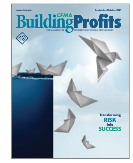


BY DR. HEATHER MOORE, DR. MEIK DANESHGARI & SONJA DANESHGARI

ARE PREVENTERS THE REAL HEROES?

Preventing Risk Pragmatically With Data

Risk is a risky subject. The term itself carries an abstract meaning and ambiguity for those trying to manage it. The definitions of risk, which all relate to probability and uncertainty, converge to what CFMs might call "lack of control of the projected outcome." In construction, every CEO, CFO, and executive VP all the way down to project managers (PMs) and field personnel in a construction company manage risk at their own level.

At the end of the day, however, risk shows up as a financial mishap or, in the best-case scenario, the inability to project.

To recognize, measure, manage, predict, and prevent any phenomenon, object, behavior, or outcome such as "risk" (and its behavior), these aspects need to be quantifiable, have an isomorphic grouping, and have a unit of measurement.

This article will review a reliable process of risk management in the construction industry[1] and help you build a system to measure, correct, and project to reduce the risk of unknown outcomes.

Risk Preventers vs. Heroes

Construction tends to spotlight (and sometimes even reward) "heroes" — the PMs who swoop in and take over a fledgling project or the superintendents who seem to be everywhere all the time, chasing one fire after another. These "heroic" acts attempt to *mitigate* risk after it is present, but they don't do much to *prevent* the risk.

Risk "preventers," at each vantage point, take certain actions and look for certain data and behaviors to reduce risk. Their work goes unseen or unnoticed because the results are smooth sailing in terms of profitability, predictability, satisfied customers, and a safe and healthy crew or workforce. These preventers can be at any level of the company, and to avoid risk in the first place, they work very hard on planning, thinking, monitoring, and communicating, as presented pragmatically in Exhibit 1.

Categorizing Risk

Risk preventers at all levels prevent and monitor risk, reducing the chances of unknown or uncertain project outcomes. Three types of risk exist in construction — business, technical, and integration (Exhibit 2).[2] These types of risk should be identified by preventers in the project startup process, following a thorough contract review and work breakdown structure (WBS).

Each type of risk requires different prevention and may be quantified and measured differently. However, the three categories of risk are isomorphic; they are independent of the type of work, the size of the project or company, and can be treated in a consistent way. In the case of service or repetitive operations, managers need to identify the risk categories on a regular basis (ideally quarterly). In the case of construction project operations, the types of risk should be identified at the startup of each project and in the project audit process (which will be explained later).

However, managing the risk categories to prevent them transcends any one area of the construction operation. For example, a business risk is present when you work for a new customer for the first time, which is a situation that can happen on any job or operation. Quantifying, measuring, and managing that situation and risk can be done consistently by the organization with a structured approach.

Exhibit 1: **How Preventers Reduce Risk**

CEO	CFO	PM	FIELD
• Watch and translate market trends into business projections • Learn and translate principles from business and other industries into the company's operations • Manage and balance investments in resources, including strategies to increase wealth and turn money • Maintain line of sight to the customers and operations • Support managers and set expectations for policy adherence that aligns with the vision, mission, and strategy of the business	• Monitor company financial health using dashboards and key indicators • Monitor market financial indicators such as interest rates, investment choices, and outcomes • Monitor job profitability via accuracy in projection, volatility in end-of-job gross profit, and gain and fade • Oversee change order management (asking for, getting paid, and recovering cost) with key indicators	• Have a contract review and customer management plan (including change management) • Develop and use a project management WBS for four phases of a project: planning, procurement, installation, and closure • Monitor job productivity and manage variation in productivity differential (e.g., JPAC®) • Translate customer needs and requirements to field operations using a project schedule, WBS, and a three-week look ahead with a feedback loop from SIS® • Manage and monitor money including cash flow and profitability	• Develop and manage the job WBS, including externalizing the work® to vendors or using prefabrication to reduce on-site risks at the jobsite • Walk the job to observe completion of the work and to identify any work being done out of scope • Work with field crew on productive means and methods • Oversee daily and weekly safety plans with measurement and feedback on their effectiveness

Exhibit 2: **Risk Categories in Construction**

	Business Risk	Technical Risk	Integration Risk
Definition	The probability of a difference between the expected and actual financial outcomes of a project	The probability of a physical failure of the built environment to function according to customer requirements or structural requirements	The probability of failure at the interface of resources required to complete the project
Examples	Local requirements and regulations, payment terms, penalties, customer relationships, and cost escalations	Labor skill for technical work, material availability, and material/component quality	Schedule; trade stacking/coordination; shift work/premium time; availability of tools, equipment, and information; lead/order time; and jobsite logistics

Without risk categorization, each unique circumstance may be identified as "risky," and a one-off solution attempted by the project team — which requires a lot more energy than necessary — may not guarantee prevention.

