

EVALUATION OF LEAN PRINCIPLES IN BUILDING MAINTENANCE MANAGEMENT

**Isabela S. Dragone, Clarissa N. Biotto
and Sheyla M. B. Serra**

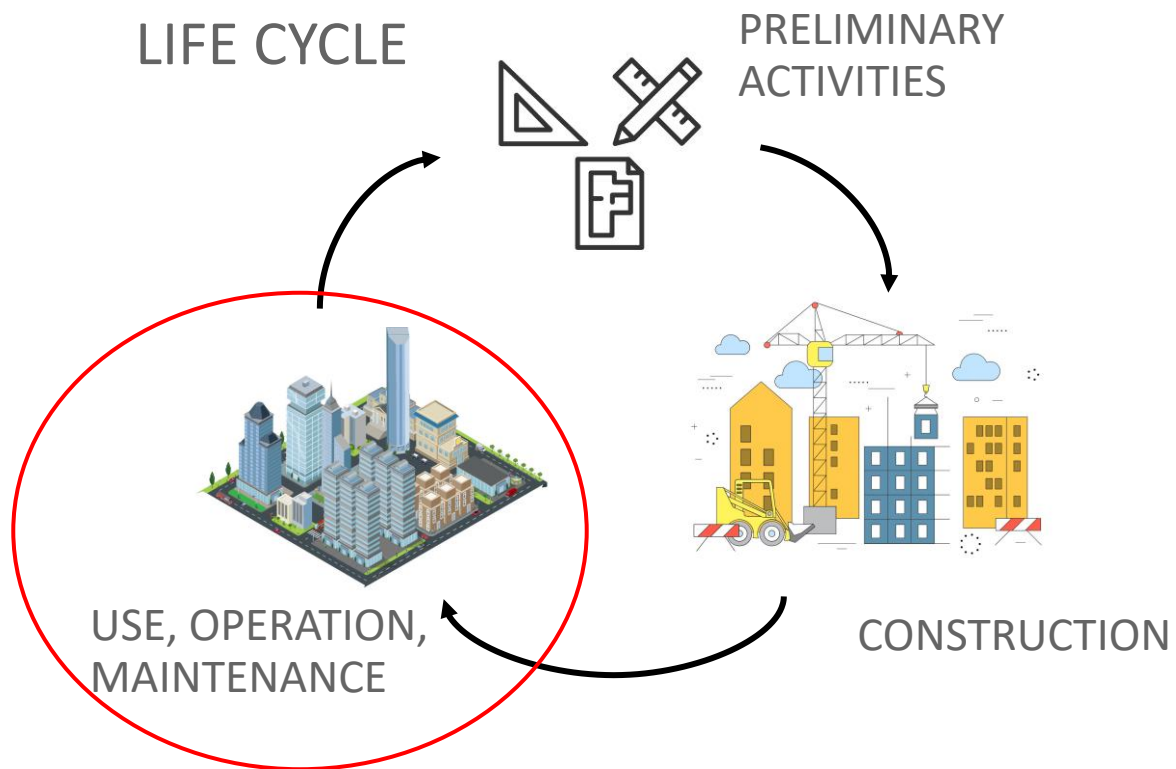
Civil Engineering Department, Federal University of Sao Carlos (UFSCar), Brazil.

AGENDA

- Introduction
- Research Method
- Results
- Conclusions



INTRODUCTION



Maintenance: Set of conservation or restoration activities that must be applied to ensure the functionality, safety and better performance of buildings.

Lack of maintenance or misapplication:

- Cost;
- Accidents;
- No guarantee of projected life.

More than 60% of buildings' accidents are caused by failures in maintenance and use.

IBAPE/SP (2015)

INTRODUCTION

- Maintenance management is a set of strategies aimed at ensuring the effective application of building maintenance.
- With the evolution of buildings, there is a gap in the methods used



- Lean philosophy becomes an alternative.
- Research: Identify lean practices and principles used in a company responsible for building maintenance and the conditions of application.

