Complex Project Management Systemic Innovation

by Gerrit Muller University of South-Eastern Norway-NISE
e-mail: gaudisite@gmail.com
www.gaudisite.nl

Abstract

Systemic innovation requires organizational competences that ensure that resources and time work properly together to achieve results.
## Project Management Tasks

- Composing the project team
- Organizing and facilitating project members
- Orchestrating solution design and analysis
- Organizing the project infrastructure and processes
- Managing budget and business and project plans
- Ensuring and monitoring progress
- Managing external contacts
- Detecting and mitigating risks
Problem and Solution Space

**Problem space**
- context
- specific problems

**opportunities**

**Solution space**
- many potential solutions
- concepts & technologies
The Landscape for Project Management in Innovation

- **Project Manager**
  - Plans, Schedules
  - Design & Analysis
  - Risk Analysis

- **Project Team**
  - Business Plan
  - Budget
  - Needs
  - Project Results
  - Project Processes
  - Project Infrastructure
  - Specs, RFPs, etc.
  - Supplies

- **Project**
  - Investors
  - Legislators
  - Standardization
  - Customers
  - Partners
  - Life Cycle Organization
  - Supporting Organization
  - Suppliers

Legend:
- Stakeholders
  - Artifacts
  - Other, e.g., Legal
  - Financial
  - Organizational
  - Customer-Oriented
  - Supplier-Oriented
  - Project

Support: other, needs results

Complex Project Management Systemic Innovation

version: 0.2
March 7, 2019
CPMSI landscape
Project Management Tasks

- managing
- arranging
- monitoring
- chasing
- communicating
- facilitating
- detecting
- mitigating

- time
- resources
- budget
- delivery
- quality
- risks

project management
Value of Tools for Complex Project Management

Complex projects

Problem space  opportunities  Solution space

orchestrating
solution design
and analysis

understanding
and exploring
the problem and
solution space

vision & milestones

insight &
options

insight &
options

data &
facts

identifying and
mitigating risk

integration & project plan

Complex Project Management Systemic Innovation
version: 0.2
March 7, 2019
CPMSIvalueForComplexProjects
Planning Methods

- **Planning**
  - pacing
  - agile, wall
  - last planner
  - PERT planning
  - planning for integration

- **Decision Timing**
  - set-based design
  - real option theory
  - late decision making

- **Long Term Outlook**
  - roadmapping
  - foresight
  - gigamaps
  - scenario planning

References:

3. Combating Uncertainty in the Workflow of Systems Engineering Projects, INCOSE 2013
11. http://www.cambridgeroadmapping.net/
**Stakeholder Methods**

**stakeholder communication**

A3AOs\(^1,2\)

T-shaped presentation

physical & virtual demonstrators:

prototypes, animations, simulations, mockups

---

**understanding and exploring problem and solution space**

conceptual modeling\(^3,4\)

illustrative ConOps\(^5,6,7\)

Ideation, Creativity techniques\(^8,9,10,11\)

storytelling, scenarios\(^12\)

virtual prototyping\(^13\)

value network analysis

---

4. Muller, G. Teaching conceptual modeling at multiple system levels using multiple views, CIRP 2014
Planning Methods

<table>
<thead>
<tr>
<th>Planning</th>
<th>Decision Timing</th>
<th>Long Term Outlook</th>
</tr>
</thead>
<tbody>
<tr>
<td>pacing¹</td>
<td>set-based design⁶,⁷</td>
<td>roadmapping¹¹,¹²</td>
</tr>
<tr>
<td>agile, wall²</td>
<td>real option theory⁸,⁹</td>
<td>foresight¹³</td>
</tr>
<tr>
<td>last planner³</td>
<td>late decision making¹⁰</td>
<td>gigamaps¹⁴</td>
</tr>
<tr>
<td>PERT planning⁴</td>
<td></td>
<td>scenario planning¹⁵</td>
</tr>
<tr>
<td>planning for integration⁵</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Stakeholder Methods**

**stakeholder communication**
- A3AOs\(^1,2\)
- T-shaped presentation
- physical & virtual demonstrators:
  - prototypes, animations, simulations, mockups

**understanding and exploring problem and solution space**
- conceptual modeling\(^3,4\)
- illustrative ConOps\(^5,6,7\)
- Ideation, Creativity techniques\(^8,9,10,11\)
- storytelling, scenarios\(^12\)
- virtual prototyping\(^13\)
- value network analysis
- business model analysis
- Business Model Canvas\(^14\)