Quantifying & Measuring Risk

Risk management requires risk identification, analysis, and evaluation. Risk can be quantified using the Failure Mode Effect Analysis (FMEA) — a system and tool that was developed in the 1940s by the U.S. military (later adopted by the automotive and other industries) — to reduce the risk of product development, production, and usage. The process includes the following steps:

1) Identify all components or steps and their potential failure modes
2) Recognize the *potential effects and causes* of the identified failure modes
3) Assign a score between 1-10 for severity, frequency of occurrence, and detectability to each failure mode
4) Calculate the risk priority number (RPN) by multiplying the three scores
5) Prioritize the failure modes based on the calculated RPN number
6) Develop a plan to reduce the risk of potential failures

To support FMEA step 3, a multi-layered risk management model can be used to assess the likelihood of occurrence and detectability of risk and potential failures like the Error Trapping — Swiss Cheese Analogy shown in Exhibit 3. This multi-layer risk management model has been proven successful in aviation as a model for building a solid plan for accident and incident prevention for decades.[3]

Exhibit 3 shows how such a model can help with measuring/quantifying detectability of risks, as it provides a structured thought process to identify:

- What company policies, processes, procedures, and technologies are in place to capture and detect the potential failures or risks;
- How likely it is to be detected; and
- What measurement can be used for quantification.

Detectability comes from correct measurement to allow for anticipation of the risk and its effects. For example, financial risk in a job or division could be made visible by measuring profitability. However, using a job's burn rate of the hours or cost (sometimes called "earned and burned" reporting) will most likely lead to a wrong conclusion or a delay in detectability of financial risk while the job is in progress; with this, the profitability stays hidden until the end of the job.

Two real examples and applications of risk management are described in the Case Studies of Risk Management sidebar on the last page, where the company was being exposed to risk by "holes in the slices of cheese" as depicted in Exhibit 3. By quantifying and measuring the risk and root causes, followed by Kaizen events (from the Japanese word for continuous improvement or change for the better) for identifying and testing solutions, the holes were filled in.

A System for Prevention

Exhibit 4 shows the fundamental concept of Agile Construction®, which is "time to detect, time to correct."[4] The earlier in which problems or risks are identified, the more time there is to avoid or correct them. Despite the

Exhibit 3: **Risk Management System**

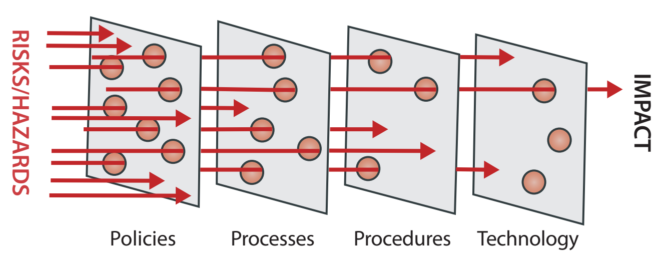
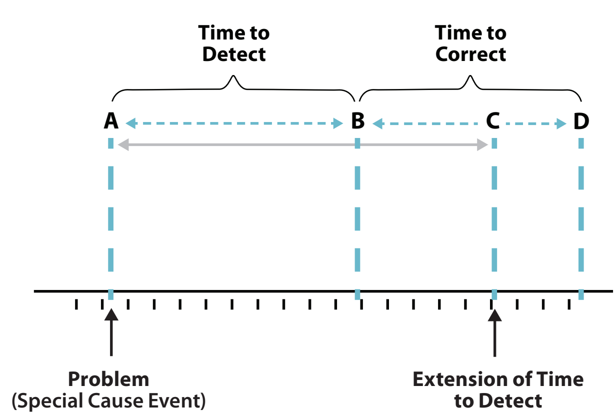


Exhibit 4: **Components of Response Time**



Source: Daneshgari, Dr. Perry. *Agile Construction® for the Electrical Contractor (Second Edition)*. MCA, Inc. 2020.

unsung preventers' useful work, a company cannot sustainably grow and survive without a system that inherently predicts risk independent of any individuals, which is why Agile Construction® was developed and designed by MCA, Inc.