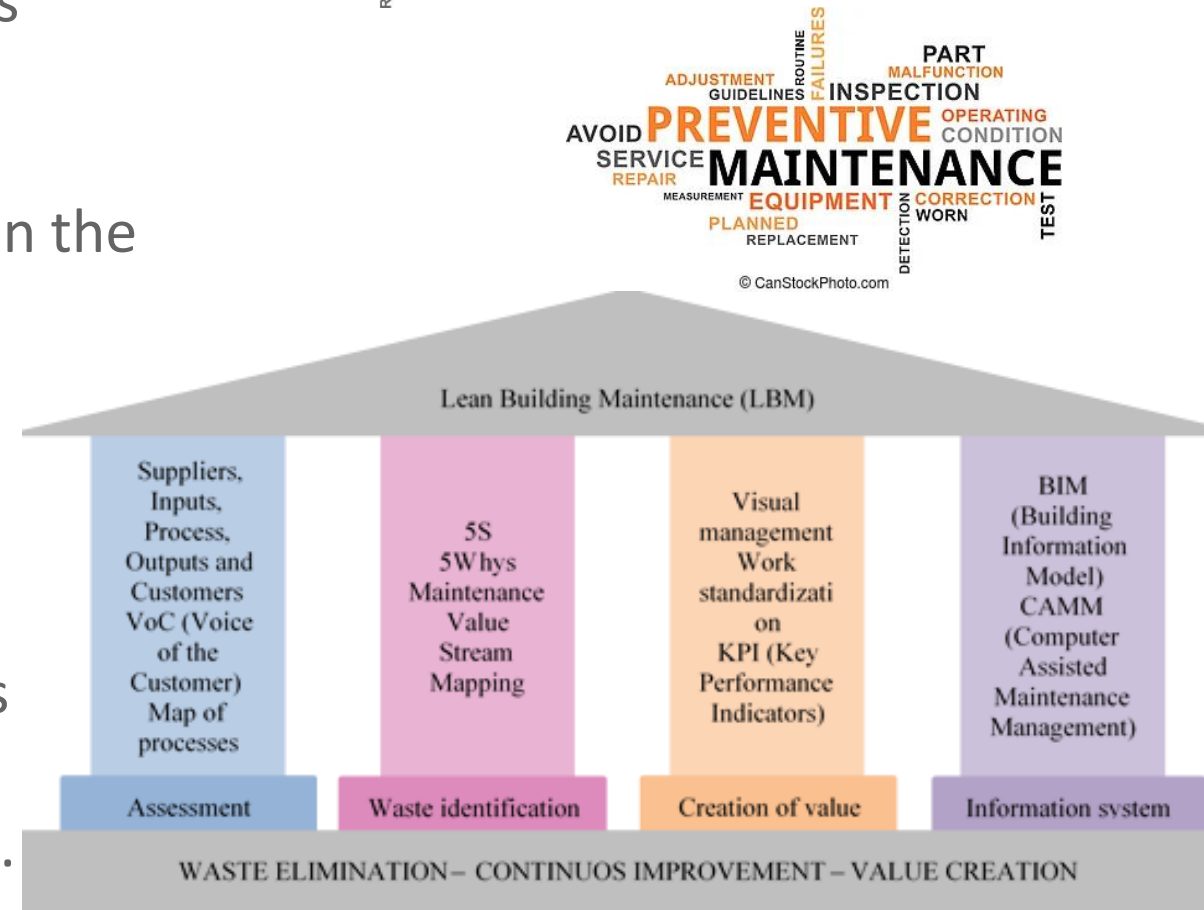


Figure 1. Lean Building Maintenance House (Abreu, Calado and Requeijo; 2016)

RESEARCH METHOD

1. Analyze individual and qualitative the responses;
2. Classify each practice identified in the check list;
3. Assign weights to each of these classification;
4. Apply weighted average.



