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

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Objective

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

Method

RESEARCH CLASSIFICATION

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

Method

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.

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DATA COLLECTION

- 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.

PRE CONDITIONS	CATEGORIES	IMPACTS	OTHER WASTE
Information	Access/Mobility	Decreased productivity	Substitution
Materials and components	Adjusting components	Demotivation	Overproduction
Labor Work	Area	Materials waste	Waiting
Equipment and Tools	Storage	Rework	Processing
Space	Equipment/ Tools	Reduction of safety	Defective product
Interdependent services	Installations provisional	Quality reduction	
External conditions	Protection	Lack of terminality	
Installations	Sequencing	Cost	
		Schedule	

Frame 1: Classification of waste by making-do (Figure in Koskela (2000), Sommer (2010) and Fireman (2012)).

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DATA PROCESSING

- The data collected were organized according to the definitions presented (Frame 02).

Company	Step	Sub-step	Prerequisites	Description	Cause	Image	Team	Category	Impacts	Other waste	Date

Frame 2: Database model. Source: Own authorship (2018).

Method

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

EMPRESA	ETAPA	SUBETAPA	PRÉ REQUISITOS	DESCRIÇÃO	CAUSA	IMAGEM	EQUIPE	CATEGORIA	IMPACTO PRINCIPAL
A	GERENCIAL	CANTEIRO	INFORMAÇÃO	Caixa de energia da rua reconstruída	Necessidade de adaptação após fiscalização da saneago (necessidade de concretar o canaflex cerca de 10 cm em seu entorno)	SEM FOTO	PEDREIROS	AJUSTE DE COMPONENTES	RETRABALHO
A	GERENCIAL	CANTEIRO	INSTALAÇÕES	Ferramentas expostas à intempéries no início da montagem do canteiro	Foram entregues na obra anteriormente a confecção de local para seu armazenamento		ESTOQUE	ARMAZENAMENTO	CUSTO
A	GERENCIAL	CANTEIRO	NENHUM	Início das atividades de canteiro anteriormente ao fechamento da obra	Visando ganho de tempo		MESTRE DE OBRAS	ÁREA DE TRABALHO	REDUÇÃO DA SEGURANÇA
A	GERENCIAL	CANTEIRO	NENHUM	Alocação de Canaletas em local indevido	Falta de análise de Layout de canteiro		MESTRE DE OBRAS	ARMAZENAMENTO	RETRABALHO
A	OUTROS	LIMPEZA	MATERIAIS E COMPONENTES	Resíduos da obra despejados em frente à caçamba	Demora na troca de caçamba, quantidade de caçamba insuficiente		CAÇAMBA	ARMAZENAMENTO	RETRABALHO
A	SEGURANÇA	GUARDA CORPO	MATERIAIS E COMPONENTES	Durante Escavação de terreno obte-se altura de talude maior que 2m sem proteção de guarda corpo	Falta de atuação da equipe de segurança; Complacencia da equipe de Engenharia		SEGURANÇA	PROTEÇÃO	REDUÇÃO DA SEGURANÇA
A	FUNDAÇÃO	GABARITO	INFORMAÇÃO	Gabarito iniciado erroneamente	Falta de locação de ponto correto de início pelo topógrafo		CARPINTEIRO	SEQUENCIAMENTO	RETRABALHO
A	GERENCIAL	TERCEIRIZADOS	MÃO DE OBRA	Funcionário terceirizado trabalhando sem documentação correta	Necessidade de abaixar o preço do serviço; falta de apoio da direção para cumprimento de norma da qualidade existente	SEM FOTO	DIRETORIA	DOCUMENTAÇÃO	REDUÇÃO DA QUALIDADE

Banco de Dados | TABELAS | GRAFICOS | Apoio | Caracterização empresas | ...

Frame 3: Database. Source: Own authorship (2018).

- 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).

