories, but most are based on the four quadrant behavioral model, with behavior mapped along two axes. While each personality theory has its own specific vocabulary, the horizontal axis is usually labeled **Introvert** versus **Extrovert**, and the vertical axis is labeled **Feelers** versus **Thinkers**.

Introverts are typically described as being less assertive, quieter, more reflective, and in no rush to make decisions. In contrast, extroverts are more assertive, more talkative, louder, and quicker to make decisions. Feelers are typically described as being more responsive to others, more playful, and more focused on feelings. In contrast, thinkers are described as being less responsive to others, more serious/reserved, and more focused on facts. The intersection of these axes forms four quadrants, each of which represents a personality “type” (refer to Exhibit 2.) Again, each theory uses its own vocabulary; however, the labels **Analytical**, **Amiable**, **Driver**, and **Expressive** serve well to define the four basic personality styles. While everyone is likely to have a dominant type or style, that style is augmented by a mixture of the other personality types and their traits are also dependent on environment and circumstance. Also, no one personality style is best; each can be successful, and each has its merits as well as its drawbacks.



**Exhibit 2: The 4-Quadrant Personality Model**

Unfortunately, most project managers ignore personality styles when dealing with project stakeholders. Yet understanding personality models is of direct help in achieving personal awareness and adaptability; it can help you recognize behavior patterns in others – and yourself. It can be a source of power. Learning about personality and realizing that people have different styles is the first step in improving your emotional intelligence. The second step is becoming aware of *your* style, including strengths, weaknesses and how you react to stress. The third step is learning to identify and work effectively with the personality styles of other people. The more you understand about your own personality and that of other people, the better able you are to realize how others perceive you, and how they react to your personality style. The fourth step is learning how to flex your style to improve the way you work and communicate with others on a project. Mastering these four steps will improve your emotional intelligence and make you a more effective project manager. Improving your emotional intelligence will provide you with more “power” to use on your projects. For more information on personality styles, see *Pardon Me – Your Personality Is Showing* (Lukas, 2009, p. 1-7).

### **Getting Results with Limited Authority**

The earlier discussion on power has hopefully helped you realize that positional authority alone won’t get results. A project manager with high emotional intelligence including knowledge of personality styles, coupled with knowledge, skills, trust and self-determination is a person with power who can consistently deliver successful projects.

A key component for getting results when you have limited authority is use of personality styles, especially the ability to “flex your style.” This means you do what is appropriate in a communication situation with another person by temporarily using some behaviors typical of your non-dominant styles. It does not mean abandoning your dominant style, but it does require that you be well aware of not only your style strengths but also your style weaknesses as well as the style of the other person. It requires using body language effectively and matching your wording to the preference

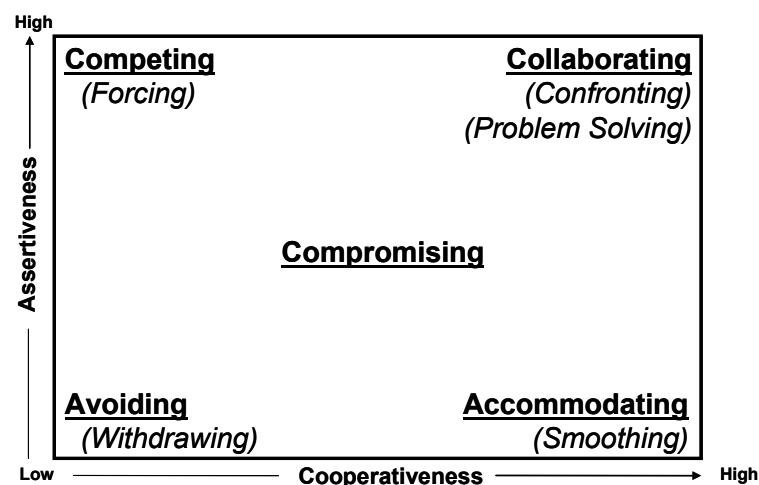
of the person you are communicating with. Learning to flex your style is especially important when the other person is stressed, something important is at stake, you need to get off on the right foot in a new setting, or you are operating with limited positional authority. Your ability to adapt or bring into play different style traits in response to different situations and needs is one of the most powerful capabilities that a project manager can possess.

### Resolving Conflicts with Limited Authority

Conflict management is inevitable on projects. Conflicts can arise due to organizational issues such as work priorities, sharing of project resources and responsibility for decisions. They can also occur within the project team over scope, technical solutions, schedule, costs, risks, and communications, or because of different personality styles, goals, and values.

Unfortunately, many project managers are uncomfortable with conflict and tend to shy away from it, hoping that the situation will somehow get resolved without their intervention. However, project managers with high emotional intelligence realize conflict can be beneficial as long as it is promptly managed and used to drive better project performance. Successful conflict management can help resolve issues, lead to creative problem solving and innovation, improve communication and understanding between team members, and strengthen team relationships.

The five common conflict resolution techniques are shown in Exhibit 3 below. This section of the paper will briefly discuss the use of these techniques in a low authority environment, along with how the personality style of a project manager can tend to make particular techniques easier or harder to use.



**Exhibit 3: The Five Common Conflict Resolution Techniques**



Each conflict resolution technique shown in Exhibit 3 represents a different combination of two dimensions:

- **Assertiveness:** the extent to which an individual attempts to satisfy his or her own concerns.
- **Cooperativeness:** the extent to which an individual attempts to satisfy another person's concerns.

### **Competing**

Competing is forcing resolution of the conflict with the solution you want. Forcing resolution of a conflict is appropriate when quick and decisive action is needed, or on important issues where an unpopular course of action must be implemented. It does help to have positional authority with this conflict resolution technique, or the other party in the conflict may challenge whether you really have the decision-making power.

Drivers find this conflict resolution technique very easy to use since this personality style likes domineering and overcoming opposition to accomplish results. However, in most situations competing is not an effective conflict resolution technique since it can alienate team members who don't agree with your point of view.

### **Avoiding**

Avoiding is not pursuing your own or the other side's concerns, so the conflict goes unresolved. This conflict resolution technique is appropriate when the issue is trivial, you have no chance of winning, people need to calm down, or others can resolve the issue more effectively. Obviously avoiding does not require any positional authority since with this technique you are trying to evade the issue.

The analytical style in particular finds this conflict resolution technique easy to use since it eliminates the need to deal with the feelings of other people. However, it should be noted that avoiding does not resolve the underlying conflict.

### **Accommodating**

Accommodating is resolving the concerns of the other side to their satisfaction while leaving your concerns unresolved. In a nutshell, it's giving in to the other side in order to resolve the conflict. With this conflict resolution technique, the need for positional authority is very low, unless you need to give the other side something that requires authority (such as paying for overtime work). Accommodating is useful when the issue is very important to the other person and not important to you, or to demonstrate that you are open-minded, or when you know you are wrong.

