FOSS Adoption by some classes of Institutions in India –
A Preliminary Study and its Findings

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Motivation for this study.

**Developing Metrics for FOSS Products & their Adoption**

- **FOSS Products** – measures exist for quantifying their capabilities & performance – *BRR, Maturity Models* by Navica, Capgemini, Qualipso etc.

- **FOSS Adoption by Countries** – *OS Potential Index (Redhat & Georgiatech)*

- **FOSS Adoption by Institutions** –
  
  a. Some European studies on Municipalities, Hospitals & Universities
  b. Present work – Generalised FAI Framework for Quantification of FOSS Adoption using Mathematical Modelling, Primary Data Gathering, Analysis and Presentation. *Needed for comparison purposes*
The FOSS Adoption Index (FAI) Model

Illustrating with a 2-level FAI model:

‘l’ is index for institutions; ‘i’ is index at level-1; ‘j’ is index at level-2; \( N^{(l)} \) is number of criteria at level-1; \( M_i \) is number of level-2 criteria under ‘i’; \( s_{ij}^{(l)} \) are scores for level (i,j) got from the survey; \( \alpha_i^{(l)} \) are level-1 Model parameters, \( \beta_{ij}^{(l)} \) are level-2 Model parameters corresponding to ‘i’:

\[
FAI^{(l)} = \sum_{i=1}^{N^{(l)}} \alpha_i^{(l)} \cdot \sum_{j=1}^{M_i} \beta_{ij}^{(l)} \cdot s_{ij}^{(l)}
\]

\[
\sum_{i=1}^{N^{(l)}} \alpha_i^{(l)} = 1 \text{ for all } 'l' \quad \sum_{j=1}^{M_i} \beta_{ij}^{(l)} = 1 \text{ for all } 'i' \text{ and } 'l'
\]

Range of s, S and FAI are 0-10.

We have studied 4 classes of organisations, l= 1 to 4 : Govt. Dept. s, IT SME s, CSE Dept. s of colleges, R&D Labs.
Level-2 Model computational flow

Data from survey of class ‘1’ organisations

Level-2 criteria scores, $s_{ij}^{(1)}$

Level-2

Computation of $S_i^{(1)}$

Level-1 criteria scores, $S_i^{(1)}$

Level-1

Computation of FAI$^{(1)}$

Level-2 criteria scores, $s_{ij}^{(1)}$

Computation of $s_{ij}^{(1)}$

$M_i, N^{(1)}$

Level-2 criteria scores, $s_{ij}^{(1)}$

Level-1 criteria scores, $S_i^{(1)}$

$\beta_{ij}^{(l)}$

Computation of FAI$^{(1)}$

$\alpha_i^{(l)}$
$$\text{FAI}^{(l)} = \sum_{i=1}^{N^{(l)}} \alpha_i^{(l)} \cdot \sum_{j=1}^{M_i} \beta_{ij}^{(l)} \cdot \sum_{k=1}^{L_{ij}} \gamma_{ijk}^{(l)} \cdot s_{ijk}^{(l)}$$

**Level-3 Model**

- **Level-3**
  - Computation of $s_{ijk}^{(l)}$
  - Level-3 criteria scores, $s_{ijk}^{(l)}$ [$L_{ij}, M_i, N^{(l)}$]

- **Level-2**
  - Computation of $s_{ij}^{(l)}$
  - Level-2 criteria scores, $s_{ij}^{(l)}$ [$\gamma_{ijk}^{(l)}$]

- **Level-1**
  - Computation of $S_i^{(l)}$
  - Level-1 criteria scores, $S_i^{(l)}$ [$\beta_{ij}^{(l)}$]

- **Level-1**
  - Computation of FAI$^{(l)}$
  - FAI$^{(l)}$ [$\alpha_i^{(l)}$]
Our choice of criteria for the two level model

\( i=1: \) Existence of Policy/Guidelines about FOSS Usage

\( j=1: \) Well-documented and open FOSS policy statements relating to the use of FOSS in the entire organisation

\( j=2: \) Guidelines for selecting FOSS Products and Technologies, using various ratings and maturity models available.

\( j=3: \) Guidelines for the maintenance of FOSS repositories, their upkeep, up-gradation and availability to the employees.

\( i=2: \) Availability & Status of FOSS trained HR

\( j=1: \) FOSS competence level of employees as revealed through formal certificates, training in FOSS

\( j=2: \) FOSS documentation available to employees

\( j=3: \) Training programs for updating FOSS skills
i=3: Extent of FOSS use at Infrastructure level
   j=1: The percentage of h/w running FOSS based operating systems
   j=2: FOSS on the desktops, including OS, office and other applications
   j=3: Support and documentation available on the FOSS being used

i=4: Extent of FOSS use at Application level
   j=1: Matured FOSS applications
   j=2: In-house FOSS applications
   j=3: Support for these applications.