PROBABILITY	SEVERITY				
	Very High - I	High - II	Moderate - III	Low - IV	Very Low - V
A - Unlikely					
B- Extremely remote					
C - Remote					
D - Probable					
E - Frequent					

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

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DASHBOARD

DASHBOARD:
MAKING DO ANALYSIS

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).
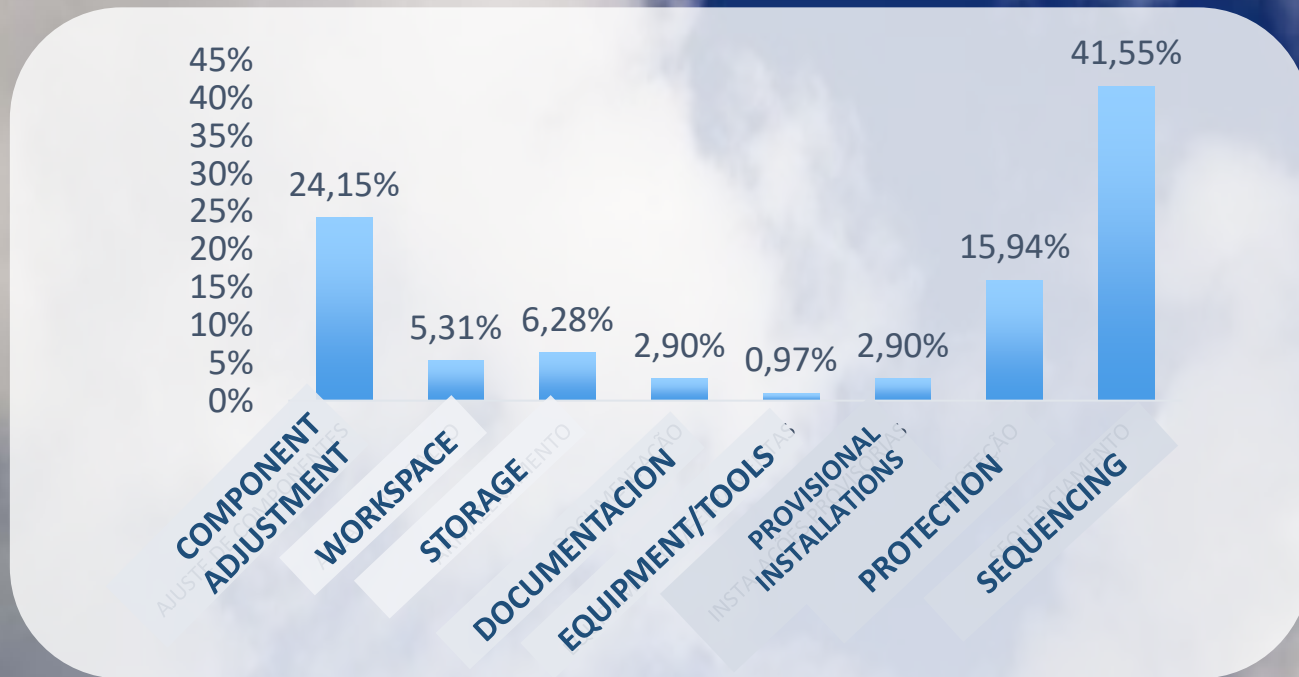
Figure 2: Categories of making-do waste. Source: Own authorship (2018).
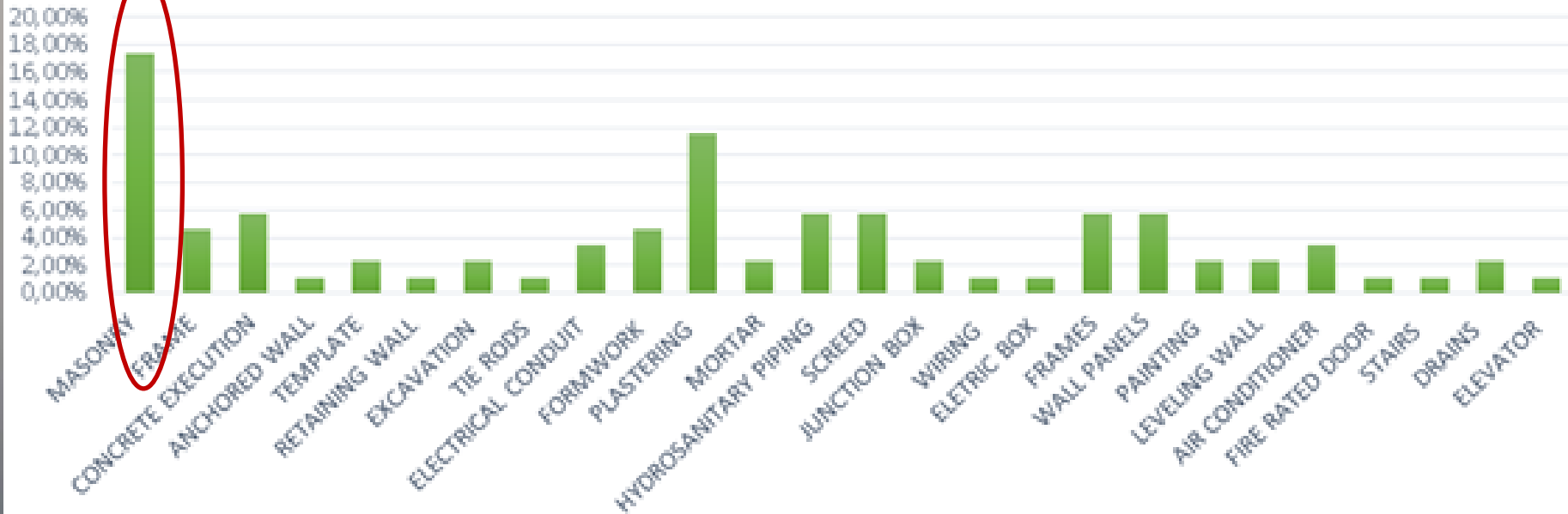
Figure 3: Sub-steps by category