The amiable personality style finds this conflict resolution technique easy to use since they focus on people, seek sincere appreciation, avoid rejection, and take difficulties personally. The expressive personality style also would find this technique easy since they also focus on people and seek popularity. However, giving in can result in the project manager being viewed as ineffectual by people within the organization and/or team.



## **Compromising**

Compromising looks to find a solution that satisfies some concerns of both parties. With this conflict resolution technique, the need for positional authority is also very low, unless you need to give the other side something that requires authority. Use of compromise is appropriate when both sides are strongly committed to mutually exclusive positions or when a quick agreement is needed.

Drivers enjoy this conflict resolution technique since they see the compromise negotiations as a competition – one they fully expect to win. The expressive personality style also like compromises since it provides the focus on people and the recognition when the compromise is finally reached.

## **Collaborating**

Collaborating looks to find a solution that satisfies the concerns of both sides in the conflict. With this conflict resolution technique, the need for positional authority is very low since both sides are working together to find that one common, acceptable solution. This technique does take more time, but provides a final resolution of the conflict. Collaboration is useful when gaining commitment on the resolution is important, for resolving interpersonal conflicts, and when the participants bring different perspectives to the issue.

The analytical personality style likes this technique because of the data and facts used to resolve the conflict. The amiable likes this technique because of the people interactions and taking time to find the right solution. The expressive and driver personality styles can also work this technique very effectively, but may get frustrated with the amount of time needed to bring resolution to the conflict.

Note that with the five conflict resolution techniques, only forcing really requires a high amount of positional authority. The other conflict resolution techniques require little or no positional authority. What this means is that project managers have lots of methods for resolving conflicts that do not require a high amount of positional authority.

## **Conclusion**

While having a project manager who is a good leader is highly desirable, the manager function is more critical in order to successfully implement the project, and many project managers are very successful “doers.” In addition, complaints by project managers that they do not have the authority to do their job are not always well founded, since they are based on the assumption that only positional authority provides power. Project managers can elicit top performance from project team members by using many other available power sources, including knowledge, skill, obligation, trust, self-determination, and emotional intelligence. What is becoming more common in organizations is a shift from power based on formal authority to these other types of power.

Project managers would be well-served by focusing on the five components of emotional intelligence: self-awareness, self-regulation, motivation, empathy, and social skill. The better you are at adapting your personality style to that of others, the more successful you will be as a project manager. Getting results, resolving conflicts and successfully delivering projects can be accomplished by having a high emotional intelligence – even in a low authority environment.

## References

Lukas, Joseph & Janice (2009) *Pardon Me – Your Personality is Showing*, 2009 PMI Global Congress NA Proceedings

Hitt, William D. (1988). *The Leader-Manager, Guidelines for Action*. Columbus, OH: Battelle Press.

*French and Raven's Five Forms of Power*. Retrieved July 17, 2010 from [http://www.mindtools.com/pages/article/newLDR\\_56.htm](http://www.mindtools.com/pages/article/newLDR_56.htm)

*Types of Power*. Retrieved July 17, 2010 from [http://changingminds.org/explanations/power/power\\_types.htm](http://changingminds.org/explanations/power/power_types.htm)

MSN Encarta. Retrieved July 17, 2010 from <http://encarta.msn.com/encnet/features/dictionary/DictionaryResults.aspx?lextype=3&search=trust>

Goleman, D. (November-December, 1998). *What Makes a Leader*. Harvard Business Review

*Four Quadrants Personality Profile*. Retrieved June 15, 2009 from [http://www.bigideasnetwork.com/four\\_quad\\_personality\\_profile.htm#1](http://www.bigideasnetwork.com/four_quad_personality_profile.htm#1)

*If you only understood your customer's personality style*. Retrieved June 20, 2009 from <http://www.ahfx.net/weblog/37>

Matthews, G., Zeidner, M., Roberts, R. (2004) *Emotional intelligence: science and myth*. Boston: MIT Press.

Montgomery, S. (2002). *People Patterns: A Modern Guide to the Four Temperaments*. Santa Maria, CA: Archer Books.

Wallington, P. D. (January, 2003) *How Personality Plays Into Leadership* [Electronic Version]. Retrieved June 15, 2009 from [http://www.cio.com/article/31654/How\\_Personality\\_Plays\\_Into\\_Leadership](http://www.cio.com/article/31654/How_Personality_Plays_Into_Leadership)

# **The Project Stakeholder Analysis Process**

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## **Abstract**

It is an undisputed fact that project stakeholders are a prime critical success factor on all projects, especially on large and technically and managerially complex ones such as those often encountered in construction and civil infrastructure development. Consequently, in order to boost project performance, reduce risk to projects, and to realize to the maximum attainable extent the benefits brought about by the projects after their completion, it is imperative to manage and engage the stakeholders professionally and effectively over the project life-cycle. A thorough stakeholder analysis constitutes the foundation of effective stakeholder management and engagement.

The importance of stakeholder analysis is now widely acknowledged. Though it is being regularly applied on construction and civil infrastructure development projects, there still appears to exist a need to further educate project owners, planners and other key decision-makers about unexplored possibilities offered by the stakeholder analysis process and how its practical usefulness can be enhanced. What seems to be lacking at present is a rigorous analytical framework which incorporates a set of integrated and sophisticated tools capable of delivering detailed and multi-dimensional insights about project stakeholders with a consistently high level of accuracy over.

Based on their research on the subject of project stakeholder management and engagement, their decades of experience with projects, and a careful study of existing stakeholder analysis approaches and tools contained in available documentation taken from numerous large and complex projects undertaken in several project categories and across the globe, the authors present in this paper a comprehensive project stakeholder analysis process framework which they believe can supplement and add value to existing approaches used by projects to analyze their stakeholders. Themes discussed include the process benefits, challenges and constraints, and the importance of having an enabling environment and acquisition of quality information on project stakeholders for the analysis to deliver optimal results. Highlighted in this paper are five powerful stakeholder analysis tools which, if applied in an integrated or coordinated manner, may deliver all the salient insights and knowledge needed by projects to effectively

manage and engage their stakeholders over their life-cycles. These tools are: the Stakeholder SWOT-Analysis, Stakeholder Attribute Analysis, Stakeholder Issues & Complications Analysis, Stakeholder Scoring Models, and the Stakeholder Scenarios & Project Impact Analysis.

Through their research the authors hope to motivate projects to improve the quality of their stakeholder analysis. A robust stakeholder analysis will serve the interests of the projects in the sense that it can reduce the risk of conflicts occurring between projects and their stakeholders and also provide projects with guidance how to respond appropriately in the event that conflicts with stakeholders do occur over the project life-cycle. The interests of the stakeholders will also be served accordingly.

