An exploratory study of why organizations do not adopt CMMI

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Introduction (1/2)

- Process capability maturity model based SPI (CMMI, SPICE, etc)
  - Frameworks for defining and measuring process and practices

- Most of previous studies about adopting CMMI report
  - Post hoc experience of organizations that
    - Have already chosen, successfully implemented, and gained benefit from CMMI
  - Problems experienced by organizations implementing CMM
    - Sample population was familiar with CMM

- No prior published evidence about understanding why organizations do not adopt CMMI
Introduction (2/2)

Empirical study environment of reasons why SW-developing organizations do not adopt CMMI

Data
- Two moths of sales data
- Contact notes

Source
- Company selling CMMI Level 2 Class B and C appraisal and improvement services in Australia

Analysis
- Examine relationships between reasons, organizational size, and organizational type
Research questions and hypotheses

Questions
- Why do organizations decide not to adopt CMMI
- How are the reasons related to the size of organizations
- How are the reasons related to organizational type

Hypotheses
- Cost, applicability, and time to benefit would be the most frequent reasons for such not adopting CMMI
- Small and medium sized organizations would have a different pattern of response that large organizations
- There would be a significant relationship between reasons and organizational type
Method (2/6)

Steps of method

- Gather the sales data
- Categorize the sales opportunities
- Classify the reasons
- Analyze the organizations
- Determine the size and type
Method (3/6)

Sales data
- Duration: Two months by 3 salespeople
- Source of the contacted organizations:
  - Third-party company databases sourced from government
  - News articles
  - Sales-people’s personal contacts

Contact information
- Date, salesperson, organization contacted, individual contacted, current and next status of the sales opportunity, current and next status

Raw data
- 429 contact events with 274 organizations
Categorizing sales opportunities
Sales data and contact notes

- No Sale : 75
- In Progress : Most of others
- Sale : Several

Use Cohen’s Kappa
(Kappa = 0.88)
Method (5/6)

Classifying reasons

<table>
<thead>
<tr>
<th>Group</th>
<th>Group frequency (of 73 orgs)</th>
<th>Reason</th>
<th>Reason frequency (of 73 orgs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>24</td>
<td>No software development</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not in business</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Already using capability</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>maturity model</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Want Class A rating</td>
<td>2</td>
</tr>
<tr>
<td>Insufficient</td>
<td>37</td>
<td>No interest</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>May consider SPI later</td>
<td>17</td>
</tr>
<tr>
<td>Could not</td>
<td>33</td>
<td>Small organization</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Too costly</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No time</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not applicable to our projects</td>
<td>2</td>
</tr>
<tr>
<td>Should not</td>
<td>17</td>
<td>Using other SPI</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No clear benefit</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Potential benefits not wanted</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Already know gaps</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No customer demands</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Risk of poor certification damaging business</td>
<td>1</td>
</tr>
</tbody>
</table>
Determining size and type of organizations

**Size**

<table>
<thead>
<tr>
<th>Size category</th>
<th>N</th>
<th>Minimum</th>
<th>Median</th>
<th>Mean</th>
<th>Maximum</th>
<th>Std Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMALL</td>
<td>15</td>
<td>1</td>
<td>5</td>
<td>7.8</td>
<td>18</td>
<td>6.53</td>
</tr>
<tr>
<td>MEDIUM</td>
<td>9</td>
<td>20</td>
<td>45</td>
<td>48.3</td>
<td>95</td>
<td>28.6</td>
</tr>
<tr>
<td>LARGE</td>
<td>4</td>
<td>200</td>
<td>245</td>
<td>313</td>
<td>560</td>
<td>169</td>
</tr>
</tbody>
</table>

**Type**

<table>
<thead>
<tr>
<th>Type</th>
<th>Definition</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single unit</td>
<td>Single office location; No international offices</td>
<td>22</td>
</tr>
<tr>
<td>Head of national</td>
<td>Multiple office locations; Head office contacted; No international offices</td>
<td>6</td>
</tr>
<tr>
<td>Branch of national</td>
<td>Multiple office locations; Branch office contacted; No international offices</td>
<td>0</td>
</tr>
<tr>
<td>Head of multinational</td>
<td>Multiple office locations; Head office contacted; International offices</td>
<td>9</td>
</tr>
<tr>
<td>Branch of multinational</td>
<td>Multiple office locations; Branch office contacted; International offices</td>
<td>3</td>
</tr>
</tbody>
</table>
## Analysis and results (1/6)

### Reason frequency

Frequency-ordered list of reasons

<table>
<thead>
<tr>
<th>Reason</th>
<th>Frequency (of 40)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small organization</td>
<td>17</td>
<td>43</td>
</tr>
<tr>
<td>Too costly</td>
<td>14</td>
<td>35</td>
</tr>
<tr>
<td>No time</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Using other SPI</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>No clear benefit</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Potential benefits not wanted</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>No customer demands</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Not applicable to our projects</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Already know gaps</td>
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<td>5</td>
</tr>
<tr>
<td>Risk of poor certification damaging business</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

### Grouping the reasons

<table>
<thead>
<tr>
<th>Reason group</th>
<th>Frequency (of 40)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only “could not” reason(s)</td>
<td>23</td>
<td>58</td>
</tr>
<tr>
<td>Only “should not” reason(s)</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>Both “could not” and “should not” reasons</td>
<td>9</td>
<td>23</td>
</tr>
</tbody>
</table>
Analysis and results (2/6)