Figure 2. Itens of check list

1	Identify the value	
1.1	There is a maintenance plan	
1.2	The maintenance plan is periodically reviewed	
1.3	There is a standardised protocol/process for supplier management	
1.4	Is there a system for identifying the opinion, need and preferences of the end customer (VoC)	
1.5	Pre-site inspections are carried out periodically	
1.6	End customers (users) are oriented on proper use and emergencies	
1.7	Maintenance personnel are trained to learn about the philosophy, principles, and basic practices of lean maintenance	
1.8	There is a computerised system for information management	3.9 The use of visual devices is disseminated for information sharing and visualisation of the process flow from start to finish
		3.10 There is the autonomy of employees to perform their duties (no need for verification by the highest positions)
		4. Establish pull
4.1	There is a computerised system for information management	
4.2	There are devices to pull process activities	
4.3	There are devices to identify the removal of items from the process, such as materials and equipment	
4.4	If Kanban cards are used, the subsequent activity removes information from the preceding only in the quantities and in the necessary time	
4.5	There are no large stocks	
4.6	Supplier deliveries are pulled rather than pushed	
4.7	Suppliers deliver in small batches and often	
4.8	Devices for pulling material deliveries contain information about what is requested when to arrive, how much, and where it should be stored	
4.9	There is an established partnership with suppliers	
4.10	There is an established partnership with outsourced services when necessary	
		5 Seek perfection
5.1	There is an evaluation of the indicators of the area	
5.2	Structured tools are used for analysis and troubleshooting, such as PDCA, 5Whys, 5W2H, fishbone diagram, or brainstorming	
5.3	Action plans are drawn up for improvements	
5.4	Senior management is involved with improvement programs	
5.5	New implemented practices are expanded to other activities/processes	
5.6	The improvements made are standardised	
5.7	Employees participate in the development of standards to incorporate their experiences into them	
5.8	The goals and indicators of the area are clearly defined and communicated to all involved	
5.9	The goals of the area are clearly and objectively unfolded so that continuous improvement actions contribute to achieving them	
5.10	Maintenance personnel are trained to learn about the philosophy, principles, and basic practices of lean maintenance	
2	Map the value stream	
2.1	There is a map of maintenance processes	
2.2	There is a map of the current state of the maintenance process	
2.3	A team draws up the current state map with representatives from each part of the process	
2.4	There are indicators for maintenance management	
2.5	There are evaluation and review of the indicators of the	
2.6	Area indicators and metrics are disseminated to all employees	
2.7	The use of visual devices is disseminated for the sharing of information	
2.8	There is a computerised system for information management	
3	Create continuous value flow	
3.1	There is a future state map, and action plans to implement it	
3.2	A team with representatives from each part of the process analyses the map of the current state and elaborates the future state	
3.3	Structured tools are used for analysis and waste solution, such as 5Whys, fishbone diagram, or brainstorming	
3.4	There is an application of 5S or similar programs	
3.5	There is a preference for preventive maintenance rather than corrective maintenance	
3.6	There are operation sheets and standard routines to guide maintenance activities	
3.7	There is a maintenance plan	
3.8	There are specific locations for depositing materials and searching for information, and these favours the performance of the activities	

RESEARCH METHOD

Parameters	Equation item	Score
Does not apply (NA)	-	0,0
Does not exist (NE)	A'	0,0
Very weak application (VWA)	B	2,5
Weak application (WA)	C	5,0
Strong application (SA)	D	7,5
Very strong application (VSA)	E	10,0

$$\begin{aligned}
 \text{Score} &= \\
 &= \frac{(\sum B \times 2,5) + (\sum C \times 5,0) + (\sum D \times 7,5) + (\sum E \times 10,0)}{(\sum A' + \sum B + \sum C + \sum D + \sum E)}
 \end{aligned}$$

