



# NAC Executive Insights

## Systemic Risks in Large, Complex Programs

### Key Points

- Systemic risk drivers may be divided into those internal to the owner organization and program team and to those external to the program.
- Systemic risk analysis must consider common risk drivers, interdependencies beyond the first order, and constraint coupling.

### Systemic Risks in Large, Complex Programs

We have examined some of the factors that drive a changed risk environment for large engineering and construction programs and some of the new tools and risk assessment approaches that must be added to our standard risk management techniques. Concomitant with this changed awareness and new framework is a more comprehensive and structured consideration of the various types of systemic risks that large engineering and construction programs are susceptible to: in effect, providing a new lens specifically focused on those types of risk that represent the greatest threats to large, complex, long duration programs.

We can think of these systemic risks as encompassing those internal to the program team and those external to the program. Frameworks exist for considering each of these, but in large programs the internal risks are fundamental to putting into place the people, processes, and systems commensurate with the challenges and opportunities the program will encounter.

Our expanded look at risk must increase our awareness of and attention to common risk drivers, second and third order interdependencies, and growing risks associated with constraint coupling.

Systemic risk drivers may be divided into those:

- Internal to the owner organization and program team
- External to the program

Systemic risk analysis must consider:

- Common risk drivers
- Interdependencies beyond the first order
- Constraint coupling

Let's look at both internal and external systemic risks in more detail, recognizing they have increased importance in large, complex programs in the engineering and construction industry.

## **Internal Systemic Risks**

Internal systemic risks lend themselves to the use of the Systems, Maintenance & Operations, Attitude, Risk Taking, Transitional (SMART) framework illustrated below. This framework guides the program manager to look well beyond the traditional quantitative and event risks typically considered and to focus on risk drivers that may impact the program.

The **SMART** framework considers a set of risks described by the acronym:

**S**ystems

**M**aintenance & Operation

**A**ttitude

**R**isk Taking

**T**ransitional

These risks should be considered for both the owner and specific program organizations.

### ***Systems***

- Owner's or program's project system
  - Funding projects before scope adequately defined
  - Weak change-control culture and process
- Business and program model implications not well understood
  - Various models "correlated" in unrecognized ways
    - Same assumptions or theoretical basis
- Failure to recognize the "program environment" as a growing and ever more complex system
  - This is perhaps the most fundamental risk we have. The owner's organization and the program do not exist in isolation, ensuring that the right system and people are put in place.
- Centralized control weaknesses
  - Partial decentralization of systems is required.
- "Tight coupling" of systems and processes
  - Simply put, an event in one system or process leads to an event in another in short order.
- Failing to KISS
  - We must recognize some classes of systems, processes, and certain technologies are inherently open to chains of failure. In such systems, adding additional safety systems only raises the level of complexity.

- Inadequate “core capacity”
  - All too often we emphasize “reach” over “responsiveness” when making key decisions regarding investment. Consideration of these risks will enhance resiliency.

### ***Maintenance & Operation***

- Failing to recognize the importance of “state of good repair”
  - Those systems and processes in a “state of good repair” suffer less collateral effects when a program element is stressed to failure. There will be a tendency to compensate by adding on top of the existing base system. In complex organizations and processes, this can act to create new risks.
- Inadequate renewal of contingency planning
  - The program is not static, nor are the systemic risks it faces.
- Inadequate operating provisions to limit risk drivers
  - Risks must be contained or “localized” to prohibit “tight coupling” effects from taking hold.

### ***Attitude***

In contrast with system and maintenance vulnerabilities that focus on whether the right system is in place and whether it is sustained properly, attitude vulnerabilities address our willingness to accept an unexpected or undesired “truth.”