### **Introductory Comments**

Stakeholder analysis has been an integral part of the project planning process for decades. Many documented examples taken from actual projects undertaken in fields as diverse as water resource management, forestry, social development, mining, urban regeneration and construction and civil infrastructure, some dating back to the early 1990s, were discovered by the authors while researching for this paper. Interestingly, most of the stakeholder analyses reviewed were quite recent specimens, having appeared after the advent of the new millennium with increasing frequency of appearance as well as complexity of content over time. Presumably, this reflects an increasing awareness of the importance of stakeholders on projects and broad concurrence among project key decision-makers of the need for understanding them managing and engaging them effectively. In fact, stakeholder analysis is almost a universal feature on all projects today.

It is now generally accepted that project stakeholders basically fall into two major categories: The ‘primary stakeholders’ which encompasses all those entities having contractual obligations or some legal responsibility towards the project, and the ‘secondary stakeholders’ which include all those entities having neither contractual obligations nor legal responsibility to the project but which are affected by it directly or indirectly in some way or the other, and positively or negatively, or both, over time. Examples of key primary stakeholders typically encountered on large and complex projects, as in construction and civil infrastructure development, are the project owner or client, steering committee, financiers, designers, consultants, contractors and sub-contractors, vendors, project manager and project team, and government agencies involved in the project. More significant secondary stakeholders on such projects would usually include affected local communities, civic and professional organizations, advocacy groups and environmentalists, media and academia, and some government agencies. All stakeholders have their respective interests in and views of the project and these can vary widely and change over time.

If primary and secondary stakeholders come to view the project as constituting a threat to their interests than it is logical to assume they will resist it using the means available to them. Resistance which is active, strong and sustained can seriously affect the project causing it to experience cost and schedule overruns, image loss, demotivation of its employees, reduced benefit realization after completion, non-attainment of some of its objectives, or in the extreme case even endanger the project's existence through the possibility of enforced premature termination. Secondary stakeholders who, unlike the primary stakeholders, lie outside the project's formal control and may initially not be known well to the project but nevertheless may pose an especially high risk to it by exercising against the project a spectrum of options which are available at their disposal. Many high-profile projects have been seriously affected by hostile stakeholder action and several examples were discussed by the authors in a previous paper on the subject.

In their paper *The Project Stakeholder Management and Engagement Strategy Spectrum: An Empirical Exploration* which was presented at the University of Maryland's fifth annual project management symposium in 2018, the authors argued that stakeholder resistance and opposition to projects can often be prevented, reduced or eliminated through the application of carefully conceived, robust and flexible management and engagement strategies. Management strategies are applied on primary stakeholders while engagement strategies are used on secondary stakeholders. Management and engagement strategies themselves lie at the end of a complex and dynamic process which commences with contextualization of the project in both primary and secondary stakeholder perspective, followed by comprehensive identification of the stakeholders, and subsequently by a careful and thorough analysis of all identified stakeholders. The analysis is the basis for designing the strategies for managing and engaging the stakeholders effectively over the project life-cycle.

Consequently, an excellent stakeholder analysis is extremely important for the project; an inadequate or flawed analysis, even in part, could result in ineffective stakeholder management and engagement strategies resulting in a wastage of project resources and possibly generating more stakeholder resistance and opposition to the project instead of reducing or eliminating these. Project performance may suffer considerably as a result. In extreme cases, the project's existence may even be jeopardized. Stakeholder analysis therefore needs to be taken very seriously and undertaken with the utmost care and professionalism. From their research the authors conclude that there are three fundamental ingredients to an efficacious project stakeholder analysis, namely, presence of an enabling environment for the analysis, acquisition of 'high quality' information about all the project's identified primary and secondary stakeholders, and the application of a set of specialized analytical tools which, viewed collectively, can deliver accurate and multi-dimensional deep insights about stakeholders based on the information inputted into them. This is a logical and systematic approach not inconsistent with

current practice on projects. The contribution which this research makes to the knowledge domain of stakeholder analysis is that it advocates the application of stakeholder analysis tools (two of which were developed by the authors) in an integrated manner which seems uncommon on projects - at least insofar as the projects which were reviewed for this paper are concerned – and, furthermore, this research proposes that stakeholder analysis should not constitute merely a one-time effort, which appears to be the current approach on projects, but an exercise which must be repeated, possibly even several times over the project life-cycle if and whenever deemed necessary, in order for it to maintain its effectiveness.

### **Project Stakeholder Analysis: Importance of an Enabling Environment**

For undertaking an effective stakeholder analysis several prerequisites must be met. First and probably foremost, projects and their decision-makers must demonstrate a sincere and unwavering interest in and commitment to professionally managing and engaging their stakeholders over the entire project life-cycle. A high-level of interest and commitment may be demonstrated by having in place a succinctly formulated and strictly adhered to policy that unequivocally acknowledges stakeholders, primary and secondary, as a (if not the) prime critical success factor and provides the resources needed by the project for the identification and analysis of the stakeholders and for the strategies needed for managing and engaging them. Project resources, however, usually are limited and effectively dealing with stakeholders, especially secondary stakeholders whose number may run into millions on large and complex schemes such as those often encountered in construction and civil infrastructure development schemes can be prohibitively costly. Cost considerations aside, Analysts equipped with the requisite knowledge, skills, abilities, experience and creative talent are indispensable for properly undertaking and managing the stakeholder analysis process and finding such talent easily, cheaply and in the required number may be difficult given the still apparent dearth of formal project stakeholder management and engagement education, training, and certification programs. Given also the voluminous amount of information on stakeholders which would normally need to be collected for performing a thorough analysis and repeating the analysis multiple times over the project life-cycle, a sophisticated technical infrastructure with appropriate software and database would be needed to store, catalogue, collate and utilize the information collected on the stakeholders. Setting up such a stakeholder information system may also prove quite cost- and effort-intensive as well as technically challenging for projects. And even if projects fully meet all prerequisites mentioned above, this still does not guarantee that the stakeholder analysis will be successful in the sense that it invariably leads to the design and execution of ‘perfect’ stakeholder management and engagement strategies.

Hence, investing in stakeholders is evidently not something which projects can expect or hope to do on the cheap with minimal effort and with the expectation of automatically reaping prompt and huge benefits in return. Stakeholder management and engagement is a rapidly

evolving subdiscipline of project management whose importance may now be universally, albeit in many quarters still somewhat grudgingly, acknowledged by project owners, planners and other key decision-makers of whom many apparently still rather prefer their projects to continue focusing primarily on performing their technical work tasks and activities and leave the possible unpleasanties of dealing with stakeholders to others.

### **Project Stakeholder Analysis: The Pivotal Role of Information**

Stakeholder Analysis is, as already mentioned, not an end in itself but a means to an end which is to deliver insights and knowledge about stakeholders, both primary and secondary, to an extent which can be used for the design and execution of effective strategies for their management and engagement respectively. It is reasonable to assume that an excellent stakeholder analysis translates into highly effective stakeholder management and engagement strategies which in turn reduce risk to, or the effect of complications on, the project resulting from stakeholder apathy or hostility while at the same time benefitting from the goodwill and helpfulness of stakeholders who are favorably inclined to the project. The likelihood that the project will be 'successful' thus increases. A deficient stakeholder analysis on the other hand will bring few, if any, benefits for the project. This is the situation often witnessed on projects, for example, when opposition to them by secondary stakeholders increases over time when instead it should have lessened in response to the engagement strategies applied on them. If the stakeholder management and engagement strategies applied prove to be ineffective or less effective than envisaged - a situation that can easily be determined by using appropriate monitoring indicators - than the underlying causes for this deficiency must be determined and prompt remedial action taken by adopting modified and more effective strategies. This implies that stakeholder analysis is not a one-time exercise which it is often treated as on projects but, if situation or circumstances dictate, may need to be repeated and up-dated over the project life-cycle.

