

# Identifying Barriers in Lean Implementation in the Construction Industry

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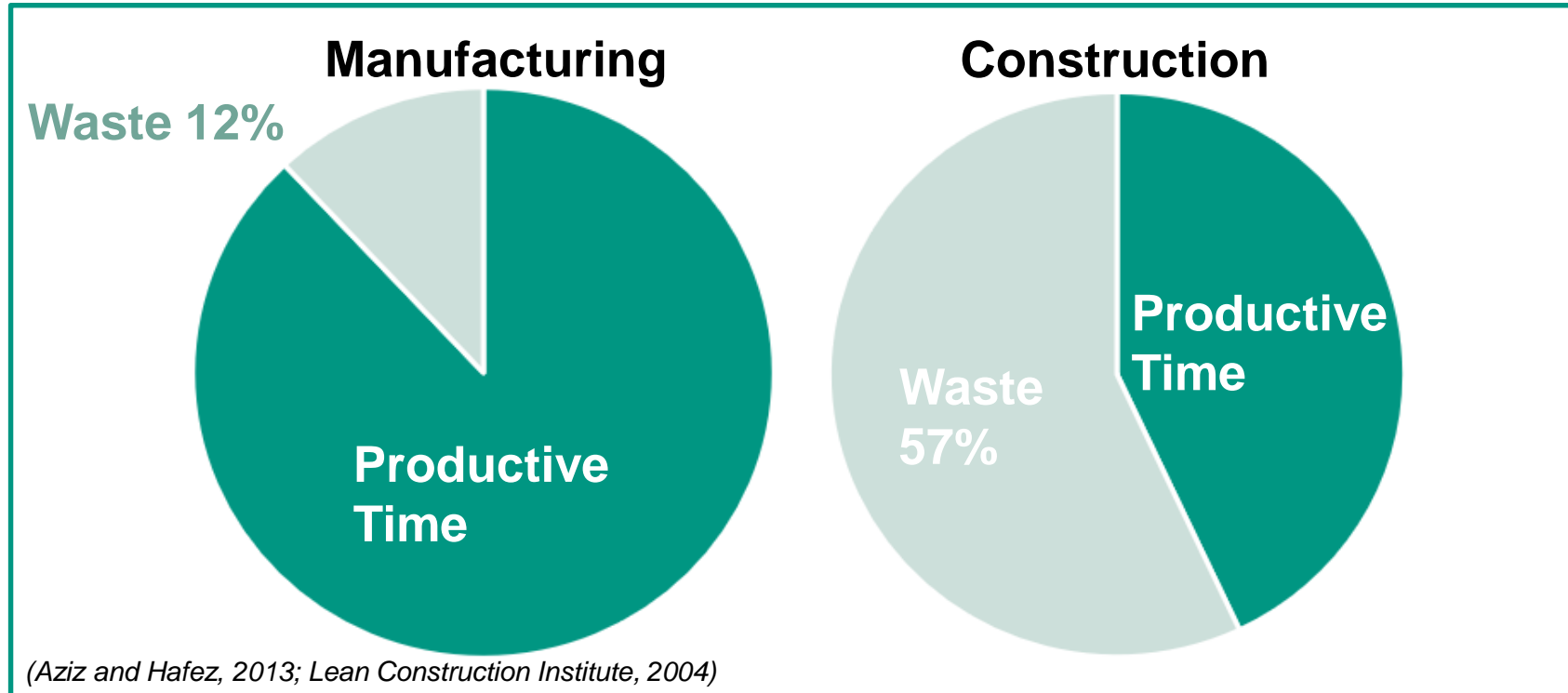
**Karlsruhe Institute of Technology**

1. Background and motivation
2. Literature Review: Barriers of lean implementation
3. Survey: Ranking of barriers
4. Conclusions and outlook

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# High share of non-value adding activities in the construction industry requires strategies to minimize waste