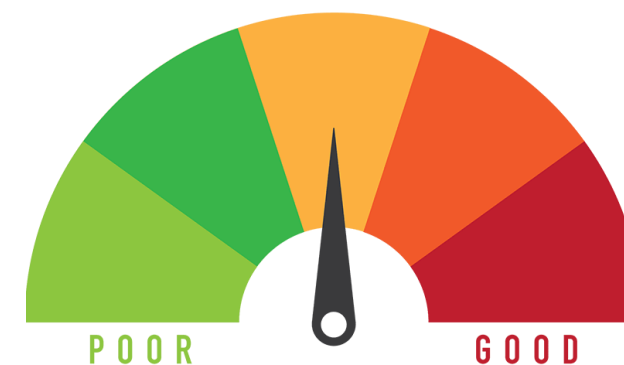


Table 1. Parameters for the evaluation of the lean maintenance practices

RESEARCH METHOD

		NA	NE	MFR	FR	FO	MFO
3	Create continuous value flow						
3.1	There is a future state map, and action plans to implemented it		X				
3.2	A team with representatives from each part of the process analyses the map of the current state and elaborates the future state	X					
3.3	Structured tools are used for analysis and waste solution, such as 5Whys, fishbone diagram, or brainstorming	X					
3.4	There is an application of 5S or similar programs						X
3.5	There is a preference for preventive maintenance rather than corrective maintenance						X
3.6	There are operation sheets and standard routines to guide maintenance activities						X
3.7	There is a maintenance plan						X
3.8	There are specific locations for depositing materials and searching for information, and these favours the performance of the activities						X
3.9	The use of visual devices is disseminated for information sharing and visualisation of the process flow from start to finish						X
3.10	There is the autonomy of employees to perform their duties (no need for verification by the highest positions)					X	
	TOTAL	2	1	0	0	1	6
	NOTA	8,4					

Figure 3. Exemple of data analysis applied.

RESULTS (CASE STUDY)

Employees in the sector	9
Main use of the buildings	Industrial
Buildings serviced	3
Total area served	78 m²
Age of buildings	From 5 to 25 years
Area served by employee	8667 sqm/employee

Table 2. Case study description

RESULTS

Company's final score

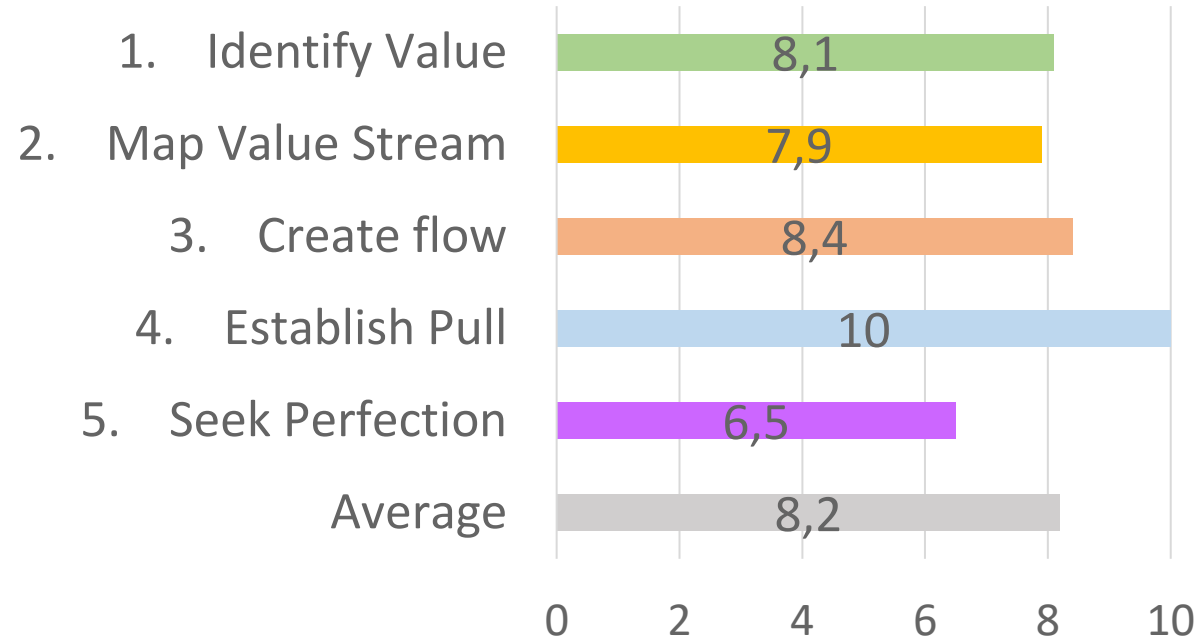
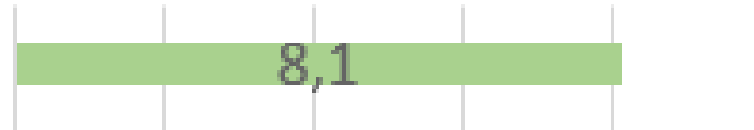