A good, robust stakeholder analysis must provide clear answers to many critical questions, both general and specific in nature, about the project stakeholders, primary and secondary, which are of interest to project decision-makers: What issues and conflicts may arise between the project's primary stakeholders over time and how may these issues and conflicts affect project performance? Which secondary stakeholders may or will support and oppose the project and why? Which secondary stakeholders will experience direct or indirect losses or disadvantages and gains and of what type because of the project over time? And so forth.

To answer these and the many other pertinent questions raised before commencement of the stakeholder analysis process two fundamental inputs are needed: information of sufficiently high quality and the analytical tools capable of filtering and systematizing this information and thereby delivering (hopefully) all the many insights and answers the project needs to de-

sign and execute its stakeholder management and engagement strategies. A major advantage of the stakeholder analysis process is that it includes all stakeholders, both primary and secondary, whereby primary stakeholders are analyzed as singular individual, group or organizational entities whereas the secondary stakeholders, with certain exceptions, are analyzed collectively.

For a stakeholder analysis information quality must always take precedence over information quantity. Amassing all and any information available about the stakeholders can easily and quickly overwhelm the Analysts and greatly erode the effectiveness as well as the efficiency of the analysis process. What is clearly needed instead is a more focused approach following which the Analysts seek to acquire only that particular information – ‘quality information’ - which can add value to the analysis process. Quality is a highly complex and multi-dimensional and multi-perceptual concept and finding information on stakeholders which satisfies all defined quality criteria can be immensely challenging. Quality information means that the information acquired on primary and secondary stakeholders must for instance be factually correct, relevant, complete, specific, up-to-date, reliable, actionable, and comprehensible. The information must also be acquired legally and ethically. Any deficiencies or shortcomings in the quality of information inputted into the analysis process may lead to inaccurate conclusions about stakeholders and these in turn can adversely affect the effectiveness of the stakeholder management and engagement strategies which are designed and executed on the basis of the stakeholder analysis.

Stakeholder analysts usually have a multitude of information sources at their disposal. Some sources may yield information of higher quality than others. Acquiring information on the primary stakeholders is comparatively easier since these entities, whether they are individuals or organizations, are all active project participants with assigned roles and responsibilities and their information can usually be accessed promptly without significant cost and difficulty. Important sources of information about these stakeholders include organizational profiles, documentation available from past or on-going projects in which they were involved, other project managers and teams who previously interacted or are currently interacting with them, employment records and performance appraisals, and direct interaction one-on-one with these stakeholders themselves. For the secondary stakeholders, i.e. those entities who do not have any contractual or legal obligations to the project and about whom information may not be so readily accessible as it is with the primary stakeholders, many sources of information still offer themselves for consideration. For instance, the Analysts can also approach these stakeholders directly and survey or interview them about their views, interests etc. about the project, consult documentation from past or on-going projects to determine the nature of the relationship and interaction the project had with them, or ask other project managers and entities about their experience dealing with them. Useful information about secondary



stakeholders may often also be found in archived newspaper and magazine back editions and in published case studies. Many organizations such as advocacy groups and environmentalists which traditionally (and often vehemently) oppose projects adversely affecting the natural environment, fauna and flora, the interests of indigenous peoples, historical or cultural sites and artifacts, and so forth, usually publish detailed material about themselves, their mission, goals, priorities, activities and other parameters which may be significant for a secondary stakeholder analysis. Such information may be available in print or on their websites which can be accessed easily, swiftly and without cost via the internet. Government agencies publish a wealth of statistical and other material, some of which may also be useful for a secondary stakeholder analysis. Information on secondary stakeholders which is difficult to acquire from 'conventional' sources may be collected by hiring 'researchers' or 'informants' who can mingle and interact inconspicuously and directly with stakeholders or observe them closely but from a distance in order to ascertain their perspectives about the project without the stakeholders themselves actually being aware of this. It is pertinent to add that if the Analysts employ this method, then it is crucial that both legal and ethical boundaries are respected and no illicit means of information gathering – for example, through phone wire-tapping or electronic eavesdropping in private spaces – whatsoever are used.

It is also important that any information collected on secondary stakeholders must be treated confidentially and appropriate safeguards are adopted to ensure the security of information stored in electronic and/or file-based systems as unintended disclosure of such information outside the project may cause complications for it. Access to information about project stakeholders, whether primary or secondary, must in principle always be confined to the Analysts and others tasked with monitoring the stakeholders or designing, executing and periodically revising strategies for managing and engaging them.

The complexity of acquiring and processing information about secondary stakeholders in practice must not be underestimated. It is possible, even highly likely, that some of the available information may not satisfy all the above-mentioned information quality criteria. Finding high quality information in the extent required for a rigorous and thorough analysis can often be a task which is arduous and frustrating, time-consuming, prohibitively costly and sometimes practically impossible to perform on large and complex projects as in major construction and civil infrastructure development schemes given their enormous number of secondary stakeholders, sometimes numbering several million entities, who are dispersed over a large geographical area and whose perspectives about the project typically vary tremendously. Some mega-projects have influential secondary stakeholders transcending national, regional and even continental boundaries who may not be apparent at first glance but whose potential impact on the projects, and vice versa, may nevertheless be highly significant and often rather unpleasant as past experience has aptly shown on several occasions. An added complication

for the Analysts is that information acquisition for the stakeholder analysis on large and complex projects cannot realistically be viewed as a one-time exercise but must be repeated in varying time intervals over the project life-cycle, and usually more frequently so during the project execution stage, for the simple reason that secondary stakeholder perspectives about the project can and often change over time according to how they view themselves and their interests in relation to the project as it progresses through its life-cycle.