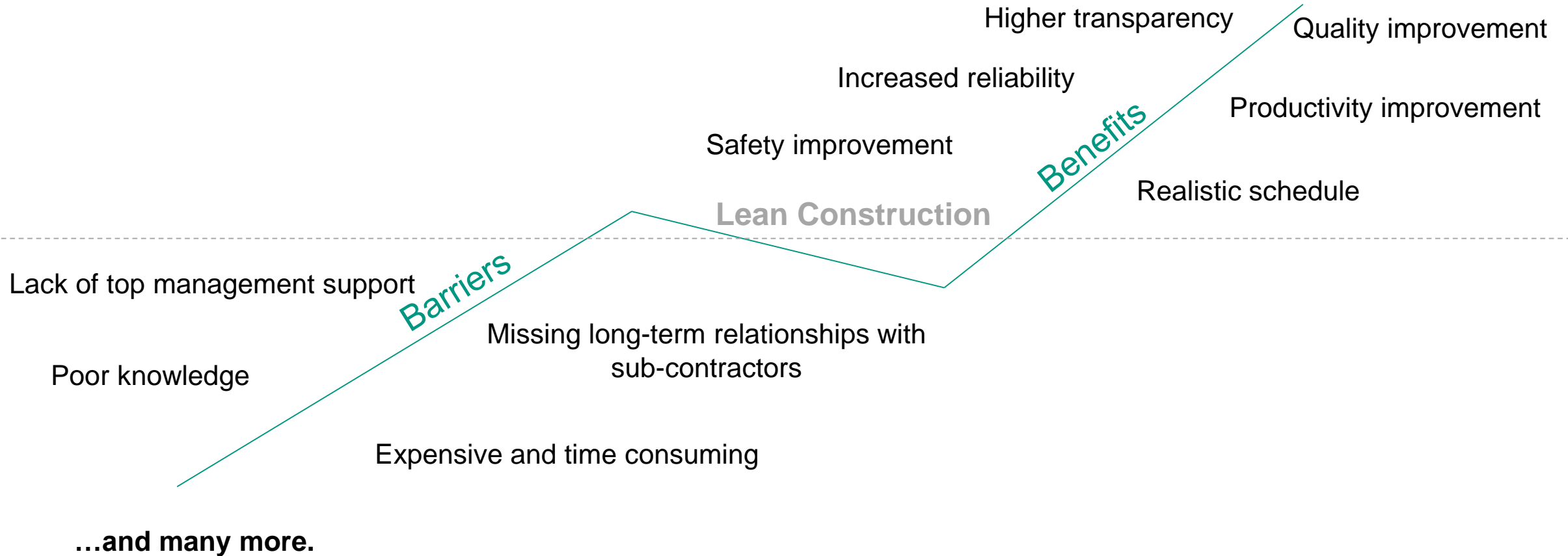
## Productive time vs. Non-value adding activities in manufacturing and construction



**Processes in the construction industry are more wasteful than processes in other industries**

(Medows D, 2011; Environmental Protection Agency USA, 2003)

