Developing a
Lean Culture Index
in Construction

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INTRODUCTION

16% of large firms listed on Fortune magazine have **survived** since early 1900s
(Cameron and Quinn 2005)

5 Life Cycle Stages of New Management Concepts **Ettore (1997)**

- 05
- 04
- 03
- 02
- 01

- Little support
- Decreasing interest
- Further studying, analyzing, and criticizing the concept
- Momentum gain
- Discovery of the new management concept

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INTRODUCTION

Several companies have failed in implementing LC (superficial manner, conflicting principles)

Simonsen et al. 2014

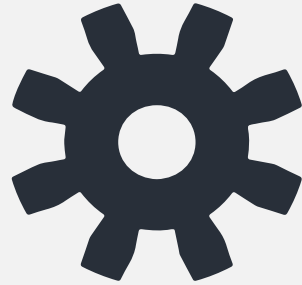**5 – 10 Years to properly engross Lean behaviors**

Emiliani (1998)

This study

Goal

To understand Lean culture as the primary step to its successful implementation

LCI Development

Lean Culture Index (LCI) is developed to reflect the construction firms' Lean culture level

Assessment

Index is applied to medium and large-scale construction firms to help in assessing their existing culture and compare it to the Lean culture
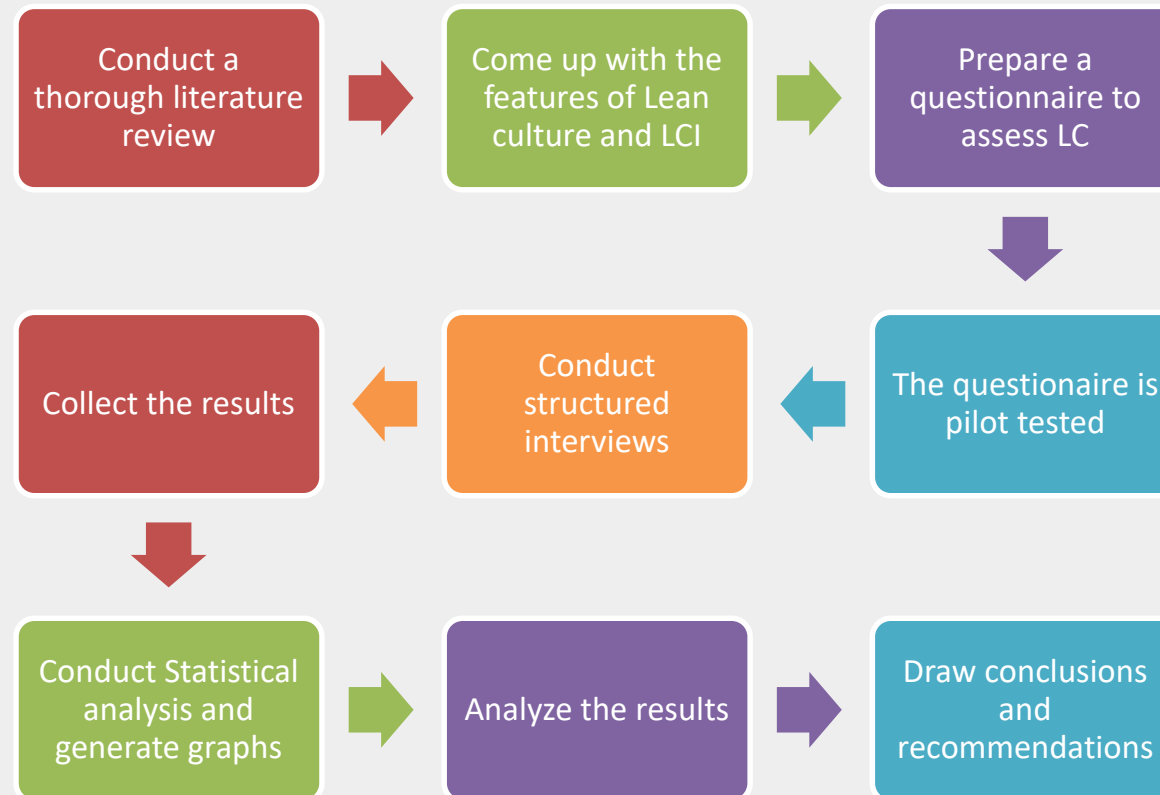
Recommendations