### **Tools for the Stakeholder Analysis Process**

Information, even of the best available quality, is of little use unless and until it can be systematically processed and filtered to fully deliver clear answers and generate the deep insights which are expected from an excellent stakeholder analysis. Several tools for analyzing project stakeholders are currently used in practice. A review by the authors of dozens of published stakeholder analyses on projects in the fields mentioned earlier indicates an evident preference for tables, mapping tools, and quadrant diagrams, on which stakeholders, primary and/or secondary, are positioned according to a set of specified parameters. Some of the more common parameters used in stakeholder analyses are, inter alia, their interest level, power or influence, legitimacy, designated priority, the impact which the project may have on them, and the stance, supportive or hostile, which the project expects them to adopt towards it. Without doubt, these are useful tools which can help projects design and execute effective stakeholder management and engagement strategies. However, the authors feel that there is still a need to take the analysis a step or two further and also attempt to incorporate potent tools which presently rarely find application in the stakeholder analysis process but which offer the possibility of significantly enhancing its quality. Furthermore - and very surprisingly - virtually all stakeholder analyses reviewed appear to constitute a one-time effort usually undertaken early on in the project life-cycle. Ignoring the time factor is a gross error with possibly far reaching implications because, as the authors have already pointed out, stakeholder perspectives on projects, especially in large and complex construction and civil infrastructure development schemes, can and often do change over time, especially during the project execution phase. Failure to detect, analyze and promptly and effectively respond to changes in stakeholder perspectives over the project life-cycle is potentially dangerous for projects and may seriously affect their performance or worse.

The four analytical tools proposed and discussed by the authors here for the category of the primary stakeholders are the SWOT (Strengths, Weaknesses, Opportunities, Threats) Analysis, the Stakeholder Attributes Analysis, and the Stakeholder Issues & Complications Analysis. Scoring Models are also useful for evaluating primary stakeholders. Three useful and recommended analytical tools for the category of the secondary stakeholders are, besides the SWOT-Analysis and the Stakeholder Attributes Analysis, the Stakeholder Scenario & Project

Impact Analysis. The application and benefits of these analytical tools are discussed below for both primary and secondary stakeholder categories separately.

**Primary Stakeholders:** Primary stakeholders are all without exception active project participants having contractual and/or legal obligations to the project. Whether they are individuals or organizations, they all have assigned roles and responsibilities which must be fulfilled to the fullest in order to ensure that the project stands a higher chance of success. Primary stakeholders do not operate in a vacuum but need to closely communicate, coordinate and collaborate with other primary stakeholders over the course of the project life-cycle in order to effectively fulfill their diverse roles and responsibilities. Stakeholders – whether primary or secondary - are somewhat like people: they have different ways of doing things, abilities, experiences, interests, motivations, concerns and so forth. By looking at stakeholders as singular entities and not as a collective group all lumped together, and then by carefully, systematically and thoroughly analyzing them, the project can gain valuable insights which can be used as the basis for designing stakeholder-specific strategies which can bring immense benefits for both the project and its stakeholders.

The SWOT analysis is a powerful and proven analysis tool that has been used by organizations and managers for a long time. From project perspective and in the context of stakeholder management and engagement, a SWOT-Analysis basically analyses primary and secondary stakeholders according to four dimensions, namely, the stakeholders' respective strengths and weaknesses, the opportunities which will or may present themselves for the project in dealing with them as well as the threats they will or may pose for the project. Since primary stakeholders are all active project participants having contractual and/or legal obligations to the project and (in most cases) are voluntary participants in it, it is reasonable to assume that under normal circumstances they will support it as much as they can. Hence, their discernible strengths are an asset for the project which it must seek to benefit from on while their weaknesses constitute a liability for the project which it must attempt to reduce or, if and where possible, eliminate in order to avoid occurrence of possibly serious problems between them and the project with consequent adverse effect on project performance.

Important strengths of primary stakeholders which would usually be of great relevance and significance to a project include having, for instance, a high level of professionalism, competence, experience, interest and commitment, dynamism, tenacity, flexibility, dependability, cooperativeness, innovativeness, robust project management infrastructure, and systems and process maturity. The higher the intensity of each identified strength, the more advantageous it obviously is for the project. Important weaknesses of primary stakeholders – besides exhibiting the opposite of some (or all) of the above identified strengths - could for instance be their inertness and overemphasis on procedures, sluggish responses, performance and capacity constraints, communicational challenges, overstretched resources, unfriendly work-

ing environments and lack of incentives. Existing or potential opportunities as seen from the perspective of the project may be the possibility of developing close long-term relationships with primary stakeholders which not only may benefit the project but possibly also projects undertaken in future by the project-owning/performing organization as well, leveraging strengths, getting acquainted with and adopting more efficient and innovative processes, tools and techniques with a view to reducing cost and risk and improving quality and time management, and promoting professional networking with stakeholders with global outreach. Threats from primary stakeholders may include the possibility of failure to meet their contractual commitments and obligations to the project, unprofessional conduct, occurrence of insolvency during the project, involvement in unethical or illegal practices and consequent damage to the project reputation, leakage of project information to competitors, loss of interest in and commitment to the project due to shifts in priority.

The SWOT-Analysis is evidently a potent tool which, if applied carefully, can provide projects with valuable information about their primary stakeholders and help analysts design effective management strategies accordingly. Much effort needs to be undertaken to conduct a thorough SWOT-Analysis on all primary stakeholders. If undertaken in isolation a SWOT-Analysis would be less useful than if it used in combination with the other suggested primary stakeholder analytical tools through which collectively much deeper insights and knowledge about the primary stakeholders can be generated which in turn can be used for crafting more effective management strategies for them. Consideration may be given to undertaking the SWOT-Analysis more than once, and possibly at least a few times over the course of the project life-cycle because while primary stakeholder observed strengths and weaknesses may not change significantly over time, the opportunities they offer and especially the threats they pose to the project may be more variable depending on circumstances and the project must be aware of these changes in order to safeguard its interests.

The Stakeholder Attribute Analysis is an approach that was developed by the authors and discussed in detail in their paper *Understanding Stakeholder Psychology. The Path to Effective Stakeholder Management and Engagement* which was presented at the University of Maryland's fourth annual project management symposium in May 2017. There the authors identified six parameters or 'attributes' shared universally by all primary and secondary stakeholders regardless of whether they are individuals, groups of individuals, public, commercial, or not-for-profit organizations, and even countries. Grouped into three binary pairs the six stakeholder attributes are motivation and concern, expectation and perception, and attitude and behavior. Motivation is the positivity inclining stakeholders in favor of a project because they view the project as a means through which they can realize, in full or in part, their respective needs and wants. By contrast, concern is the negativity reflecting their misgivings and apprehension about the project. By juxtaposing their motivation and concern stakeholders develop

expectations about what the project may or will bring them or may or will not bring them over future points in time, and they subsequently compare these positive or negative expectations with their perceptions of project reality as it unfolds and envelopes them. Attitudes are the feeling stakeholders develop about the project based on their motivation, concern, expectations and perceptions, while behavior is the consequent visible stance - supportive, indifferent or hostile - which they adopt towards it. The attributes are not static but can change over the project life-cycle. Stakeholders which initially were supportive of the project may not be supportive of it later on, and vice versa. The authors also argued that since primary stakeholders are bound contractually to the project they normally would not be expected to develop animosity towards it as secondary stakeholders may and often do but if primary stakeholders are not managed properly they may lose interest and their performance may consequently drop which obviously is detrimental for the project. The Stakeholder Attribute Analysis, therefore, constitutes a very useful analytical tool because, first, it looks at a set of universal fundamental factors which are dynamic in nature and which provides crucial insight into why primary stakeholders behave as they do over time and, second, it can be repeated flexibly and without great cost and effort over the course of the project life-cycle to capture and compare any substantive changes occurring within any the primary stakeholder attributes and study the reasons for such changes. Information about primary stakeholder attributes can be acquired by the Analysts using simple and tested methods such as by surveying and carefully interviewing primary stakeholders as well as through close observation and monitoring of their behavior over time. To determine if and to what extent any changes have occurred over time the surveying and interviewing can be repeated over the project life-cycle. It is important that the reasons for changes be explored and identified, especially if these run counter to project interests. A key benefit stemming from the fresh insights gained through periodic stakeholder attribute analysis is that management strategies for primary stakeholders can be modified promptly if and when the need should arise so that their effectiveness does not diminish over time.

