APPLICATION OF DYNAMIC SPREADSHEETS IN THE ANALYSIS OF WASTE BY MAKING-DO

Universidade Federal de Goiás – UFG
Universidade Federal do Ceará

Tatiana Gondim do Amaral, Pedro Boaratti Braga, José de Paula Barros Neto
Objective

- To categorize waste by making-do through a spreadsheet to analyze the data dynamically and simultaneously.
RESEARCH CLASSIFICATION

- We carried out an exploratory and descriptive study, through surveys at nine construction sites, to qualitatively and quantitatively identify events that caused waste by making-do.
DATA COLLECTION

Company selection criteria:
- Interest in participating in academic studies;
- Having a QMS or mapped and monitored processes, allowing access to information such as: plans and their follow-up, verification sheets services and checklists;
- Present projects in execution that make it possible to collect data for research.
Seven medium and large companies were selected, with more than 20 years of experience, which work mostly with high income residential buildings.

All companies except one had PBQP-h - level A (Brazilian Quality System for Construction) and ISO certifications.

The data were collected between July 2017 and August 2018.
DATA COLLECTION

- The questionnaires were applied to the engineers, supervisors and those in charge of the construction sites to obtain better details and associations of surveyed records.
- Photographic records, notes and analysis of drawings and documents were carried out to prove facts and correct waste classification.
- For each site visited, we sought to verify the existence of the following documents: schedule, short and medium-term planning and service verification sheets.
<table>
<thead>
<tr>
<th>PRE CONDITIONS</th>
<th>CATEGORIES</th>
<th>IMPACTS</th>
<th>OTHER WASTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information</td>
<td>Access/Mobility</td>
<td>Decreased productivity</td>
<td>Substitution</td>
</tr>
<tr>
<td>Materials and components</td>
<td>Adjusting components</td>
<td>Demotivation</td>
<td>Overproduction</td>
</tr>
<tr>
<td>Labor Work</td>
<td>Area</td>
<td>Materials waste</td>
<td>Waiting</td>
</tr>
<tr>
<td>Equipment and Tools</td>
<td>Storage</td>
<td>Rework</td>
<td>Processing</td>
</tr>
<tr>
<td>Space</td>
<td>Equipment/ Tools</td>
<td>Reduction of safety</td>
<td>Defective product</td>
</tr>
<tr>
<td>Interdependent services</td>
<td>Installations provisional</td>
<td>Quality reduction</td>
<td></td>
</tr>
<tr>
<td>External conditions</td>
<td>Protection</td>
<td>Lack of terminality</td>
<td></td>
</tr>
<tr>
<td>Installations</td>
<td>Sequencing</td>
<td>Cost</td>
<td></td>
</tr>
</tbody>
</table>

**Frame 1**: Classification of waste by making-do (Figure in Koskela (2000), Sommer (2010) and Fireman (2012)).
The data collected were organized according to the definitions presented (Frame 02).

<table>
<thead>
<tr>
<th>Company</th>
<th>Step</th>
<th>Sub-step</th>
<th>Prerequisites</th>
<th>Description</th>
<th>Cause</th>
<th>Image</th>
<th>Team</th>
<th>Category</th>
<th>Impacts</th>
<th>Other waste</th>
<th>Date</th>
</tr>
</thead>
</table>

From the data collected and classified, these were analyzed using the dynamic spreadsheet Dashboard (Frame 03).

- The risk analysis proposed by Fireman (2012) is used in this work and is based on a subjective and qualitative assessment of cases (Frame 4).

**Frame 4:** Matrix for risk assessment using severity and probability parameters. Source: Fireman (2012)
**Figura 1:** Dashboard

Source: Own authorship (2018).
Among all occurrences of making-do, recorded the "sequencing" category stands out, with 41.55% of the registered cases (Figure 2).

Figure 2: Categories of making-do waste. Source: Own authorship (2018).
The evaluation of the processes related to sequencing shows that there is a greater number of failures in the sub-step "Masonry".

Figure 3: Sub-steps by category
Regarding the missing prerequisites, “labor” stood out with 26.09% of total cases, followed by “information” with 23.19% of cases (Figure 4).

Figure 4: Percentage of prerequisites
When analyzing the main making-do records' impacts, the rework was confirmed with 27.05% of the main impacts generated, followed by the reduction of security, with 23.19% of the analyzed data.
Considering 207 making-do cases recorded, about 29% were classified as high priority, followed by 60% as medium priority, and 11% as low priority.
The records related to “Installations” had a greater need for interventions, with approximately 65.22% of these cases (Figure 7).
## Conclusions

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Access/Mobility</td>
<td>36% Company A</td>
<td>33% Company B</td>
<td>32.5% Company A</td>
</tr>
<tr>
<td>Installations</td>
<td>82% Company A</td>
<td>81% Company B</td>
<td></td>
</tr>
<tr>
<td>Reduction of safety</td>
<td>72% Company A</td>
<td>72% Company A</td>
<td>24% Company A</td>
</tr>
</tbody>
</table>
The objective to categorize waste by making-do through a spreadsheet to analyze the data in a dynamic, crossed and simultaneous way was met.

The dynamics of the results obtained, provides an analysis of the various factors involved in the records collected, serving as a basis for making managerial decisions.
Thanks!

tatiana_amaral@hotmail.com

pedrobraga.engcivil@gmail.com

barrosneto@gercon.ufc.br