Intangible Risk Assessment Methodology for Projects (IRAMP): Assessing Behavior-Centric Intangible Risks in Capital Projects

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Abstract

Industrial projects are complex sociotechnical systems (e.g., human agents interacting with technology) where the cause-and-effect implications of human actions do not necessarily occur in time-and-space proximity. The proposed methodology, Intangible Risk Assessment Methodology for Projects (IRAMP), utilizes a behavior-centric risk breakdown structure, risk causal factors, and a risk inducement matrix linking risks to their causal factors. A metanetwork (i.e., a network of networks) matrix is presented consisting of the interactions among intangible risks, causal factors, human agents, and project tasks. We build upon Rasmussen's dynamic safety model and address the need for a framework to assess causal factors that influence behaviors in the context of energy-sector project management. Looking forward, the evolution of technology (e.g., artificial intelligence, automation, robotics, etc.) will increase the need for enhanced social and emotional skills in the workforce to effectively deliver project objectives. Consequently, the ability to proactively identify and address the associated "softer" risks could become a source of competitive advantage.

Keywords
Intangible risk, Project development risk, Metanetwork matrix, Sociotechnical system.

1. Introduction

Project development can take many years to move from conceptual planning to initial operation, subjecting them to a myriad of risks. Empirically 60% to 80% of projects fail to be completed on time and within budget (Deloitte Center for Energy Solutions 2015; EY 2014; Morris 2008), and these failures are due in part to human behaviors (Flyvbjerg et al. 2009). For instance, fewer than 25% of oil and gas projects undertaken in the North Sea between 2011 and 2016 were completed on time and within budget. The Oil and Gas Authority (OGA) of the United Kingdom has attributed this low level of performance to events that are "non-technical in nature" (OGA 2017).

Risks can be either tangible (e.g., design error) or intangible (e.g., behavior), with the emergent intangible dimension creating project complexity. Current risk assessment methods are oriented toward systems that are linear and vary from basic qualitative assessment to complex statistical analysis primarily focused on tangible project factors (Atkinson et al. 2006; Teller et al. 2014). However, projects can be conceptualized as systems comprising multiple interconnected networks of people, resources, and tasks (Zhu et al. 2017) occurring within a wider company culture where barriers, biases, and internal controls may allow dysfunctional behaviors to arise (Atkinson et al, 2006). Rasmussen recognized the intangible implications of behavior in the context of safety risk in process plant operating environments. His conceptual framework, the dynamic model of safety and system performance, is a triangular form of constraints (economic, workload, and performance) with human behavioral actions within the boundaries exhibiting "Brownian movements." These movements are the result of interactions among management expectations of efficiency, the implications on individual workloads, and employee response to this potential increase in effort. Rasmussen referred to these interactions as "gradients." Rasmussen went on to say that "we need a framework for identification of the objectives, value structures, and subjective preferences governing the behavior within the degrees of freedom faced by the individual decision maker and actor" (Rasmussen 1997). These interactions or gradients can be conceptualized as a network of interacting subnetworks within an organization.

The current literature regarding the implications of intangible risk factors on project and project portfolio performance is sparse (Olsson 2008; Teller 2013; Hofman et al. 2017). What does exist is subjective and tends to focus on specific behavioral issues (e.g., conflict). Establishing a more holistic approach to assessing intangible risk will benefit project development in the near term, as well as in the future when technology redefines how teams work together (Bughin et al. 2018). The proposed framework is empirically grounded and contains the Intangible Risk Assessment Methodology for Projects (IRAMP) and metanetwork matrix. The IRAMP includes a behavior-oriented intangible risk breakdown structure (IRBS), a checklist of potential risk causal factors, and a risk inducement matrix (RIM) identifying the interaction of behavior-centric risks and causal factors. The metanetwork matrix consists of the individual subnetworks making up the overall met-network. As far as the authors are aware, this is the first-time that behavioral risks have been assessed in a metanetwork context.

2. Background

2.1 Context

Current risk management assessment methods are oriented toward systems that are linear and vary from basic qualitative assessment to complex statistical analysis primarily focused on tangible project factors. Risk profiles vary as a project moves through the development cycle and include a systemic dimension for portfolios of projects. However, the implications of human behavior on project objectives are highly variable and can be "blind spots" for individuals and teams (Dargin 2013). As artificial intelligence systems become more prominent, the need for social, emotional, and creative skills will increase (Bughin 2018). Consequently, the ability to identify and proactively address behavior-centric risks will likely become more pronounced in the risk management process.