**low-tech tools:**
- flip over sheets, sticky notes, markers

**high-tech tools:**
- modeling, simulation, animation, virtual reality
Example of Pacing Milestones

- Functioning exposure and acquisition
- First image manual preparation
- 10% IQ manual preparation
- 20% IQ automated preparation 10% speed
- 50% IQ automated preparation 100% speed
- Full IQ Full speed

Pacing:
- Maximum 6 months between milestones
- Depending on technology and domain

- Complex Project Management Systemic Innovation
- version: 0.2
- March 7, 2019
- MSIPMpaceMilestones
The development spiral

Design Thinking

Business Development

Systems Engineering
The mindset of the project team shifts over time

- Room for open perceptive exploration
- Increasing goal orientation
- Emphasis on Design Thinking
- Architecting
- Emphasis on Detailed Design and Engineering

Complex Project Management Systemic Innovation

version: 0.2
March 7, 2019
CPMSIConvergence
Example of an Illustrative ConOps
Example A3AO from Offshore Energy

This A3 based on the work of SEMA participants: Martin Moberg, Tormod Strand, Vazgen Karlsen, and Damien Wee, and the master project paper by Dag Jostein Kleiver, Aker Solutions, FMC Technologies

version 2.2 Gerrit Muller
## Example Pugh Matrix

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Priority setting</th>
<th>A</th>
<th>B.1</th>
<th>B.2</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware Cost</td>
<td>High</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Installation Cost</td>
<td>Standard</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Operational Cost</td>
<td>Standard</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Engineering hours (Amount of new engineering, re-use, analysis)</td>
<td>Standard</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Design familiarity (Is the design known in AkSo? Previously delivered?)</td>
<td>Standard</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Requirement compliance</td>
<td>Standard</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Deliverytime from call-off (Long lead items, fabrication time)</td>
<td>High</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Amount of new qualifications (TQP's)</td>
<td>High</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>On-shore Testability (Availability of necessary equipment and procedures)</td>
<td>Standard</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Number of installation runs required</td>
<td>Standard</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Installation time</td>
<td>Standard</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Weather vulnerability (Meteocean constraints, Hs )</td>
<td>Low</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Need for special tools</td>
<td>Low</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Guide system robustness</td>
<td>High</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Size of vessel required (Frig, heavy lift vessel, installation vessel)</td>
<td>Standard</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Weight &amp; Size</td>
<td>Standard</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Retrieval flexibility of equipment</td>
<td>Standard</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>ROV access</td>
<td>Standard</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Flow assurance (Hydrate/Scale, pipeline friction, pressure bleed-off)</td>
<td>Standard</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Dewatering &amp; start-up (Service access, injection points, etc.)</td>
<td>Standard</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Reliability</td>
<td>Standard</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Interchangeability</td>
<td>Standard</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

**Indicating summary:**

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B.1</th>
<th>B.2</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>78</td>
<td>74.5</td>
<td>78.5</td>
<td>84.5</td>
<td></td>
</tr>
</tbody>
</table>

This priority setting enables you to prioritize individual criteria to a higher or lower importance. If the priority is set to low for a criteria, that criteria will count less compared to a standard or higher prioritized one.

<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unfavorable performance</td>
</tr>
<tr>
<td>2</td>
<td>Less than satisfactory performance</td>
</tr>
<tr>
<td>3</td>
<td>Satisfactory performance</td>
</tr>
<tr>
<td>4</td>
<td>More than satisfactory performance</td>
</tr>
<tr>
<td>5</td>
<td>Excellent performance</td>
</tr>
</tbody>
</table>

### Executive Summary

![Executive Summary Graph]

- **Cost**
- **Design**
- **Installability & Retrievability**
- **Operability**

---

**Complex Project Management Systemic Innovation**

Gerrit Muller

version: 0.2
March 7, 2019
CPMSlpughMatrix
Stepwise Approach to Planning for Integration

Understand Solution Design and Context
Parts inside solution and in context, their interactions, emergence of Key Performance Parameters

Identify Risks
gaps in knowledge of problem and solution space, uncertainties, and ambiguity

Determine an Integration Sequence to get Key Performance Parameters functioning ASAP using a pacing process (regular visible results)

Merge Constraints from Test Configurations, Suppliers, Partners, Resources, etc. with a mindset to fail early
From Integration Sequence to Project Master Plan

- defining integration sequence
- project planning
- resource management
- facility management
- suppliers
- lead customers
- (test)facility management
- suppliers
- resource management

actual situation
master plan
now

options constraints
needs
options constraints
needs