Specific “attitude” risks include:

- Cognitive lock – In life, particularly when we are under stress, we expect certain situations to evolve in certain ways. Sometimes they don’t. Cognitive lock occurs when we hold onto a course of action against all contradictory evidence. This can be particularly disastrous when combined with a complex system and often requires a fresh pair of eyes to see the new “truth” in front of us. I include haste as an attitude vulnerability given the risks often incurred, unknowingly, when blindly charging ahead.
- Over-commitment to bureaucratic goals – The goal has been set and any deviation from the goal is not acceptable. Problems that arise are ignored if they put the goal at risk.
- Prisoner to heuristics – Past experience or what we’ve heard prevent us from taking a broader look. We adopt a perspective of “it never happened, so it’s not credible.” Being a prisoner to heuristics also involves a failure to consider what we see or learn from analogous systems or settings.
- Denial – Conventional risk analysis has us consider a range of “likely” scenarios and design our program and risk management approach accordingly. But the “unlikely” is also possible, and it, too, must be considered. This brings us full circle to the need to have inherently flexible, redundant, and reliable systems. “Core capacity” provides the trained manager with the tools to address a broad range of “unlikely” scenarios.

Contingency planning for the program must include training in the capabilities and limits of various program elements. The “unlikely” must be part of our planning processes.

- Failure to learn “lessons learned.”

### ***Risk Taking***

None of us likes to be wrong. The way we perceive risks and handle mistakes, however, affect the range of actions we are willing to consider when faced with extreme situations. Two particular risk-taking vulnerabilities are worth calling out.

- Litigation constrains risk taking.
- Fear of “satisficing”
  - We are often called to make decisions or take actions in the absence of complete information. Our willingness to take action and move forward with an apparently workable solution is often a function of how mistakes are perceived and handled.

### ***Transitional Vulnerabilities***

- Inadequate use of currently deployed resources
  - There is a tendency to look for the “silver bullet” as opposed to better deploying and applying the resources at hand.
- Change processes further stress existing systems.
  - Change for change’s sake is not necessarily the answer and, approached narrowly, may increase the overall risks we face.
- New system failure rates not planned.

### **External Systemic Risks**

External systemic risks lend themselves to the use of the Economic, Social, Political, Religious (or Cultural), Intellectual (or Ideas), and Technological (ESPRIT) framework illustrated below. This framework guides the program manager to look well beyond the traditional quantitative and event risks typically considered and focus on risk drivers that may impact the program.

The ESPRIT framework considers economic, social, political, religious (or cultural), intellectual (or ideas), and technological risk drivers. Let’s look at some potential systemic risks to be considered in each of these categories.



## **Economic**

- Market and revenue – These would include risks that change (accelerate/decelerate) the demand for the program’s outputs or otherwise modify the desired outcomes. Similarly, it would include changes in market conditions for primary or critical program inputs. Other market and revenue risks could include:
  - Market development slower than projected
    - Slower general economic growth
    - Changed priorities
    - Longer gestation time
  - Market rates lower than projected
    - Higher than anticipated price sensitivity
    - Increased competition
    - Free (or subsidized) government alternate
    - Price caps
  - Reduced market share
    - Delayed project completion
    - Increased competition
  - Synergistic opportunities fail to emerge
- Finance risks – These would include changed financial market conditions that either limit access to capital or change the cost of capital for the program. Similarly, finance risks may affect the supply chain because of “local” financial market changes for key elements of the program’s supply chain. This may put added pressure on advance funding for the program. Owner finance difficulties may drive suppliers to seek additional advance payment further exacerbating the owner’s financial situation.

Other finance risks could include deflation, local currency collapse, non-convertibility of select currencies or repatriation taxes, and financial market volatility.

- Cost risks – On programs using a strategic program management approach (life cycle approach to program management), these will include both construction and operating costs, but beyond those traditionally considered such as escalation, exchange risk, and quantitative uncertainty. Examples would include supply-demand imbalances for key CAPEX inputs, embargoes or other export controls from supply chain countries (e.g., China’s constraint of rare earth exports), changed tariff structures affecting both CAPEX and operating feedstock, strengthened labor bargaining power, and general discontinuous cost increases for major inputs beyond those associated with normal escalation (example: carbon tax).