The Stakeholder Issues & Complications Analysis is the second tool proposed by the authors. This Analysis utilizes a set of pre-specified and distinct categories which are project-specific and which each represent part of the more serious issues and complications which in practice tend to crop up and overshadow the relationship between projects and their primary stakeholders over the project life-cycle. Examples of common issues and complications typically encountered on projects relate to information & communication, methodology, complexity management, conflicts (task, process, inter-personal), work performance, behavior, and compliance. For every primary stakeholder, the frequency, severity, duration and consequences of the issues and complications occurring over time must be documented and, very importantly, their causes analyzed and determined so that corrective action can be taken, especially with a view to preventing future reoccurrence as much as possible. If issues and complications arise

with increasing frequency over shorter intervals of time this is an indicator that the underlying reason(s) must be investigated. This practical tool enables Analysts to develop a detailed profile of each primary stakeholder and the information acquired can help shed light on significant aspects about these stakeholders which are relevant for the project including their observed strengths, weaknesses and possible opportunities for and threats to the project which is useful input or supplement for the SWOT-Analysis of these stakeholders.

Another useful and practical tool which can find application in the context of a primary stakeholder analysis are scoring models. This in practice already established quantitative modeling tool is especially well-suited for assessing and selecting stakeholders before the project enters into a contractual agreement with them. In a competitive environment it can determine which out of a pool of prospective stakeholders are the ‘most suitable’ entities for the project. Stakeholders on which scoring models can be applied typically include designers and consultants, contractors and sub-contractors, vendors and key human resources such as the project manager and team members.

Using a scoring model is a simple exercise which usually makes use of a comparison table for the purpose. For each stakeholder type, the project determines a set of assessment criteria. In other words, different stakeholder types would have different criteria. Overlapping will, to some extent, occur. Some of the criteria may be considered by the project as being comparatively more important than others in which case a weight factor may be applied to these more highly regarded criteria; criteria considered as being of the highest importance are assigned the highest weight factor while criteria deemed as being of lesser importance are assigned lower weightages in order of their perceived relative importance. Through a careful analysis which relies on information available on all the stakeholders under consideration, each stakeholder’s score against each criteria is determined and its aggregate score is then calculated by multiplying its criteria scores with their corresponding weightage factors and then summing up. The stakeholder scoring highest is selected.

Scoring models, like quantitative tools in general, tend to be highly regarded by practitioners because of their supposed advantage of mathematical ‘objectivity’ over qualitative or ‘subjective’ methods (such as Expert Opinion). Social reality, however, is usually far too complex to be expressed in numbers only and being ranked at the top of the list does not automatically guarantee that the selectee will ensure a stellar performance on the project or perform better than another lower-scoring entity.

In summarizing, the four powerful analytical tools presented above collectively yield multi-dimensional insights about primary stakeholders which enable projects to develop very detailed and dynamic profiles about each of them. This information can immensely help in managing them very effectively and flexibly over the project life-cycle. Additional knowledge and

insights about primary stakeholders which are not acquired through the application of these analytical tools can be acquired by the Analysts from the project manager or project team members based on his, her and their routine interactions and experience with them over time and which often may not find its way into the project documentation.

**Secondary Stakeholders:** There are two basic differences between primary and secondary stakeholders. Unlike the primary stakeholders, secondary stakeholders have no contractual or legal obligations to the project and they exhibit three modes of behavior - supportive, indifferent, adversarial - towards it whereas primary stakeholders normally are not supposed to exhibit adversity towards the project (which they nevertheless still do on occasions).

For secondary stakeholders the SWOT- and Stakeholder Attribute Analyses can also be applied. Both should also be performed as early as possible in the project. But whereas it makes sense to conduct a SWOT-Analysis on each primary stakeholder, doing so for the secondary stakeholders would be too costly, time-consuming and effort-intensive given their large number, heterogeneity and geographic dispersion on large and complex (and controversial) projects, especially such as those in construction and civil infrastructure development. A more practical approach would be to divide secondary stakeholders into two categories, supportive and adversarial, and then analyze them collectively and thoroughly for each category. However, powerful secondary stakeholders, both supportive and adversarial, should be analyzed individually.

From project perspective, the strengths of its supportive stakeholders can be highly beneficial for it if the project acknowledges and consciously seeks to make use of these strengths. The strengths of adversarial stakeholders by contrast may constitute a serious challenge which the project must closely heed in order to safeguard its interests. The weaknesses of its supportive stakeholders offers the project no benefits but weaknesses identified can sometimes be transformed into strengths with appropriate engagement strategies. The weaknesses of the adversarial stakeholders are good for the project. Typical strengths of secondary stakeholders, both supportive and adversarial, include being well informed about the project and its consequences (positive or negative) on them, commitment to their support or adversity, determination and tenacity, ability to organize themselves quickly by forming alliances and coalitions for or against the project, access to resources, skillfulness in using information and communications technology, the ability to influence other stakeholders (e.g., in politics, public administration, media), and awareness of their legal rights and the spectrum of options available to them which they can exercise either for or against the project.

Typical weaknesses of supportive and adversarial stakeholders may be the opposite of some (or all) of the above mentioned strengths, for instance, their disinterest or reluctance of the stakeholders to involve themselves directly in the project, lack of time and resources to

engage directly with the project, lack of information about the project, inability to organize themselves collectively and form alliances and coalitions, and non-awareness of their legal rights and options at their disposal and through they can influence the project in the positive or negative sense.

Opportunities which may present themselves between the project and its secondary stakeholders are off course desirable and must be utilized to the maximum. For the supportive secondary stakeholders these are, for instance, openness on the part of these stakeholders to accept the change which the project will inevitably bring about in time provided the project can convince them that it is their best interest to do so, their approachability, openness and keenness to learn about the project, desire to communicate and to cooperate, being in possession of and having the willingness to provide resources (informational, material, human and others) which the project needs, and consent to become active advocates for the project. For adversarial stakeholders opportunities for the project may, for instance, result from the willingness of at least some of these entities to enter into a dialogue with the project and to curtail or cease their hostility towards it in response to appropriate engagement measures applied by the project on them.