2.2 Intangible Risks

The empirical evidence for intangible risks in projects is sparse, and what exists tends to be conceptual, with minimal focus on behaviors and the causal factors that influence them. Even when behavior-centric intangible risk (e.g., conflict) is presented, frameworks to systematically identify and provide a level of measure are not attendant. For instance, events such as project teams blocking each other or displaying opportunistic behavior with regard to resources are mentioned, but empirical evidence is not available (Jonas et al. 2013). Others have identified clarity of roles, stakeholder interaction, coordination between projects, conflicting project objectives, lack of cross-functional teamwork, and interpersonal conflicts as having effects at the portfolio level (Beringer et al. 2013; De Reyck et al. 2005; Hofman et al. 2017). Although behavioral conditions have been identified generally (interpersonal conflict) and causal events specifically (conflicting project objectives), there is no information regarding how they might emerge and interact or how to analyze them.

2.3 Behavior-Centric Intangible Risks in Sociotechnical Networks

Behavior-centric intangible risks by their nature cannot be easily quantified and require a departure from the existing assessment methods (Barber 2005). Human emotions and cognition are themselves dynamic nonlinear systems (Afraimovich et al. 2011), and because projects are developed and delivered by teams of people, it stands to reason that risks have an emotional and cognitive dimension. This accentuates the importance of understanding behavior-centric intangible factors. Lencioni explored the effectiveness of teams from the perspective of the presence or absence of dysfunctional behavior in the following five dimensions: trust, conflict, commitment, accountability, and results (Lencioni 2007). Unlike other frameworks, Lencioni's work provides a rubric to assess team behaviors.

Rasmussen conceptualized the interaction between man and machine as a dynamic model of safety and system performance. His framework is a triad of constraints (economic, workload, and performance), with operating points being influenced by subjective preferences exhibiting Brownian ("idiosyncratic and unpredictable") movements within a space of possibilities. Projects face a dynamic similar to Rasmussen's safety and system model, where multiple networks (gradient toward efficiency, gradient toward least effort, countergradient for safety culture) exist within the overall delivery network.

3. Materials and Methods

3.1 IRAMP Framework

Human behavior cannot be quantified in terms of probability and impact given its adherence to mental models, beliefs, and values, leaving risk estimation subjective and unreliable (Barber 2005). In the project context, there is a general reluctance to discuss sensitive subjective issues due to concerns of being seen as insensitive or provocative, making these issues difficult to address and resolve (Barber 2005). The proposed framework is constructed utilizing an IRBS, a RIM, and a metanetwork matrix conceptualizing projects and portfolios as complex sociotechnical systems incorporating behavioral responses to events (Carley et al. 2007).

The ability to effectively address behavior-centric intangible risks requires a construct identifying the factors capable of materially impacting the overall effectiveness of project stakeholder interactions. According to Bordage, robust conceptual frameworks should be based on "sets of concepts, or evidence-based best practices derived from outcome and effectiveness studies" (Bordage 2009). The behavior-centric elements in Lencioni's book *The Five Dysfunctions of a Team* can be considered a rubric in light of this qualification. Table 1 translates the five dysfunctions of a team into the IRBS in a typical risk breakdown structure format.

Table 1. IRBS from Lencioni's *The Five Dysfunctions of a Team*

Level 0	Level 1	Level 2
Intangible risks	Absence of trust	Conceals weakness and mistakes
		Hesitates to ask for help or provide constructive feedback
		Jumps to conclusions about intentions and aptitudes of others without trying to clarify them
		Fails to recognize and tap into others' skills and experiences
		Wastes time and energy managing behaviors for effect
		Holds grudges
		Finds reasons not to engage meaningfully
	Fear of conflict	Holds ineffective meetings
		Creates environments where back-channel politics and personal attacks thrive
		Ignores controversial topics critical to team success
		Fails to tap into all the opinions and perspectives of team members
		Wastes time and energy with posturing and interpersonal risk management
	Lack of commitment	Creates ambiguity among the team about direction and priorities
		Misses deadlines and opportunities due to excessive analysis and delay
		Breeds lack of confidence and fear of failure
		Revisits discussions and decisions again and again
		Encourages second-guessing and distancing among team members
	Avoidance of accountability	Creates resentment among team members who have different levels of performance
		Encourages mediocrity
		Misses deadlines and key deliverables
		Places undue burden on the leader as the sole source of discipline
	Inattention to results	Stagnates / fails to grow
		Rarely is proactive
		Loses achievement-oriented staff
		Encourages individuals to primarily support their group or themselves
		Is easily distracted and inwardly focused
		Will not bear an extra burden of another group even to benefit the firm overall

Causal factors can be thought of as early warning signs and can provide the project team with an indication of potential behavior-centric risk emergence. These causal factors can be stakeholder politics (Haji-Kazemi et al. 2015), misaligned project objectives (Beringer et al. 2013), unclear or overlapping role requirements (Klakegg et al. 2011), and conflicting interpretations of policies and procedures (Thamhaim and Wilemon 1975). A checklist of causal factors from various literature sources (Brockman 2014; Gardiner and Simmons 1992; Hofman et al. 2017; Liew n.d.; Symonds 2011) is shown in Table 2. This list and the definitions are intended for use in project- or portfolio-specific workshops where the stakeholders are free to modify the content and definition to fit the local project or portfolio conditions.