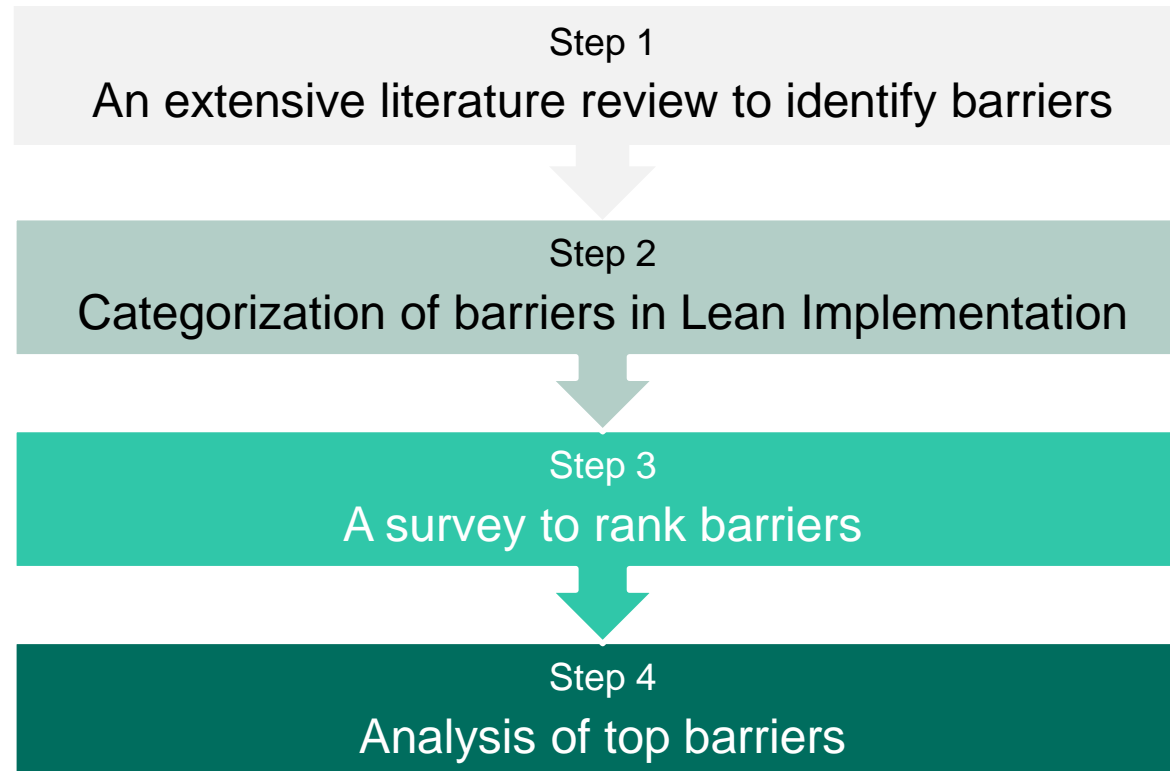
# One of the main aims of lean construction is the minimization of waste – Overcoming barriers is necessary



(Mossmann 2009; Sarhan and Fox, 2013; Almani et al. 2017; Okere 2017; )

# To facilitate an efficient and successful lean implementation, barriers of implementation need to be identified & understood

Research methods to identify barriers of lean implementation



1. Background and motivation
2. Literature Review: Barriers of lean implementation
3. Survey: Ranking of barriers
4. Conclusions and outlook



# A comprehensive literature review was conducted and 27 barriers were identified

## Literature review

- Keywords: “barriers, Lean implementation, and Lean construction“
- Databases such as Google scholar, Sciencedirect, ASCE library, and Web of Science, IGLC papers
- 50 papers