Threats to the project are reflected in the hostile actions adversarial secondary stakeholders may adopt and which could seriously impair project performance and, in the most extreme case, result in its premature termination. Consequently, the project must take threats to it very seriously. Stakeholders can influence projects negatively by exercising the ‘options’ available to them. Secondary stakeholder options can be categorized as soft options, hard options, and illicit options, with options in the context of transnational projects making up a special category. Options can be exercised both for projects (i.e., by supportive stakeholders) and against projects (i.e., by adversarial stakeholders). It is empirically evident that stakeholders opposed to projects tend to have more options at their disposal than stakeholders who support projects. Indeed, long is the list of high-profile projects across the globe which have been seriously affected by options exercised by hostile secondary stakeholders in the past few decades. The subject of stakeholder options on construction and civil infrastructure development projects was discussed in detail with several examples by the authors in their paper *Adversarial Project Stakeholders. Influencing Projects With Options* which was presented at the University of Maryland’s fourth annual project management symposium in May 2017. Examples of adversarial stakeholder options are, for instance, refusal to cooperate, formation of an organized front against the project, launching of a public campaign to defame it in the eyes of the wider stakeholder community, attempting to influence powerful stakeholders to intervene in the project, mounting legal, administrative or political challenges to the project or, in more extreme cases, resorting to the use of scare tactics and direct intimidation in an attempt to ‘kill’ the project or at least to severely damage its performance. For their part,



supportive stakeholders do not per se constitute a direct threat to the project but if they feel ignored or disrespected by it or are poorly engaged by the project than they may in time also turn hostile and become a real threat to project interests.

Similar to the primary stakeholders, a Stakeholder Attribute Analysis can also yield very useful insights about the project's secondary stakeholders. Two potentially formidable challenges present themselves here: the dearth of quality information on secondary stakeholders which projects usually have at the early stage of their life-cycles and, when compared to the primary stakeholders, the higher level of variability which secondary stakeholder attributes may possibly exhibit over time and which may necessitate the Analysis to be repeated several times over the course of the project life-cycle so that the stakeholder engagement strategies can be modified accordingly if and when the need arises. Repetition of the Analysis can be costly, time-consuming and effort-intensive given the largeness, heterogeneity and spatial dispersion of secondary stakeholders.

Research indicates that in the context of construction and civil infrastructure projects for instance, the secondary stakeholders attribute 'motivation' appears to be fairly rigid and broadly consistent across location and typically revolves, inter alia, around a general acknowledgement of product or service deficiencies and recognition that such deficiencies can best be overcome through projects, creation of jobs and business opportunities, investment inflows, appreciation of property values and rental incomes, improvement in the quality of life, and civic pride. Secondary stakeholder concerns can be both general and entity-specific and they may be relatively quite numerous, diverse and location-specific and must be comprehensively and accurately identified by the Analysts and then reduced or preferably eliminated by the project in order to reduce stakeholder resistance to and win over stakeholder support for it. Against the backdrop of their motivation and concern, secondary stakeholders may develop a complex set of positive and negative expectations about the project and its individual phases over time and these must be then matched with their corresponding perceptions. Surveying and interviews are excellent direct methods with which to determine stakeholder motivation, concern, expectation and perception; the many sources of information about stakeholders indicated earlier in this paper can also be used if and when circumstances so dictate. Determining stakeholder attitudes and especially stakeholder behavior, which can manifest itself as supportive, indifferent, or adversarial, are also a feature of the Stakeholder Attribute Analysis. Stakeholder behavior especially must be closely monitored throughout the project life-cycle. A sudden or over time gradual observed increase in stakeholder adversity or decrease in stakeholder support for the project signals that the Analysis may need to be repeated.

The higher the quality of the Stakeholder Attribute Analysis the more accurate the insights it can be expected to yield about stakeholders and the more useful it is for the project for designing effective stakeholder engagement strategies which on the one hand seek to reduce

and eliminate adversity while attempting to boost stakeholder support for the project on the other.

A third powerful analytical tool capable of providing useful insights about secondary stakeholders and especially their positive and negative influence on project performance is the Stakeholder Scenario & Project Impact Analysis. This tool basically explores a set of hypothetical situations - 'scenarios' - resulting from possible stakeholder action, i.e., the exercise of options by stakeholders for and against the project, and then quantifies their consequent impact on key project performance parameters. Effective application of the Stakeholder Scenario & Project Impact Analysis hinges on comprehensive identification of all stakeholder options by the Analysts – an exercise already performed as part of the threat component of the secondary stakeholder SWOT-Analysis. The consequent quantitative impacts on the project can then be determined with the help of a methodology mainly involving the use of mathematical formulae developed specifically for the purpose and which are specific to the project. There could be qualitative impacts as well but as these are not possible to easily express in numbers, alternative methods such as expert opinion may have to be used to examine these instead.

The options available to secondary stakeholders depends on several factors such as the type of project and the place where it is undertaken. The use of this tool is demonstrated with the help of a simple and on projects commonly occurring example: Suppose some adversarial stakeholders vehemently opposed to a project may at some future time prior to the project's execution phase exercise their legal option of obtaining a Court stay order before commencement of construction work resulting in an indefinite delay (i.e., the scenario) of construction activities. The delay will presumably have a negative impact on both project schedule and cost; the longer the delay the greater the negative impact on the project. With mathematical calculations it may be possible to specify exactly or approximately the magnitude of schedule and cost overruns the project may consequently experience. Many scenarios are conceivable off course and in addition to cost and schedule other critical parameters of project performance, such as its scope, quality, future benefits realization, image, client satisfaction and the relationships of key stakeholders, may also be adversely affected as a result of the exercise of adversarial stakeholder options. The reverse holds true for exercise of options by supportive stakeholders. Projects can hence utilize the valuable insights acquired through application of this flexible and powerful tool to proactively design and implement appropriate engagement strategies for their secondary stakeholders to minimize the possible danger they may pose in future to project interests and to develop contingency plans in the event that such scenarios inevitably become reality eventually.

## Concluding Remarks

Project stakeholder analysis constitutes a crucial, costly and usually highly complex process on large projects. It is also the prime input in the process of design and execution of stakeholder management and engagement strategies as well as the possible subsequent revision of these strategies. Good stakeholder analyses can benefit projects immensely by reducing the risk of stakeholder action against the projects, and the consequent and possibly immense practical complications such action may entail, while at the same time helping the projects benefit from the opportunities which present themselves in their dealings with their stakeholders over the project life-cycle.

Poorly undertaken project stakeholder analyses on the other hand may reduce project performance. High quality information, a set of powerful and complementing stakeholder analytical tools, and an enabling environment are the three fundamental factors on which an effective stakeholder analysis depends. It is a field which undoubtedly can benefit from more research in future.