Figure 4. The average score of company for the principles

RESULTS

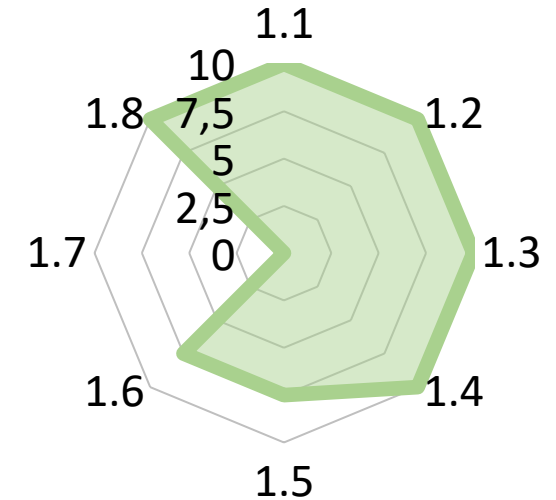
1. Identify Value



PRACTICES AND TOOLS

- Customer's satisfaction survey;
- Maintenance plan;
- Building inspections;
- Users' guidance regarding the building's use and operation, including emergencies.

1. Identify Value



RESULTS

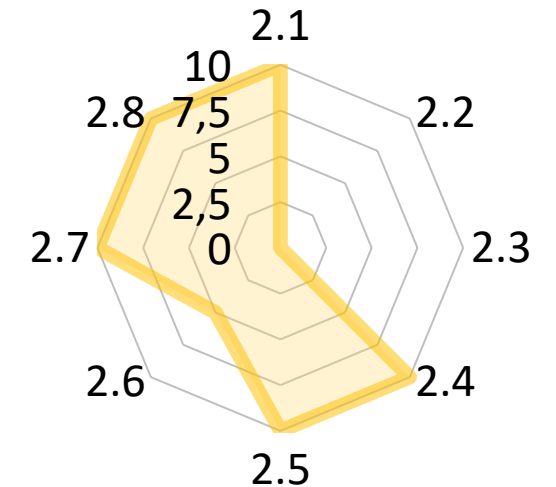
2. Map Value Stream



PRACTICES AND TOOLS.

- Process map;
- Elaboration, evaluation and dissemination of indicators;
- Use of visual devices.