Table 2. Causal factor checklist

Causal factor	Definition
Lack of management commitment	Ongoing active support is not obvious to the project team
Improperly defined priorities	Lack of clear management directive on the priorities for project team deliverables
Poorly defined roles and responsibilities	Stakeholder roles and responsibilities not clearly defined, communicated, and agreed
Team weakness (composition)	Missing or inadequate required skill sets on the project team
End-user expectations	End user has clearly communicated and documented conditions of satisfaction, and changes must be mutually agreed by impacted stakeholders
Inappropriate risk tolerance	Delays caused by reluctance to make necessary decisions
Misaligned or overlapping objectives	A stakeholder's objectives intrude on or are opposed to those of other stakeholders
Undefined objectives and goals	Lack of complete clarity regarding project objectives and goals
Poorly defined scope	Scope is not properly detailed for effective delivery
Inadequate or vague requirements	Requirements that can have multiple interpretations or lack necessary details
Competing priorities	Stakeholder groups' priorities are misaligned or in conflict
Poor communication	Channels of communication are ineffective
Culture	Project context is conducive for project team to succeed
Lack of necessary authority	Authority is not commensurate with responsibility
Business politics	Specific interests take precedence over what is best for the business or power is challenged
Interpersonal conflict	Conflict has gotten personal and creates adverse implications to accomplishing the project
Lack of organizational support	Project needs are not acknowledged by organization

The RIM (Table 3) is created by combining the most detailed level of intangible risks from the IRBS and the list of risk causal factors. The RIM provides a way to address system complexity by providing a means for mapping multiple events interacting with multiple risk factors. The Level 2 risks from the IRBS (e.g., conceals weakness and mistakes) are listed along the x-axis (IRF1, etc.), and the appropriate causal factors are listed along the y-axis (RT1, etc.). The RIM is used in risk workshops with project teams to identify the events that are likely to instigate an intangible risk factor in the project's particular context. Once complete, the RIM provides a perspective of the extent to which the risk causal factors influence risk events. Some of the causal factors can be caused by shortcomings in corporate policies and procedures, while others stem from behaviors (Barber 2005; Isabella 1992). The RIM is a tool for project teams to use in project risk meetings, as well as input for system analysis modeling.

Table 3. RIM

	IFR1	IFR2	IFR3	IFR4	….	….	IFRx
RT1	x						
RT2		x		x			
RT3	x		x				
RT4			x				
:							
RTy							

3.2 Metanetwork Matrix Development

The metanetwork matrix is a framework that is useful in representing the interactions among various networks. The fundamental building blocks of networks are nodes that can represent tasks, agents, information, resources, etc. in organizations, and their interactions are referred to as links (Carley 2002). An advantage of this approach is the ability visually display complex behavioral interrelationships (McCulloh and Carley 2008). Human behaviors and mental frameworks are themselves dynamic nonlinear systems (Afraimovich et al. 2011). This accentuates the importance of understanding behavior-centric intangible factors that influence a project in ways that are difficult to quantify. These risks can manifest themselves in human interactions, such as ability to adapt, appropriate application of experience, communication, cooperation, culture, teamwork, relationships, leadership, and conflict resolution.

Rasmussen was interested in the question, “Do we actually have adequate models of accident causation in the present dynamic society?” His methods to assess safety are based on structural decomposition rather than functional abstraction. His approach conceptualizes the interaction between human and machine as a dynamic model of safety and system performance. His framework is a system of constraints (economic, workload, and performance), with operating points being influenced by management pressure for efficiency and working-level response to workload implications (Rasmussen 1997).

Like plant operations, projects face financial, workload, and performance boundaries. Rasmussen’s model can be extended to projects where the boundaries are commercial performance in terms of cost, schedule, and scope; human performance in terms of workload, adequate competent resources, workflow, and procedure; and acceptable project performance. Rasmussen pointed out that “idiosyncratic and unpredictable” behaviors can lead to a seemingly innocuous decision to deviate from a standard activity, which can lead to a catastrophic event (Rasmussen 1997).

