Responding to Complex System Challenges for Project Management

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Old Dominion University

Established 1930, 26,000+ students from 106 countries, 795 Full-time faculty
Degree Programs: 70 undergraduate, 54 Masters, 42 doctoral
Graduates: 124,000+ from 77 different countries
Home to the National Centers for System of Systems Engineering (NCSOSE) – focused on system science based engineering of technologies to improve complex system performance
Topics

01. Challenges Facing PM

02. “Some” Systems Concepts to Help meet Challenges and Improve PM

03. “Real” Considerations in Transforming PM Systems
5 Challenges

1. Context Dependence
2. Holistic Nature
3. Ambiguity
4. Complexity
5. Uncertainty

7 Critical Systems Concepts for PM
1. **CONTROL** – The process by means of which a whole entity retains its identity and/or performance under changing circumstances.*


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**Control – what this means for PMs**

- Control often gets a bad rap

- Paradox of control – to get control we must give up control

- Control is about balanced constraint – balance is dynamic, shifting, & subject to interpretation
2. MINIMAL CRITICAL SPECIFICATION – Only those constraints necessary to ensure performance should be invoked.*

Minimal Critical Specification – what this means for PMs

- Excess constraint wastes resources – constraint is not free – it costs M5I (manpower, materials, money, methods, minutes, information)
- Too little constraint impacts performance – maintenance of performance requires sufficient constraint for integration
- Constraint is not constant over time – requires tradeoff to continual balance Autonomy and Integration
3. **PURPOSIVE BEHAVIOR** – in short ‘the purpose of a system is what it does’, not what it is designed, intended, or desired to do.

- The ‘goals’ for a system are user determined
- A representation is not the system

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**Purposive Behavior – what this means for PMs**

- Don’t confuse design with performance related, but not interchangeable
  - Designed ≠ Observed

- Effective design must consider context – there is no such thing as a context free system

- Evolution – maintenance of performance requires system development & evolution – faster than context change

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4. System Boundary

A constructed delineation of the separation of a system from that which exist outside the system.

Complex System Boundary – in a nutshell of 3 fundamentals points for PMs

Separates a system from its environment, determining what is included and excluded – criteria answers inclusion question and serves purpose

Is arbitrary and dynamic -- subject to value judgments and changes over time based on new knowledge, changing interpretations, or shifts in purposes

Can be tacit (left undefined, ambiguous, and debatable) or explicit (defined, clear, and negotiable)

Careful with system boundary establishment & maintenance
5. Complementarity

*Any two perspectives (or models) of a system will reveal truths about the system which are neither entirely independent nor entirely compatible


Complementrarity – what this means for PMs

- All perspectives of a system or problem are correct and incorrect – depending on their vantage point
- Perspectives are incomplete surface manifestations
- To challenge a perspective – attack the assumptions, underlying logic, or inconsistent ‘system’ model
6. Incompressibility

We are not capable of complete knowledge of a complex system. The system is known only through its representation (model) – which is always incomplete.

Incompressibility – what this means for PMs

- Can’t know everything about a complex system – understanding & knowledge change over time
- Representations are NOT systems – all representations have ‘abstraction’ errors; system knowledge is fallible
- Emergence – behavior, structure, and performance emerge over time as a system operates
7. **Self-organization**

The structural and behavioral patterns (performance) of a complex system emerge as a result of interactions between entities within the system; subject to externally imposed constraints (energy).

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**Self-organization – what this means for PMs**

- **Left alone systems organize for lowest energy**
  - NOT maximum performance

- **Emergence is product of self-organization**
  - behavior, structure, and performance emerge over time as a system operates

- **Self-organization should be maximized**
  - ‘by design’ to maximize autonomy and preserve system level performance
Considerations in Development of PM Systems

8R Framework to Engage System Development
(including PM Systems)

- **Rigidity**: Flexibility in design and execution of system development effort
- **Responsibilities**: Clarity in definition of roles and obligations with respect to the system and effort
- **Rigor in Execution**: Adherence to the design to create feasible alternatives for development
- **Resources**: Provision for sufficient resources and access necessary to engage in the effort
- **Relevance**: Recognition of need, measurable value, comprehensive nature, and relationship to other development efforts
- **Realism**: Consistency between expectations and feasible system development activities
- **Resolve**: Institutional will and commitment to the effort and system development sustainment
- **Requisite Compatibility**: Congruence in worldview, support infrastructure, approach, context, and risk-threat-reward balance

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