However, looking for problems and risks shouldn't be left to ears and eyes alone. Data translated into information[5] should be used to identify risk (as explained with FMEA) and used in a practical way on the jobsite. Lead indicators can predict the isomorphic risk types such as:

- Visibility of work through a WBS
- WBS quality and updating
- Active manpower and crew management
- Measurement of common and special causes for labor productivity variation through Job Productivity Assurance and Control (JPAC®) and Short Interval Scheduling (SIS®)[6]
- Consistent and frequent review of job status and situation
- Ongoing identification and usage of prefabrication opportunities
- Agile Procurement® through vendor usage for reduction of material handling

The system for preventing risk starts with detection and must follow through with action. In other words, to ensure that risk is prevented, it must be identified, a solution designed, and then implemented. Kaizen events focus on incremental process improvement that is aimed at increased productivity (described and exemplified in the Case Studies of Risk Management sidebar). On projects using Agile Construction®, a project audit process is used for a data-driven approach to forward-looking risk reduction every 25% complete.[7] The purpose of the project audits is twofold:

1) *In the short term:* review and identify opportunities for course correction on manpower, material, and money; and create clear actions for reducing risk in the upcoming project phase.

2) *In the long term:* establish, expand, and improve corporate memory.[8]

The goals of the audit process are to collect and review the "knowns" about the project to-date and to use the information and data to predict, reduce, and prevent future risk by lowering the project's "unknowns" and "uncertainties" for the next 25% of the job. Exhibit 5 shows a schematic for project tracking and the types of both short- and long-term data that are gathered to connect each risk identification, as well as the ongoing planning and risk reduction of the project.

Conclusion

Risk management is not about someone swooping in and saving the day — it's about a disciplined, thoughtful approach that prevents risk in the first place. Protecting your company from unnecessary risk exposure by understanding its behavior through quantification, categorization, and measurement is key.

Companies that put structure in place to learn from the past and prevent future risk exposure build a stronger resilience to risk. ■

Endnotes

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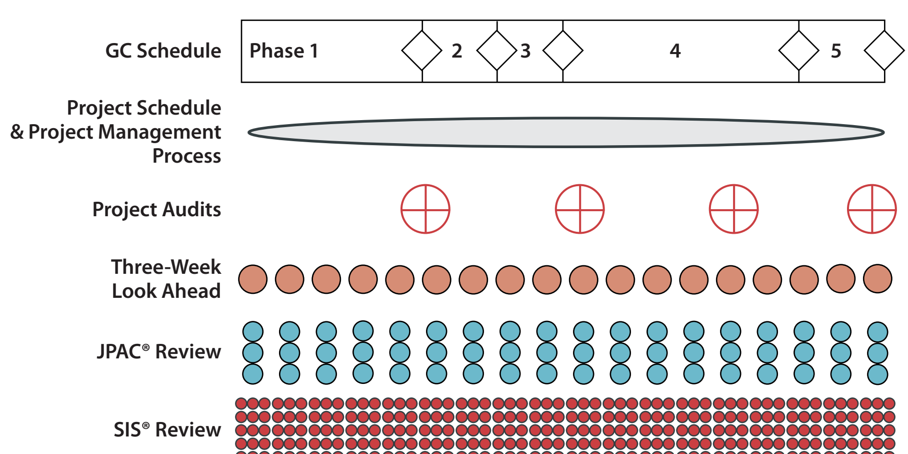
Exhibit 5: **Elements of Project Tracking**



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In the following case studies, the companies were being exposed to risk by "holes in the slices of cheese" (Exhibit 3). By quantifying and measuring the risk and root causes followed by Kaizen events for identifying and testing solutions, the holes were filled in.