Other cost risks could include regulatory changes to standards, delayed government action or government pressure for scope beyond regulatory requirements; changed work rules or government payments (social security contribution rates); mandated payments (healthcare); supply chain logistical

disruptions (maritime strike, damaged port, rail or road disruption from failed infrastructure, rail or road transport strikes, or other labor actions); expropriation of land, equipment, or materials; changed visa requirements; changed tax or corporate laws; constrained project bonding market; defaults of key suppliers or capital sources; free services to be provided as part of social license to operate; changed pension requirements in operating phase; shortage of skilled labor; increased cost of security; war; change of government; natural disaster; and cost of inefficiency from not engaging in corruption.

Each of these cost risks needs to be considered at the program and supplier level as well as in the program country and key supplier countries.

### ***Social***

- Culture – On international engineering and construction programs, the increased use of global workshare practices elevates the importance of cross-cultural risks associated with differences in norms, gender roles, social stratification, role of authority, sense of time, and decision making frameworks. These risks may be elevated by geopolitical events that increase tensions between cultures outside of the program itself.
- Ethics – Bribery and corruption risks (both payment and receipt), agent risks including changed agent agreements

### ***Political***

Political risks include consideration of not only the program's home country, but also those of key suppliers. Specific political risks to consider in each of these locations include:

- Change of government including party or revolution
- Sequestration – may include seizure of supplier inputs or materials or product intended for the program
- Exclusivity
- Changes in fiscal policy that can change sovereign debt ratings affecting project financing
- Changes in law, both general and program specific
- Approvals
  - Development
  - Right-of-way
  - Environmental
  - Construction
  - Import/export
  - Operating
  - Repatriation of profits
- Adverse government action/inaction

- Regime change
  - Political stability process to avoid collapse
  - Economic or cultural stability to uphold agreements
- Provision of utilities/other services
- Increases in taxes, both general and program specific
- Political *force majeure* events
  - Civil strife
  - Terrorism
  - Conventional war
  - WMD
- Termination of concession/contract
- Payment failure by government
- Property rights
  - Clear title or lease
  - Easements or other limitations
  - Intellectual property (patents/copyrights), including third-party actions alleging infringement by suppliers
- Ownership of assets
- Structure of project securities
- Availability of securities market
- Insolvency by government or concession company
- Changed conditions on foreign ownership or operation
- Enforceability of legal rights
  - Contract rights
  - Regulatory obligations
  - Financing documents
  - Security and insurance

### ***Religious***

- Tension and intolerance
  - Christian, Jew, Muslim, Hindu, Native Peoples, and others

- Rise of militant fundamentalism
  - Different from political or national culture risk

### ***Intellectual/Ideas***

- Corporate social responsibility
  - Social responsibility including anti-child labor throughout the supply chain, indigenous peoples risks, and risks associated with changed social outreach requirements including changed social benefits for the general population
  - Environmental stewardship including changed risks associated with mitigation and enhancement, greenhouse gases, international and local pressure groups, and international protocols
- Corporate governance, including engagement of more stakeholders, increased disclosures and data collection requirements throughout the supply chain, and a reduced owner and supplier risk appetite
- Evolving political form
  - Socialism with Chinese characteristics
  - Militant Islam
  - Nuclear blackmail
- Homeland defense
- International and local pressure groups
  - Can be a major risk to schedule, costs, and approvals
  - Can stall projects indefinitely
- Access to knowledge, including limitations on internet access

### ***Technology***

- New technology, including development delays, unacceptable failure rates, latent failures or risks, changed export control regimes or duties, or changed social acceptability
- New applications, including supply chain reconfiguration
- Scale, including available production capability and growth in unknown unknowns
- Capacity building
- Intellectual property, including theft and infringement



## **Reference**

The GIGA Factor; Program Management in the Engineering & Construction Industry; CMAA; ISBN 978-1-938014-99-4; 2011

## **About the Author**

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