- The evaluation of the processes related to sequencing shows that there is a greater number of failures in the sub-step **"Masonry".**

- 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

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- 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.
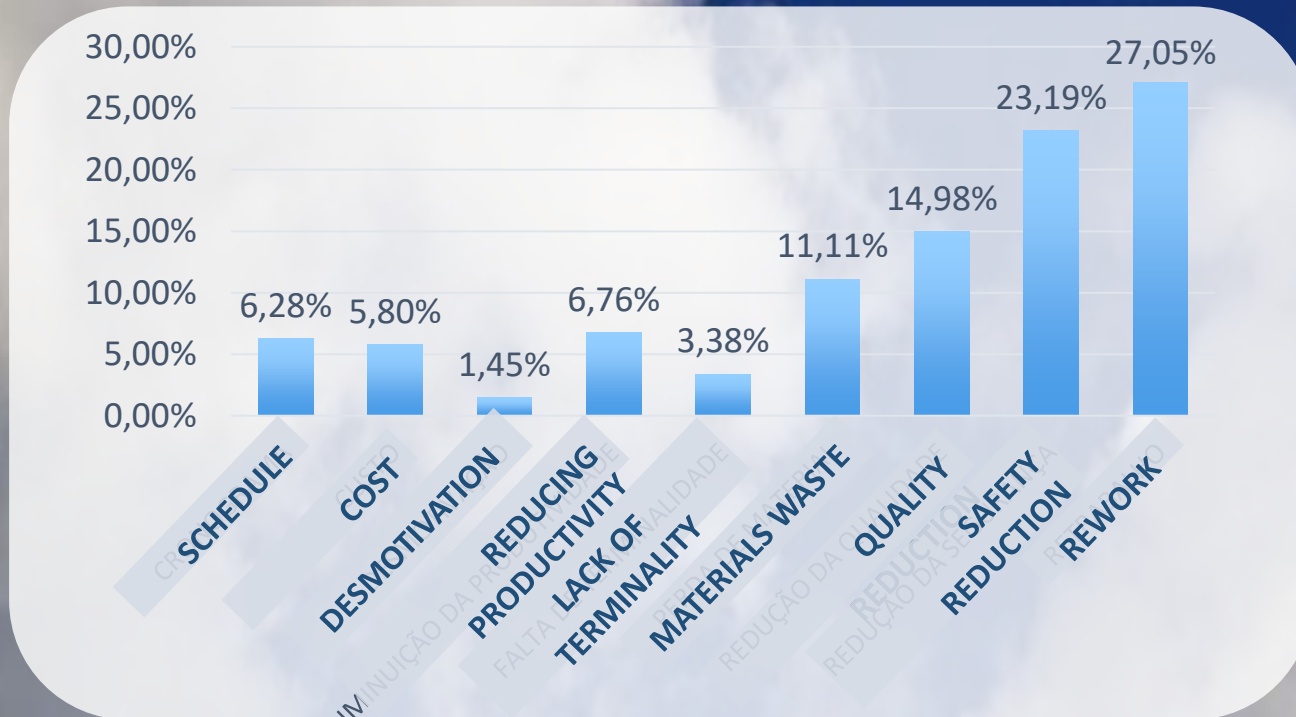
Figure 5: Main impacts