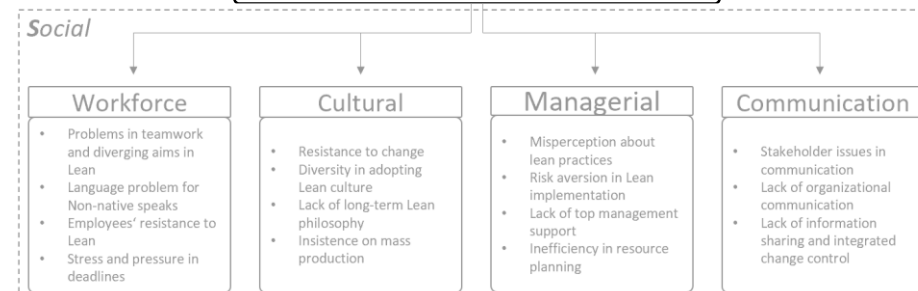
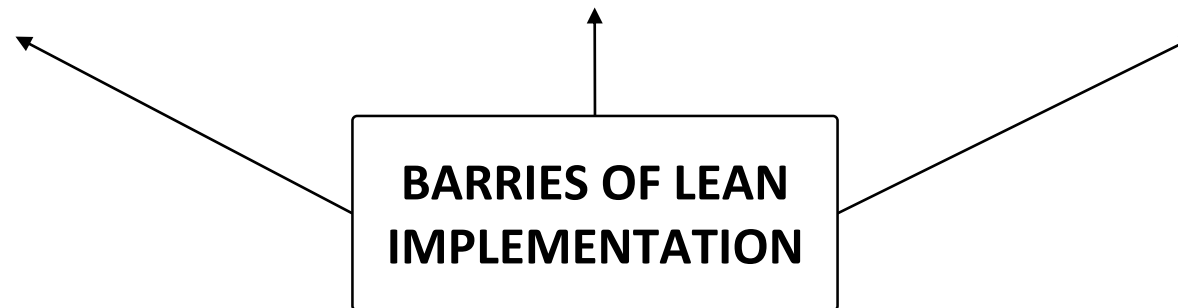
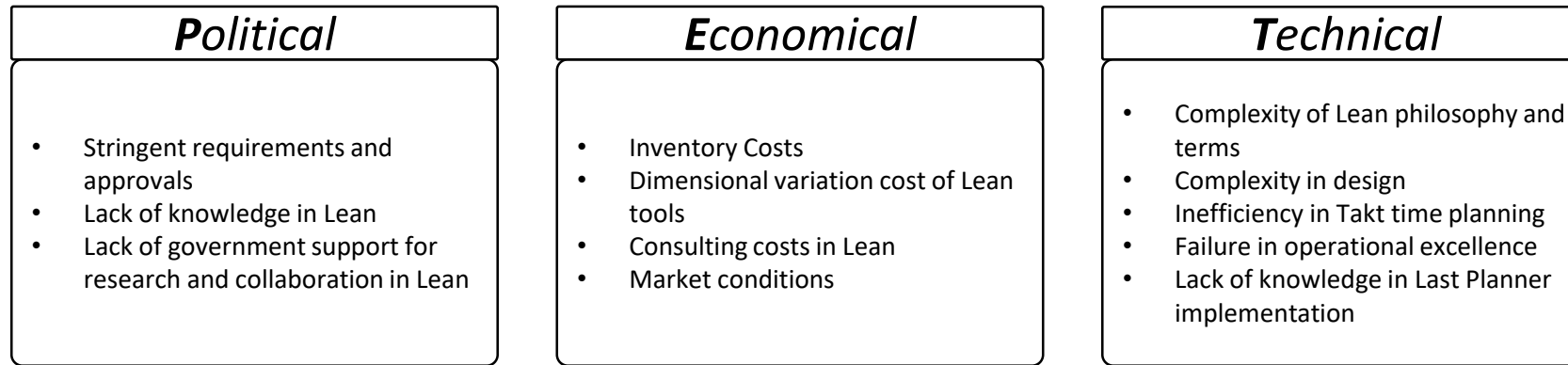
## Discussions with experts

- Face-to-face or via Skype
- Three university professors
- Four industry practitioners