Throughout their years-long research on the subject of project stakeholders the authors have incessantly argued that project stakeholder management and engagement in the ideal sense dictates that no stakeholder, primary or secondary, experiences a net loss (financial, material or otherwise) and that all stakeholders should experience at least some net gain as a result of the projects which they are either voluntarily involved in or are involuntarily affected by. An excellent project stakeholder analysis can help ensure that achievement of this ethical imperative can become a reality.

## Selected References

Andrew L. Friedman & Samantha Miles, *Stakeholders. Theory and Practice*, Oxford University Press, New York, 2006.

Aurangzeb Khan, Mirosław Skibniewski, & John Cable: *Understanding Stakeholder Psychology: The Path to Effective Stakeholder Management and Engagement*, in: PM World Journal, Vol. VI, Issue IX – September 2017.

Aurangzeb Khan, Mirosław Skibniewski, & John Cable: *Adversarial Project Stakeholders. Influencing Projects With Options*. Paper presented at the University of Maryland's Fourth Annual Project Management Symposium in College Park in May 2017.

Ezekiel Chinyio & Paul Olomolaiye, *Construction Stakeholder Management*, Blackwell Publishing Ltd., UK, 2010.

John McManus, *Managing Stakeholders in Software Development Projects*, Elsevier Butterworth-Heinemann, Oxford, UK, 2005.

Kammi Schmeer, *Guidelines for Conducting A Stakeholder Analysis*. Bethesda, MD: Partnerships for Health Reform, Abt Associates Inc., November 1999.

R. Panneerselvam & P. Senthilkumar, *Project Management*. PHI Learning Private Ltd., New Delhi, 2009, pp. 211-235 (Chapter 14: Vendor Evaluation).

William M. Babiuch & Barbara C. Farhar, *Stakeholder Analysis Methodologies Resource Book*. National Renewable Energy Laboratory, US Department of Energy, March 1994.

# The Top 3 Triggers for Conflict in the Project Environment – And How You Can Mitigate Them

By Jeannette Terry



Conflicts are inevitable on projects. Differences of opinion, competing priorities, and pressure from tight deadlines and long work hours can produce conflict. Some types of conflict – especially issues with contract terms or escalating costs – can impact the project’s ability to be successful.

[Learn more about the Cost of Unresolved Conflict >](#)

Fortunately, most project conflicts are less intense than these and considerably easier to resolve. Understanding what can trigger conflict is the first step in preventing it or resolving it if you find yourself in the middle of a conflict.

A recent analysis of TerconPartner’s database consisting of 8,000 individual project team member responses from over 225 projects worldwide revealed the following three most frequently mentioned causes of project conflict. Not surprisingly, these top three were all related to communication.

## Trigger # 1 – Too much reliance on email.

Emails are easy to send and help document what was communicated. However, when the content of that message is complex, unfamiliar to the reader or unclear, it's better for both parties to talk on the phone or face-to-face to prevent any misunderstandings or unintended consequences. If a project manager uses email to cut corners in communicating to his team because he or she is short on time, there will be potential negative repercussions.

### What you can do to fix it:

1. **Be intentional about which communication mode you choose for different types of messages.** Recognize that email and other written forms of communication are notorious for causing misinterpretations about the tone and intent of the message.
2. **Avoid using email when dealing with complex tasks that could spark a lot of questions from the reader.**
3. **Avoid using email to deliver a message that the other person may not be receptive to hearing** (such as saying “no” to an important request or giving critical feedback) or any topic that could cause a defensive response. Even if you would prefer to avoid the conversation, remember that the repercussions of avoiding a two-way conversation might be worse than a few uncomfortable minutes face-to-face or on the phone.

## Trigger # 2 – Lengthy delays in receiving requested information from another individual or team.

When project team members ask for information they need to make a decision, meet a deadline, or take an action, they usually need a timely response. Therefore, when responses to RFI's are delayed or specific requests are ignored, the resulting frustration frequently leads to conflict. And sometimes these types of delays not only have a negative impact on the requestor's team, but also can create “bad blood” between the requestor's team and the responder's team that lingers on.

### What you can do to fix it:

1. **Determine why the delay is occurring.** This can go a long way toward avoiding delays in the future. The most common reasons why responses are delayed in the project environment include the following:

- **Your request didn't go to the correct person or team.** Especially when timeframes are short, you should confirm – by telephone or in person – that your request will be directed to the correct individual.
- **Your request was not treated as a high priority by the receiver.** If this is the case, you must make the case for why your request *should* become a priority for the receiver. Develop your persuasive argument by: 1.) Summarizing exactly what information is needed and *why*, 2.) Describing the potential consequences if you don't receive it in time, and 3.) Identifying who you may have to go to next if your contact can't provide what's needed. Then it's time to put on the charm! (This process is most effective via a face-to-face conversation or telephone call, if possible.)
- 2. **Hold brief update meetings with teams or individuals that impact your work or vice-versa.** In Tercon's experience, approximately 90% of the frustration caused by not having timely access to needed information can be eliminated by scheduling brief, periodic check-in meetings to share information and resolve issues on a Just-in-Time basis.

## Trigger # 3 – Problems with the Decision-Making Process

An analysis of our Project Team Alignment Survey™ database found that there are usually three types of decision-making concerns raised. These are the most likely to trigger conflicts within the commenter's team, across their project, or between disciplines or functions.

1. **Issues with how decisions are made.** When making a decision, one of the following comes into play:
  - Lots of decisions are made under time pressure without the right people or expertise in the room. Typically, this means that the decision will have to be re-cycled which will take more of everyone's time.
  - Leaders make decisions without consideration for the impact on the people who have to implement them. Team members believe they should be able to give input *before* some decision are
  - Many decisions are ad hoc and not based on the reality of what people have to deal with on an everyday basis.
  - Sometimes an important decision gets delayed because no one on the team knows who has the authority to make it.
2. **Issues with how decisions are communicated.** If communication on a decision is slow, incomplete or nonexistent, team members are more likely to speculate about why the decision was made or begin to lose trust in leadership.

## What you can do to fix it:

1. When making a decision, take the time to include the right people and consider all potential ramifications
2. From the beginning, clarify roles and responsibilities so that if a decision needs to be made, there is someone in the meeting who can make it.
3. Decisions about new processes should be quickly and formally cascaded to the team instead of letting people hear about them by word of mouth without proper explanation.
4. Be sure to communicate how a decision will impact other teams and/or individuals soon after it's made.
5. Give team members more information about why a certain decision was made and how it fits in with the overall project or team. Team members care about "the big picture" as well as their smaller piece of the work that will make the project successful.
6. Ask for feedback from your team before making a big decision. If they give suggestions you do not implement, be sure to close the loop and communicate why you did not use.

Some conflicts can actually be beneficial, such as when issues get clarified or alternative solutions to a problem are found. That said, most people want to avoid or prevent conflict when possible.

Having a better understanding of conflict triggers can empower you to prevent them- or at least reduce the negative impact of many workplace conflicts. For more on constructive conflict management see [Ten Tips for Reducing Conflict on Your Team](#) and [The High Cost of Unresolved Conflict](#).