Exploring the Relationship between Project Selection and Requirements Analysis

Mark Bergman, Gloria Mark
Information and Computer Science Dept.
University of California, Irvine
mbergman@ics.uci.edu, gmark@ics.uci.edu
Initial Project Formation

- First, Project Selection
  - Determine project choices
  - Choose a project to fund and develop

- Then, Requirements Analysis
  - Determining stakeholders’ wants, needs, and constraints for a project
  - Requirements Analysis traditionally follows Project Selection

- How does Project Selection relate to Requirements Analysis?
  - Project Selection decisions frame subsequent Requirements Analysis
Research Questions

- In practice, does the order of first determining project choices, making project selection and then performing requirements analysis hold?
- If not, what are possible procedural relationships between project choice construction, project selection and requirements analysis?
- How are they similar or different to current requirements analysis views?
Research Methods

- Project Selection and Requirements Analysis have been studied individually, but not together
  - Project Selection has been examined empirically
  - Almost no *in situ* Requirements Analysis studies

- Apply Ethnographic Methods to study initial project formation *in situ*
  - 5 months (2-3 times weekly) of on site participant observation
  - 46 individual semi-structured interviews and 34 semi-formal and formal group meetings
  - 5 detailed technical presentations
  - Hundreds of related documents
The Field Site

- The New Millennium Program (NMP) at the Jet Propulsion Laboratory (JPL): A group in a NASA (National Aeronautics and Space Administration) research laboratory located in Southern California

- The NMP program’s mission: Space flight validate new technologies that are deemed important to NASA’s future science missions
  - This includes maturing new technologies (TRL 3 → TRL 7)

- NMP Selection Process: Choosing which new technologies to validate

- Each new technology candidate can become the basis of a new project – a validation mission
  - NMP selection process is a highly developed form of *in situ* initial project formation
## Roles and Requirements

<table>
<thead>
<tr>
<th>Lab Roles</th>
<th>Description</th>
<th>General Requirements Profile</th>
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| NASA Administrators     | NASA upper level decision makers with the authority to assign organizational resources to implement their decision | Wants, needs and constraints tend to be general, somewhat vague, and usually conflicting  
Want broadly applicable array of new technologies to become available for NASA wide science mission usage, while minimizing cost  
Constrained by budgetary and policy guidelines from the US Congress  |
| Mission Themes          | Planners, designers, scientists, builders, and managers of science mission space systems | Technically explicit and precise in their needs and constraints  
Want new technology that would lower future science mission system costs or enable experiments  
Constrained by tight budgets and project deadlines  |
| Technology Providers    | Builders of new aerospace related technologies                              | Have very precise constraints and usage guidelines while providing specific, semi-customizable technical functionality  
Want their technologies space flight validated, likely creating a long term revenue stream, while minimizing technology development costs  
Constrained by VAL award amounts and project deadlines  |
| NMP Technologists       | Assist and promote the technology and project selection process              | Want new technologies to space flight validate  
Want to balance and satisfy the needs of the administrators and themes, while validating as many providers’ technologies as possible  
Constrained by allotted project cycle budgets and given deadlines |
### Roles and Project Selection

<table>
<thead>
<tr>
<th>Process Role</th>
<th>Lab Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO: Process Owners/Principals</td>
<td>NASA Administrators</td>
</tr>
<tr>
<td><strong>TC_p</strong>: Theme Customers</td>
<td>One of p Mission Themes</td>
</tr>
<tr>
<td><strong>P_i</strong>: Technology Providers</td>
<td>One of i Technology Providers</td>
</tr>
<tr>
<td><strong>NMP_m</strong>: Process Agents</td>
<td>One of m NMP Technologists</td>
</tr>
<tr>
<td>Concept N</td>
<td>One of N Competing General System</td>
</tr>
<tr>
<td><strong>P_{i,N,x}</strong></td>
<td>Candidates Competing Technologies for Concept N from Provider</td>
</tr>
<tr>
<td>Project Stream N</td>
<td>One of N Candidate Project Plans, Project Plan N is for Concept N</td>
</tr>
</tbody>
</table>

![Diagram of roles and project selection]
Project Selection Process

Process Steps

Concept Requirements Defined
Technology Candidate Proposals Solicited
Proposals Peer Reviewed
Peer Review Panel
System Proposal Selection Panel
Project Plan Development
Project Review Board
Final Project Selection

Time (not to scale)

Selected Project(s)

- ~9-10 mo. per project selection cycle
- 6 mo. used in project plan development
Relationship Between Project Selection and Requirements Analysis

- Initial project streams (concepts) defined by Theme Customer’s requirements
- Competition between technology candidates informs and refines project stream requirements
  - Early identification of *wanted* and *undesired* existing technological capability, costs and constraints
  - Technology selection frames project definition and tightens project requirements
- Competition between project streams also refines each project’s requirements
  - Project level requirements are used in project selection decision, especially negative requirements
Multiple Parallel Competitive Requirements Analysis (MPCRA)

- Relationship between project choices, selection and requirements analysis is bidirectional, *not* unidirectional
  - Projects created and selected requirements
  - Requirements identified and framed projects, and informed project selection

- Found multiple parallel competitive requirements paths, not just one
  - Refutes traditional requirements analysis – single project path
  - Outcome could be multiple projects, as opposed to the traditional assumption of one

- Extensive, multi-step, well-documented, open, competitive process built consensus for final project selection