**27** barriers were identified

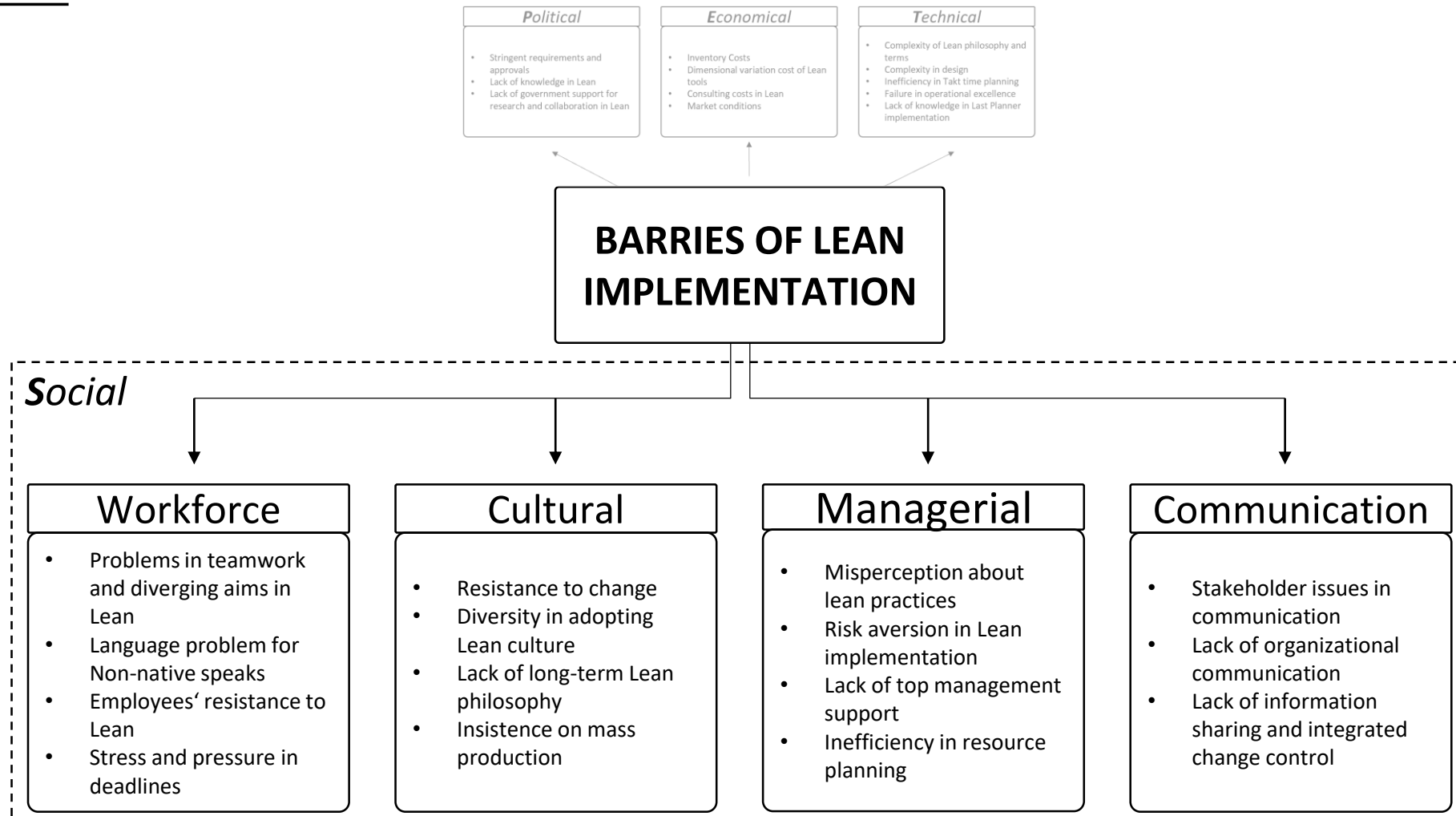
# The 27 barriers for lean implementation were categorized with a PEST analysis (1/2)