2. Map Value Stream

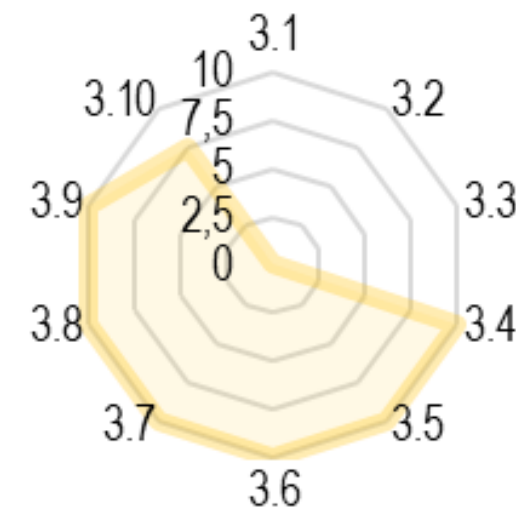


RESULTS

3. Create flow



3. Create Flow

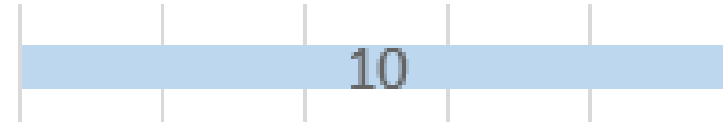


PRACTICES AND TOOLS

- Maintenance plan with standardised maintenance procedures;
- Preference for preventive and predictive maintenance;
- 5S program (imposed by contract);
- Specific locations for stock and information;
- Use of visual devices;
- Employee autonomy.

RESULTS

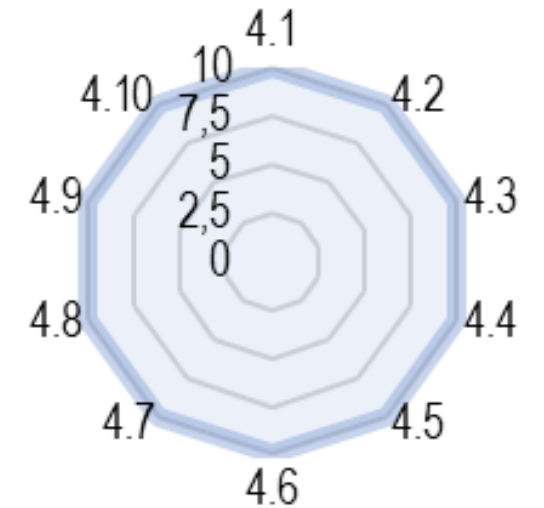
4. Establish Pull



PRACTICES AND TOOLS

- Devices for pulling activities from the process;
- Devices to identify a removal of items (Kanban);
- Small stocks;
- Established partnerships.

4. Establish Pull



RESULTS

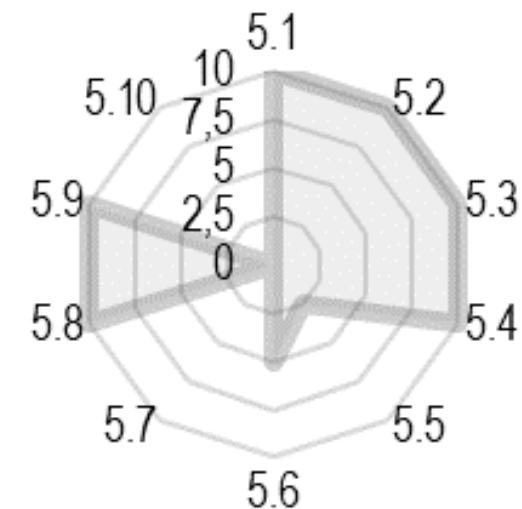
5. Seek Perfection



PRACTICES AND TOOLS

- Indicator evaluation;
- Use of structured tools for analysis and problem solving;
- Improvement action plans;
- Standardized improvements.

5. Seek Perfection



CONCLUSIONS

Check list demonstrated despite the high score of the case that the company can still improve based on lean principles and technical standards.



The organizational culture had an impact on the results as it led to several practices.



The isolated application of lean tools and practices does not guarantee the implementation of the mentality.





ACKNOWLEDGMENTS

THANK FOR YOUR ATTENTION!

Isabela S. Dragone

isabeladragone@estudante.ufscar.br

Clarissa N Biotto

clarissa.biotto@ufscar.br

Sheyla M. B. Serra

sheylabs@ufscar.br



Núcleo de Pesquisa em Racionalização
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