Formulating the Experiment

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Experiment Formulation

- Formulation of the Experiment will be an iterative process with development of the initial Experimentation Plan.
- Issues are complex and involve many dimensions that form MCP’s.
Formulating the Experiment

- What Question(s) is the Experiment Intended to Address?
- Review of Existing Body of Knowledge
- Drafting the Hypotheses
- Identifying Assumptions
- Identification of Dependent and Independent Variables
- Articulation of the relationships between variables
- Selection of the variables to be controlled
- Identification of limiting conditions
- Development and articulation of the conceptual model
What Question is the Experiment Intended to Address?

- What Type of Experiment?
  - Discovery
  - Hypothesis Testing
  - Demonstration
- Understand the issues to be addressed.
- Understand the Context in which the issues will be addressed.
- Propositions, hypotheses, and/or relationships to be explored
Review of Existing Body of Knowledge

- Identifies what is already known and unknown
- Assists in establishing a baseline for experimentation
- Source include:
  - NATO Lessons Learned data repositories
  - National Lessons Learned data repositories
  - Academic data repositories
  - Industry’s data repositories
  - Others?....
Drafting the Hypothesis

• **Discovery Experiments** - Need to be designed around clearly articulated questions

• **Hypothesis Testing Experiments** – Need to be expressed as a specific hypothesis or set of related hypotheses…
  – “if…then…condition” statements
  – Include null hypotheses to be tested
  – Differentiates between two or more treatments or sets of independent variables
  – Must know how the propositions are anchored in the real world

• **Demonstration Experiments** – show that specific approaches and/or federations of systems (TOPP) provide operational utility
  – Should allow for identification of novel insights
Identifying Assumptions

• It is good practice to clearly articulate all of the key assumptions being made

• Assumptions:
  – Determine the scope of the experiment
  – Clearly identify areas that are not to be investigated
  – Are important in helping all to understand and evaluate the resulting empirical data and its interpretation
Identification of Dependent and Independent Variables

• Dependent Variables
  – Is a factor whose values in different treatment conditions are compared.
  – Are the outputs or products of an individual, team or organization
  – Must be valid and reliable indicators or measures of the anticipated benefits of innovation being investigated
    • May require multiple variables
    • Need to consider what will need to be observed and recorded and how it will be done

• Independent Variables
  – Is the variable that is manipulated or selected to determine its relationship to an observed phenomenon (the dependent variable)
  – Are the inputs & taken together frame the experimentation space
  – Focus on the relationships of interest
Articulation of the relationships between variables

- Selection of the independent variables to be controlled
- Identification of limiting conditions
- Development and articulation of the conceptual model
Outputs of Formulation

• Construction of an Experimentation Model
  – Contains key Variables & relationships
  – Identifies Assumptions
  – Draws from existing knowledge
  – Helps ensure the problem has been thought through precisely
  – Descriptive of the experiment problem

• Specification of the Relationships of Primary Interest
  – Related assumptions
  – Constraints
Reference Material

• pp 66-72 Chapter 5 COBP Experimentation
• Chapter 6 COBP Experimentation