To address the “idiosyncratic and unpredictable” Brownian movements, behavior-centric intangible risk in projects and project portfolios can be conceptualized as a dynamic network of networks made up of the following entities: (a) people involved in the project, (b) deliverables or tasks, (c) behavior-centric intangible risk factors, and (d) causal factors. Extending Rasmussen’s dynamic model of safety and system performance to project performance and incorporating the aforementioned conceptualized metanetwork is shown in Figure 1. Movement in the space between the boundaries is driven by the interaction of the human agents, tasks, causal factors and behavior-centric intangible risks being influenced by boundary conditions and culture.

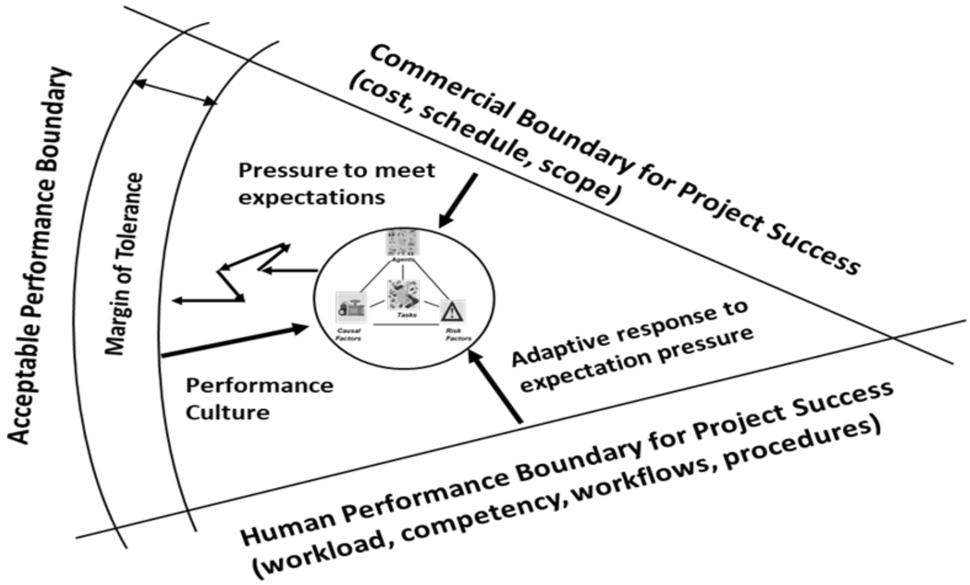

Figure 1. Extension of dynamic model of safety and system performance to project performance including behavior-centric intangible risk (adapted from Rasmussen [1997]).

The proposed metanetwork (Table 4) comprises interconnected networks, providing a framework to assess the emergence of behavior-centric intangible risks in the project and portfolio context. These networks represent the interactions among the four elements: agents (stakeholders), behavior-centric intangible risk factors, causal factors, and tasks. The development of each of the networks relies on input from IRAMP, stakeholder feedback, and a project-specific document. However, depending on the unique context of the project or portfolio setting, some of the networks may not be relevant.

Table 4. Metanetwork matrix

	Agent	Causal factor	Intangible risk factor	Task
Agent	Communication network: who interacts with whom	Activation network: who “lights the fuse”	Influence network: who is likely influenced by which risk factor	Assignment network: who is involved (input/review) in which task
Causal factor		Dependence network: factor-to-factor interaction	Inducement network: causal factor influence on intangible risk	Impedance network: causal factor impact on task
Intangible risk factor			Correlation network: which risks are mutually exclusive and which interact with other risks	Contagion network: which tasks are impacted by which intangible risk
Task				Interaction network: task interactions with other tasks

4. Discussion

This paper presented a new framework for the identification and quantification of behavior-centric intangible risks and causal factors during the project development cycle. The structured approach to addressing behavior-centric intangible risks and their causal factors creates a nonpolitical opportunity to align management and project teams in proactively addressing the threats and opportunities they present. Incorporating this framework into the existing risk management process enables project and portfolio teams to identify and prioritize the behavior-centric intangible risks and the associated causal factors for their particular projects.

The era of artificial intelligence will likely be one of disruption and change leading to a reconceptualization of the essence of work and effective leadership. Current valued hard skills such as deep technical expertise, assertiveness, authority, and task-focused delivery are likely to give way to higher cognitive skills and the softer social deference and emotional intelligence. This requires a conducive workplace and an appropriate leadership style (Bughin 2018). Consequently, the need to effectively manage the behavior-centric dimension of risk will likely become more pronounced. This paper introduced the IRAMP approach and metanetwork matrix. Analysis of the metanetwork using simulation and social network measures is covered in a book soon to be published by CRC Press entitled *Decision Making in Risk Management: Quantifying Intangible Risk Factors in Projects*.

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