The level can go further to 3\textsuperscript{rd} or 4\textsuperscript{th} level for large organisations.
## Parameter values selected by us

<table>
<thead>
<tr>
<th>Government Departments</th>
<th>IT-SMEs</th>
</tr>
</thead>
<tbody>
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<td><strong>Level-1 criteria(i)</strong></td>
<td><strong>α_i^{(l)}</strong></td>
</tr>
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<td></td>
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</tr>
<tr>
<td>R &amp; D Organisations</td>
<td>Educational Institutions/Departments</td>
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<tr>
<td>---------------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Level-1 criteria (i)</td>
</tr>
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<td>0.15</td>
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<tr>
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<td>0.5</td>
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<tr>
<td>4</td>
<td>0.5</td>
</tr>
<tr>
<td>5</td>
<td>0.15</td>
</tr>
</tbody>
</table>
Data Collection

- Primary Data Collected using questionnaire through:
  a. Face to face meetings (govt. dept.)

- Typically each questionnaire contained 30-40 questions for 2-level model.

- 484 organisations approached, 166 satisfactory responses received (for the 4 different classes: 42, 50, 48, 26); employee size range: 30-300, 4-350, 4-40, 45-300

- The Online survey too has been made available ([www.au-kbc.org/survey/](http://www.au-kbc.org/survey/)), and can be customised on request for specific classes of institutions.
## Results

**Table: Distribution of organisations against FAI value**

<table>
<thead>
<tr>
<th>FAI value</th>
<th>Govt. Depts.(42)</th>
<th>IT SMEs(50)</th>
<th>Education Institutions(48)</th>
<th>Research Organisations(26)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
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<td>98</td>
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<td>100</td>
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<tr>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
• Organisations distribution against the FAI value (range 0 to 10)

Figure 3: Pdf for the FAI variable
Drilling down... Govt. Departments.

**Figure:** Level -1 score contribution for FAI>5

**Figure:** Level -1 score contribution for FAI<2
Drilling Down… IT SMEs

**Figure** : Level -1 score contribution for FAI>5

**Figure** : Level -1 score contribution for FAI<2
IT SMEs – some more details

1. FOSS usage policy and guidelines
   - 78% had FOSS as an option in procurement policy/guidelines
   - 42% maintained FOSS repository
   - 14% had a defined criteria/model for selecting FOSS products.

2. FOSS awareness of HR
   - 98% had staff aware of FOSS.
   - 12% had all its staff aware of FOSS
   - 54% had about 25% of their staff with FOSS certifications.
   - 4% gave commercial training to their staff, 72% used community support.
3. Use of FOSS in IT-infrastructure

- 32% used only FOSS on servers, 54% used both.
- On desktops, 16% used only FOSS while 74% used both.
- Apache webserver, Mysql & Tomcat commonly used on server side
- Office-suite, browsers and IDE (Eclipse, Netbean, Geany) were the commonly used FOSS on desktop.

4. Use of FOSS in IT-Application

- Around 40% use FOSS in their IT-application but the level of usage is very low.
- Major FOSS items: CMS (~38% orgs), CRM (~ 20%) , ERP (~ 18%) (OpenERP-10, Project-open/ERP5-8%) and Engg. SW (~12%)
- 30% used FOSS tools to build their business specific SW, though only 16% released them under a FOSS license.
Drilling Down... *Education Departments*

**Figure**: Level -1 score contribution for FAI>5

**Figure**: Level -1 score contribution for FAI<2
Drilling Down… *Research institutions*

**Figure**: Level -1 score contribution for FAI>5

**Figure**: Level -1 score contribution for FAI<2
FAI Model as a diagnosis tool
FAL Model – *need to go beyond just one number*
Some Recommendations from our study

List of Priority areas that needs to be addressed, in order of decreasing priority

<table>
<thead>
<tr>
<th>Priority</th>
<th>Govt. Depts</th>
<th>SME s</th>
<th>Education</th>
<th>R&amp;D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Policy &amp; Guidelines</td>
<td>FOSS in Application</td>
<td>Participation &amp; Contribution</td>
<td>Participation &amp; Contribution</td>
</tr>
<tr>
<td>2</td>
<td>FOSS in Application</td>
<td>Policy &amp; Guidelines</td>
<td>FOSS in Infrastructure &amp; Application</td>
<td>Policy &amp; Guidelines</td>
</tr>
<tr>
<td>3</td>
<td>HR</td>
<td>HR</td>
<td>HR</td>
<td>HR</td>
</tr>
<tr>
<td>4</td>
<td>FOSS in Infrastructure</td>
<td>FOSS in Infrastructure</td>
<td>Policy &amp; Guidelines</td>
<td>FOSS in Application</td>
</tr>
<tr>
<td>5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>FOSS in Infrastructure</td>
</tr>
</tbody>
</table>
Some limitations of this work

1. Selection of the criteria and sub-criteria at different levels needs greater attention and validation.

2. Selection of model parameter values (α, β, γ) were largely heuristics and not rigorously validated or optimized.

3. Selection of organisations was not done using scientific sampling techniques, but from considerations of convenience, ease of access, speed of response, etc.

4. No independent check was done on the authenticity and truthfulness of the data gathered through the surveys
**Acknowledgements**

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- The basic concept of this work was first published in

Thanks everyone!