## Political, economical and technical barriers



# The 27 barriers for lean implementation were categorized with a PEST analysis (2/2)

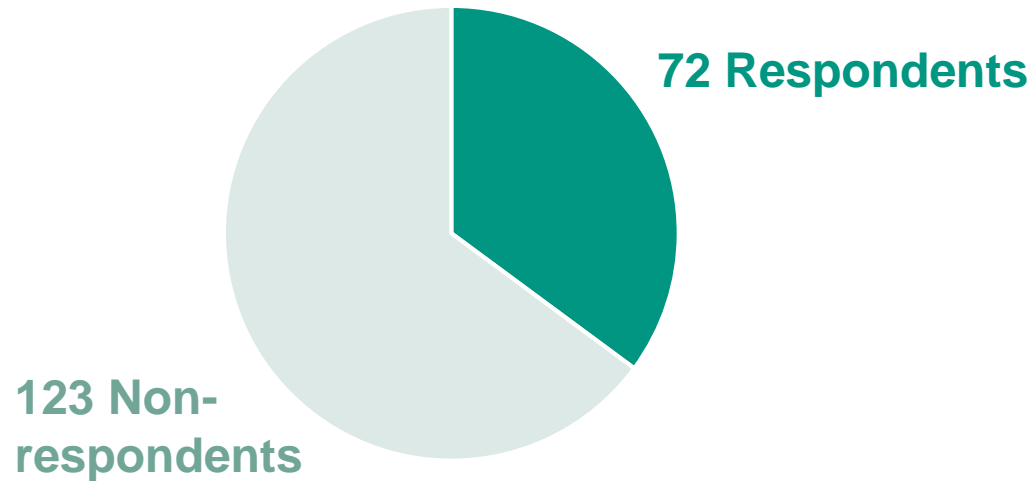
## Social barriers



1. Background and motivation
2. Literature Review: Barriers of lean implementation
3. Survey: Ranking of barriers
4. Conclusions and outlook

# Via a survey with 72 participants, the identified barriers were ranked with respect to their relevance

## Response rate



- ➔ Survey was distributed to 205 corporate members of the LCI in the USA.
- ➔ 72 Respondents → Response rate of ~35%

## Method of evaluation 1-5 point Likert scale

Relevance of the respective barrier....:



Please rank barriers for lean implementation from 1 to 5, where 1 means "not important" and 5 means "most important"

	Not important	Slightly important	Moderately important	Important	Very important
Inventory costs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dimensional variation costs of Lean tools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Consulting costs in Lean	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Market conditions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Misperception about Lean practices	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Risk aversion in Lean implementation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of top management support	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inefficiency in resource planning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Complexity of Lean philosophy and terms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

# „Lack of top management support“ was rated as the top barrier of lean implementation

## Ranking results – Top 3 barriers of lean implementation

Barrier	Mean	Rank
Lack of top management support	4.61	1
Misperception about Lean practices	4.14	2
Lack of information sharing and integrated change control	4.09	3
...	...	...

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## Lessons Learned

- The socio-cultural barriers were rated as top barriers
- Successful Lean implementation is possible with a better coordination of work teams and support from managerial side is a must!

## Outlook

- Further investigations in other countries
- Impact of barriers on construction costs
- Impact of barriers on construction site safety

**Lean implementation affects the overall success of construction. Therefore, one needs to consider these barriers carefully to execute construction works with more success.**