Case 1: Labor Code Performance

In a recent study, an Agile Construction® contractor's labor performance was analyzed and evaluated across the company's labor codes. Using a data sample of 126 completed projects revealed significant productivity improvement opportunities for the company's five highest weight labor codes — branch rough-in, low voltage wiring, branch wiring, supervision, and feeder rough. With close to 250,000 manhours expended annually in branch rough-in alone, which was performing 25% worse than expected in productivity, the opportunity for improvement was measured in millions of dollars.

In a mutual effort among executives, PMs, and field leads, MCA, Inc. facilitated a Kaizen event, where key leaders in the company reviewed the current practices and identified the potential root causes for their underperformance of its largest labor code (branch rough-in) and a related labor code (branch wiring). After following a defined improvement process, a follow-up analysis of 82 projects showed that labor productivity in the branch rough-in labor code went up by almost nine percentage points and by about 30 points for branch wiring (Exhibit 6). Along with the productivity improvement, the company also achieved better predictability of labor performance, thus lowering the risk of labor cost overruns. (Research Department. MCA, Inc.)

Case 2: Labor Overruns

Field labor usage is an unpredictable variable throughout construction. Due to the amount of knowledge and decisions that are kept in the heads of skilled tradespeople and the result of those individuals interacting on-site to achieve company and customer outcomes, the resulting job productivity and performance can be a guessing game. Although this risk is present across all jobs regardless of size, its presence on larger projects poses business risk, as resulting labor cost overruns can easily wipe out a large proportion of profits for a given year or even jeopardize the financial health and sustainability of the business.

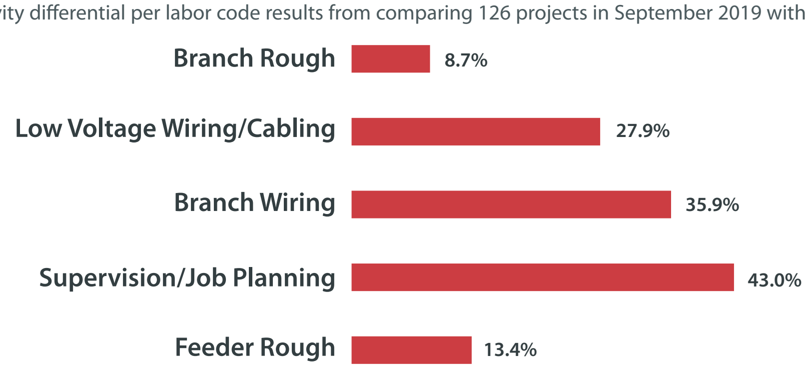
A civil contractor had a hunch that most, if not all, of his jobs faded from the estimated labor hours. "Jobs always go over on hours, but we make it up with dollars." In other words, the labor performance alone was not the reliable contributor to profitability. Following an analysis conducted by MCA, Inc., this hunch was validated with 85% of the projects expending more hours than estimated (including change orders). Key stopgaps were also identified, including the use of FMEA to focus on site conditions up front on projects. (Research Department. MCA, Inc.)

Without the visibility, correct categorization, and a common unit of measurement, performance factors based on lag indicators from job cost reporting or estimating cannot provide the information required to reduce the information gap to reduce or prevent risk. Risk management and prevention for labor overruns requires predictive measures that fill the gap between estimating and accounting and provide immediate feedback from the field to the board room to reliably predict future labor performance. This feedback reduces the time to detect deviations and increases the time to react.

Studies and data analysis of reasons for gain and fade of construction project profits shows that labor cost overrun is the common cause for the deterioration and variation from expected project profits. Further, the variation of labor performance is largely driven by the invisibility of decisions made in the field, unknown systemic external factors, and on-site obstacles that prevent full labor productivity, such as schedule changes, lack of access to an area or incomplete area, trade interference, weather, absenteeism, and material/delivery issues. Lead indicators that provide the visibility, categorization, and common unit of measurement for quantifying and measuring risk (such as JPAC® and SIS®) can generate the data and information to help predict labor performance and manage or prevent labor cost overrun.

Exhibit 6: **Improvement in Productivity on Top Five Largest Labor Codes**

Change in JPAC® productivity differential per labor code results from comparing 126 projects in September 2019 with 82 projects in March 2021.



Percentage indicates positive change in productivity at a company-wide level in labor codes, as a result of Kaizen event. For example, the company's productivity on branch rough-in improved 8.7%, which alone saved approximately 21,750 hours of unproductive time on its projects.