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RISK ANALYSIS

- Considering 207 making-do cases recorded, about 29% were classified as high priority, followed by 60% as medium priority, and 11% as low priority.
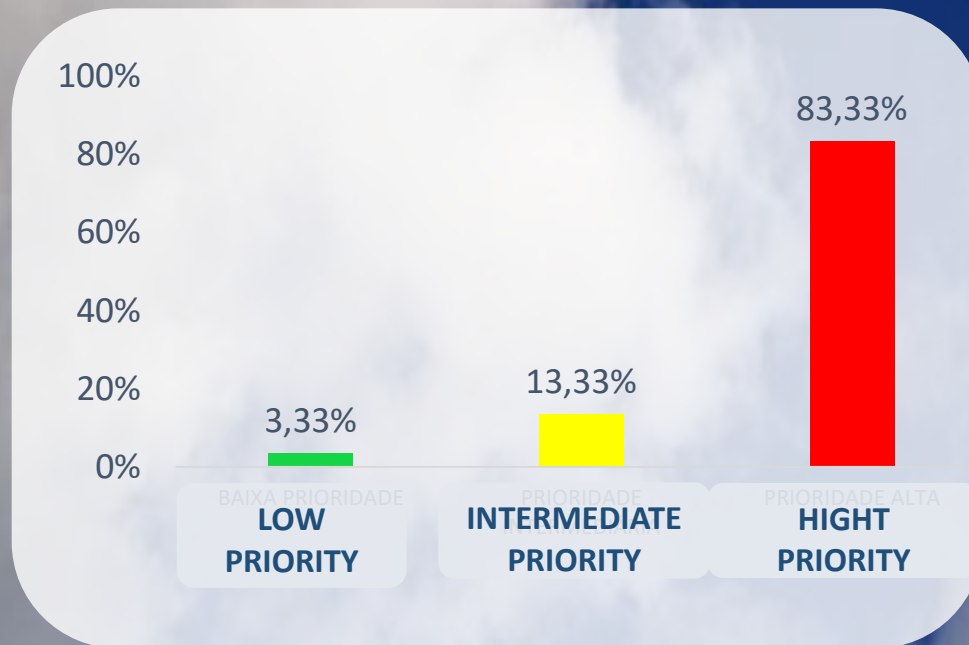

Figure 6: Risk analysis of the security category.