Reason vs. size

Tested the significance of relationships using Fisher’s exact test

Small organization, too costly, no time, using other SPI

Observation

Overall relationship between size categories and reasons

Source of any significance

- Collapsed SMALL and MEDIUM categories
- Collapsed MEDIUM and LARGE categories
Analysis and results (3/6)

- Reason vs. size (cont’d)
  - Result 1: each of reasons vs. size category

```
Percent of each size group for organizations giving each reason

<table>
<thead>
<tr>
<th>Reason</th>
<th>SMALL</th>
<th>MEDIUM</th>
<th>LARGE</th>
<th>UNKNOWN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small organization</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Too costly</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No time</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Want Class A Rating</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk of poor certification</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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- Because of cost, resource constraints
- Because they consider CMMI to be inapplicable to small organizations
  - "too costly"
  - "no time"
  - "using other SPI"

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*(SMALL)

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*○*(SMALL)

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*○*(SMALL)
Reason vs. size (cont’d)

Result 2: reason group vs. size category

<table>
<thead>
<tr>
<th>Size Category</th>
<th>Reason Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMALL+MEDIUM, LARGE</td>
<td>“should not”</td>
</tr>
<tr>
<td>SMALL, MEDIUM, LARGE</td>
<td>“could not”</td>
</tr>
</tbody>
</table>

Percent of organizations giving reasons in either or both group:

- SMALL
- MEDIUM
- LARGE
- UNKNOWN

Result of significance test:

- SMALL+MEDIUM, LARGE:
  - “should not”
  - “could not”
Analysis and results (5/6)

Size vs. type

Percent of each organizational type for organizations giving each reason

<table>
<thead>
<tr>
<th>Size Category</th>
<th>Type</th>
<th>Result of significance test</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMALL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEDIUM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LARGE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SMALL+MEDIUM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEDIUM+LARGE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reason

- Too costly
- No time
- Using other SPI
- No clear benefit
- Already know gaps
- Not applicable to our projects
- Potential benefits not wanted
- Risk of poor certification damaging business
- No customer demands

Legend:
- Single unit
- Head of National
- Head of Multinational
- Branch of Multinational
Analysis and results (6/6)

- Reason vs. type

There is not a significant relationship between organizational type and the reasons.

Percent of each organizational type for organizations giving each reason.
Considerations (1/5)

Results of the tests for the hypotheses

- Cost, applicability, and time to benefit would be the most frequent reasons for such not adopting CMMI
  - The most reasons from the sales data
    - Small organization, too costly, the lack of available time to adopt, competition from other forms of SPI already being used

- Small and medium sized organizations would have a different pattern of response that large organizations
  - SMALL organizations tend to give “could not” reasons
  - MEDIUM and LARGE organizations tend to give “should not” reasons

- Small organizations face other additional barriers than simply being unable to absorb additional cost overheads
  - “no time”, “not applicable to our projects”, “small organization”
Considerations (2/5)

- Results of the tests for the hypotheses (cont’d)
  - There would be a significant relationship between reasons and organizational type
  - Can not conclude that the relationship is significant
  - Relationships between organizational type and size, and between size and reason are not transitive
    - Factors influencing the relationships between size and reason may be different to those influencing the relationships between type and reason
Considerations (3/5)

Improving SPI for small organizations

Issues

- Negative perceptions of CMMI
  - Lack of widespread adoption of process capability maturity SPI among small organizations
  - Lack of studies of failed adoption of CMMI-based SPI

CMMI tailoring

- Emphasizes the tailoring “down” rather than tailoring “up”
- Requires additional burdens for tailoring CMMI to small organizations
  - Small organizations are likely to have fewer resources available to do tailoring
Considerations (4/5)

Improving SPI for small organizations (cont’d)

Issues

- Needs of small organization
  - More interest in product quality than product quality assurance
    - Product quality: the product working well
    - Product quality assurance: evidence of the product working well
  - Extent and nature of variability in small organization
    - Not yet well understood

Suggestion

- Agile methodologies
  - Target issues of greatest concern to small organization
  - Require low cost and time to trial and adopt
- Recasting CMMI for the needs of small organizations
Considerations (5/5)

- Validity of method
  - Difference of concept between “buying” and “adopting”
    - Excludes organizations that gave the reason “already using CMM”
  - Inaccurate reasons that reflected better on them
    - Allows organizations to give the “Insubstantive” responses
Conclusion

Summary

- Why organizations do not adopt CMMI
  - Small organization, too costly, no time, already using another form of SPI
- There is a significant relationship between size and the reason of being a “small organization”
- There is no significant relationship between an organization’s type and the reasons

Future work

- Study the extent and nature of variation of business context, needs, and constraints of smaller organizations, and their differences to larger organizations
**Discussion (1/2)**

- How to deal with the survey data
  - Consider the validity issues in utilizing the data
    - Collected data can be biased to satisfy a specific purpose
    - Data are not collected using a survey instrument designed to support academic usage
  - Guideline is necessary to improve the validity
Finding research issues that SPI for small organization

- How to integrate agile methodologies into SPI
- New capability model to support growing “up” tailoring
  - Ex) k-model

 초기 수준 (Initial level)

 우수 수준 (Good level)

 최우수 수준 (Excellent level)

- 전사적 관리 프로세스
- 정량적 개선 프로세스
- 프로젝트 계획 및 통제 프로세스
- 개발 프로세스
- 지원 프로세스