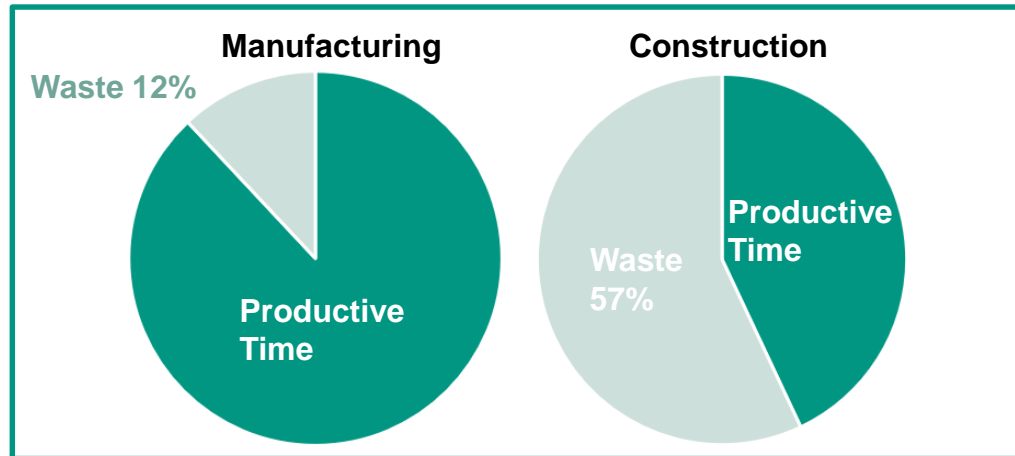


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BACKUP

# High share of non-value adding activities in the construction industry requires strategies to minimize waste

## Productive time vs. Non-value adding activities in manufacturing and construction



(Aziz and Hafez, 2013; Lean Construction Institute, 2004)

Processes in the construction industry are more wasteful than processes in other industries

(Medows D, 2011; Environmental Protection Agency USA, 2003)

## 8 types of waste according to lean construction

- Transportation
- Inventory
- Motion
- Waiting
- Over-Production
- Over-Processing
- Defects
- Skills misuse

(Terry and Smith, 2011; Sarhan and Fox, 2013)

# Via a survey with 72 participants, the identified barriers were ranked with respect to their relevance

Please rank barriers for lean implementation from 1 to 5, where 1 means “not important” and 5 means “most important”

	Not important	Slightly important	Moderately important	Important	Very important
Inventory costs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dimensional variation costs of Lean tools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Consulting costs in Lean	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Market conditions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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Risk aversion in Lean implementation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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Inefficiency in resource planning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Complexity of Lean philosophy and terms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## BACKUP: Respondent Profile

	Average	Median	Maximum	Minimum
Years of Experience in the Construction Industry	42	48	125	12
Years of experience in Lean implementation	13	17	20	3
Number of Employees	282	38	10000	2

# BACKUP: Ranking of barriers of Lean implementation

Barrier	Mean	Rank
Lack of top management support	4.61	1
Misperception about Lean practices	4.14	2
Lack of information sharing and integrated change control	4.09	3
Stakeholder issues in communication	4.04	4
Inefficiency in resource planning	4.00	5
Failure in operational excellence	4.00	6
Lack of organizational communication	4.00	7
Employees' resistance to Lean	3.96	8
Resistance to change	3.96	9
Problems in teamwork and diverging aims in Lean	3.91	10
Diversity in adopting Lean culture	3.91	11
Lack of knowledge in Lean	3.83	12
Inventory costs	3.74	13
Lack of long-term Lean philosophy	3.67	14
Market conditions	3.65	15
Stress and pressure in deadlines	3.65	16
Complexity of Lean philosophy and terms	3.64	17
Risk aversion in Lean implementation	3.61	18
Complexity in design	3.57	19
Inefficiency in Takt time planning	3.57	20
Stringent requirement and approvals	3.57	21
Dimensional variation cost of Lean tools	3.52	22
Lack of knowledge in Last Planner implementation	3.52	23
Insistence on mass production	3.52	24
Consulting costs in Lean	3.43	25
Language problem for non-native speakers	3.30	26
Lack of government support for research and collaboration in Lean	3.04	27

## BACKUP: Ranking of barriers of Lean implementation (1/2)

Barrier	Mean	Rank
Lack of top management support	4.61	1
Misperception about Lean practices	4.14	2
Lack of information sharing and integrated change control	4.09	3
Stakeholder issues in communication	4.04	4
Inefficiency in resource planning	4.00	5
Failure in operational excellence	4.00	6
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Lack of knowledge in Lean	3.83	12
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## BACKUP: Ranking of barriers of Lean implementation (2/2)

Barrier	Mean	Rank
Market conditions	3.65	15
Stress and pressure in deadlines	3.65	16
Complexity of Lean philosophy and terms	3.64	17
Risk aversion in Lean implementation	3.61	18
Complexity in design	3.57	19
Inefficiency in Takt time planning	3.57	20
Stringent requirement and approvals	3.57	21
Dimensional variation cost of Lean tools	3.52	22
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