A Case Study on Improving Standardization in the Conception Phase by Developing Tools and Protocols

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Martin Michaud, Daniel Forgues, Julien Meyer, Claudiane Ouellet-Plamondon
Problem Statement

- **Recurring problem:** Low productivity due to the fragmented nature of construction project.

- **Fragmentation** leads to the presence of complications, risks and uncertainty making the transfer of information difficult.

- **Building Information Modelling** (BIM) approach reduces information loss and centralizes it, aiming at decreasing fragmentation and inefficiency.

- **BIM issue:** Major waste in the production and exchange of information.
Research

- A collaborative action-research
- Focuses on the architects
- Uses approach derived from **Value Stream Mapping (VSM)** to visualize the information flows and identify waste
Context

**The Architecture Firm**
- Multidisciplinary (architects, engineers and technicians)
- Functional structure (5 departments)
- More than 100 employees in 3 offices

**The research chronology**
2014: Change Lab (activity theory)
2015- : Devising a participative action-research approach
  - Devising a maturity model
  - Conducting a Share Lab
  - Defining the transformation plan and conducting the transition to BIM using VSM
Maturity Audit

<table>
<thead>
<tr>
<th>Élément BIM Planifié</th>
<th>Architecture</th>
<th>Commercial</th>
<th>Ingénierie</th>
<th>Design</th>
<th>Corporatif</th>
<th>Total Possible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stratégie</td>
<td>9</td>
<td>8</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>25</td>
</tr>
<tr>
<td>Usages du BIM</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Processus BIM</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Information BIM</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>12,5</td>
</tr>
<tr>
<td>Infrastructure BIM</td>
<td>7</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>12,5</td>
</tr>
<tr>
<td>Opérationnel</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>5</td>
<td>4</td>
<td>30</td>
</tr>
<tr>
<td>Totales</td>
<td>35</td>
<td>31</td>
<td>20</td>
<td>18</td>
<td>15</td>
<td>100</td>
</tr>
</tbody>
</table>

profil de maturité BIM
Share Lab: assist the organisational change for BIM implementation
Collaborative Action Research Objective

• To provide a framework designed to help increase standardization as a way to improve the information flows → To facilitate the change from a traditional practice to a BIM approach.
Literature review

Helps to identify and eliminate waste
Improve productivity
Identifies opportunities for improvement

From document-centric to information-centric approach
Problem: Issues with BIM collaboration

Lean construction: eliminate waste from processes and improve productivity
Koskela (2000) theory of production: link between value generation and the concept of flow
Knowledge gaps

- Tools and approaches developed to improve flows, mainly focus on materials and work flows and undermine information flows.

- The construction phase is the main focus when trying to improve flows. However, up to 33% of waste is generated in the design phase (Innes 2004).
Change Management Framework: derived from VSM principles

1. Thinking (Analysis)
   1.a. Current State Map
   1.b. Map analysis
   1.c. Sources for standardization

2. Operationalization
   2.a. Future State Map
   2.b. Map analysis
   2.c. Prepare action plan and tools

3. Diffusion
   3.a. Implementation of the action plan and tools
Analysis (Thinking)

- Use of VSM helped this work group visualizing the waste in their process through mapping of their information flows.
- This protocol was used to maintain repeatability and standardization:

1. Focus on input and output of information to create the model or plan
2. Point out only the advantages of the practices presented
3. Identification of important elements and needs for each source of information identified
4. Ruling is made on the strategy and tools adopted
## Analysis (Thinking)

<table>
<thead>
<tr>
<th>Sources of waste</th>
<th>Forms of waste identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under-utilization of talents</td>
<td>Lack of new ideas</td>
</tr>
<tr>
<td>Waiting inputs</td>
<td>Difference of semantic</td>
</tr>
<tr>
<td></td>
<td>Lack of knowledge, understanding, communication and coordination</td>
</tr>
<tr>
<td>Information transfer</td>
<td>Silo mentality</td>
</tr>
<tr>
<td></td>
<td>Lack of communication and coordination</td>
</tr>
<tr>
<td>Overproduction of information</td>
<td>Repetition of activities</td>
</tr>
<tr>
<td></td>
<td>Lack of knowledge, understanding, communication and coordination Push system</td>
</tr>
<tr>
<td>Loss of good ideas</td>
<td>The information created is not reused between the departments or the different projects</td>
</tr>
<tr>
<td>Resistance to change</td>
<td>Desire to keep the traditional processes</td>
</tr>
<tr>
<td>Achievements unappreciated by the</td>
<td>Misunderstanding between the client’s needs and their interpretation</td>
</tr>
<tr>
<td>customer</td>
<td>Lack of communication and coordination</td>
</tr>
</tbody>
</table>
## Potential sources of information identified for standardization

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level of Detail (LOD)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Templates</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Zoning plans</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Estimates</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Coordination per phases</strong></td>
<td></td>
</tr>
<tr>
<td><strong>BIM execution plan</strong></td>
<td></td>
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</tbody>
</table>
Current State Map: architectural information flow in the design phase
Operationalization

● The role: **format the templates**

● Every change implemented during this step needs to be **tested in practice**.

● **The standardization**: helped to give a better understanding of BIM processes to the users.
Diffusion

- The need to identify all training tools available for BIM authoring software.

- The solution therefore revolved around the design of a single manual.

- Work is still in progress
Conclusions and future work

● We investigated a collaborative design science research using VSM principles to **improve standardization** of information flows in the design phase.

● VSM proved to be a useful technique to **understand and visualize processes** in the design phase to **improve coordination** and to **reduce waste** within the information flows.

● **Future work**: This research is part of a larger research aiming to develop an interactive process map that represents a standardized process:
  ● To develop protocols for each activity
  ● To develop templates for documents
  ● To validate the approach in a real environment
Thank You!