- The records related to "Installations" had a greater need for interventions, with approximately 65.22% of these cases (Figure 7).
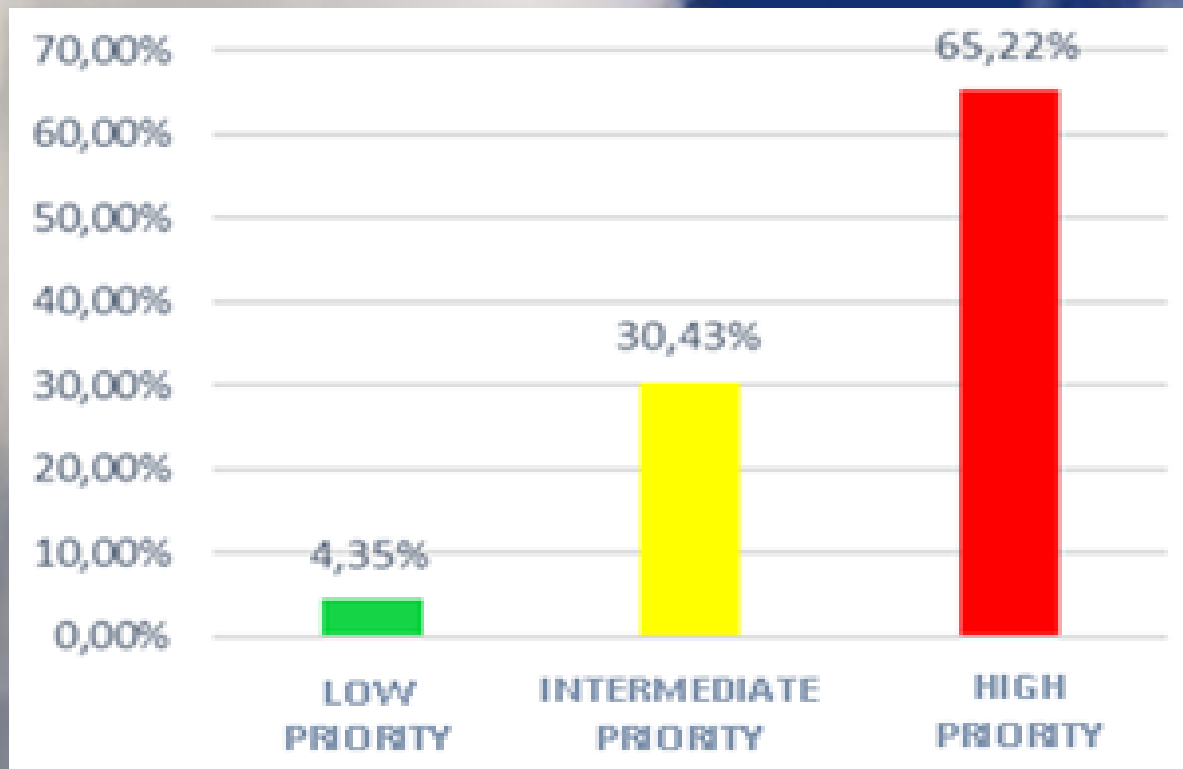

Figure 7: Risk analysis of the prerequisite "Installations"

Conclusions

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	Sommer (2010)		Elias and Brandão (2018)			Braga (2018)		
	Company A	Company B	Company A	Company B	Company C	Company A	Company B	Company C
Main category	36% Access/ Mobility	33% Access/ Mobility	32.5% Sequencing	45.5% Sequencing	46.2% Sequencing	38.71% Protection	26.67% Protection	46.17% Protection
Main Prerequisite	82% Installations	81% Installations	27.3% Information			35.48% Installations	20% Installations and Materials and Components	26.92% Installations
Main Impacts	72% Reduction of safety	72% Materials waste	24% Rework			54.84% Reduction of safety	26.67% Quality reduction and Reduction of safety	53.85% Reduction of safety

Frame 5: Comparative research.
SOURCE: Own authorship.

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Conclusions

- 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.
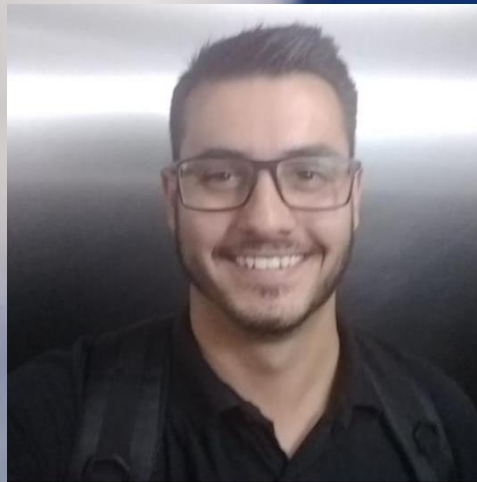
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Thanks!

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