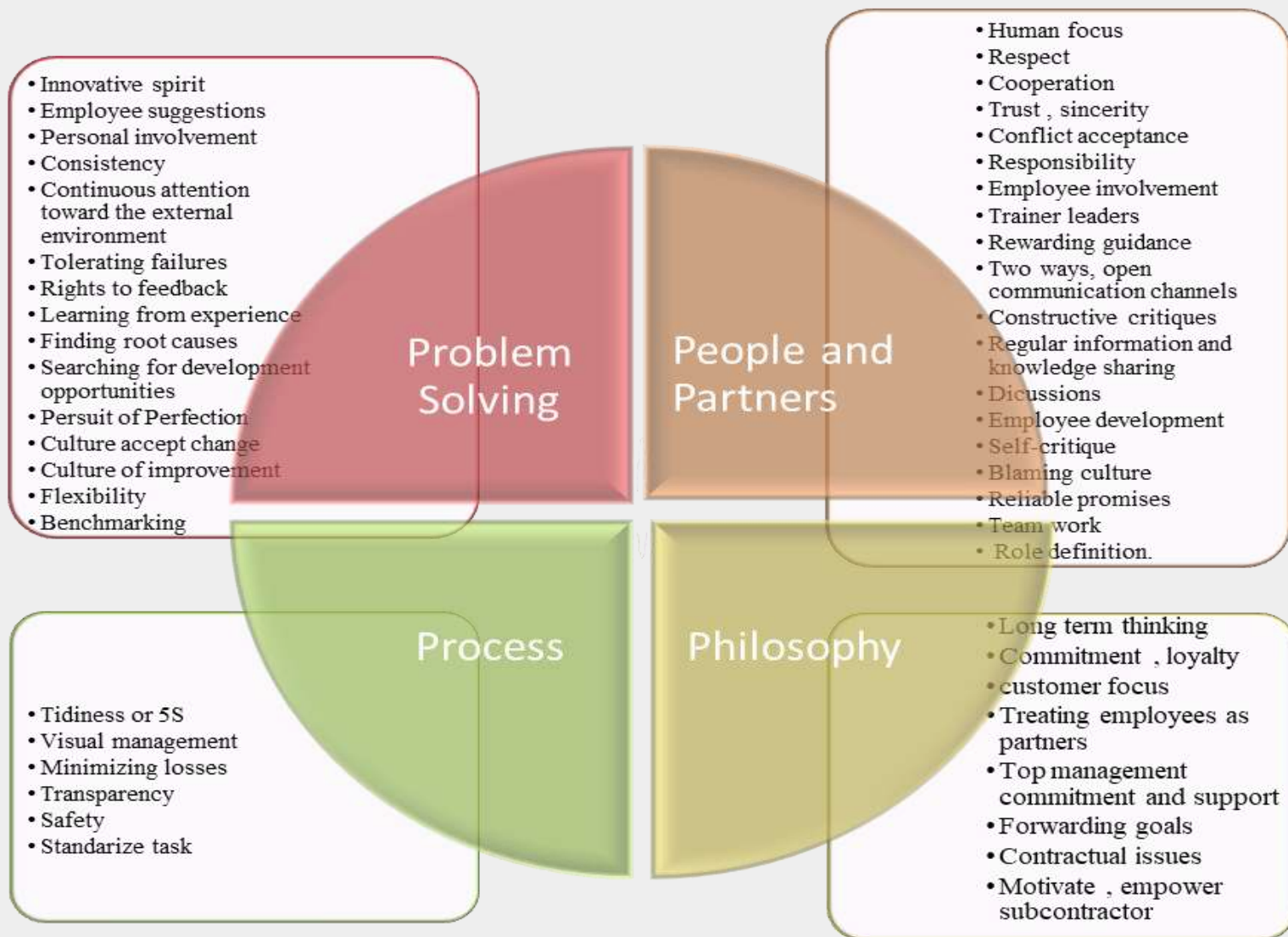Recommendations related to cultural change are given as a foundation for successful lean implementation

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METHODOLOGY
Design Science Research (DSR)

Conduct a thorough literature review	Come up with the features of Lean culture and LCI	Prepare a questionnaire to assess LC
Collect the results	Conduct structured interviews	The questionaire is pilot tested
Conduct Statistical analysis and generate graphs	Analyze the results	Draw conclusions and recommendations

Index development-Lean Features

Problem Solving
- Innovative spirit
- Employee suggestions
- Personal involvement
- Consistency
- Continuous attention toward the external environment
- Tolerating failures
- Rights to feedback
- Learning from experience
- Finding root causes
- Searching for development opportunities
- Persuit of Perfection
- Culture accept change
- Culture of improvement
- Flexibility
- Benchmarking

People and Partners
- Human focus
- Respect
- Cooperation
- Trust , sincerity
- Conflict acceptance
- Responsibility
- Employee involvement
- Trainer leaders
- Rewarding guidance
- Two ways, open communication channels
- Constructive critiques
- Regular information and knowledge sharing
- Dicussions
- Employee development
- Self-critique
- Blaming culture
- Reliable promises
- Team work
- Role definition.

Process
- Tidiness or 5S
- Visual management
- Minimizing losses
- Transparency
- Safety
- Standarize task

Philosophy
- Long term thinking
- Commitment , loyalty
- customer focus
- Treating employees as partners
- Top management commitment and support
- Forwarding goals
- Contractual issues
- Motivate , empower subcontractor

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Structured face-to-face interviews

60 questions in (1-5) Likert scale format representing **48** lean features.
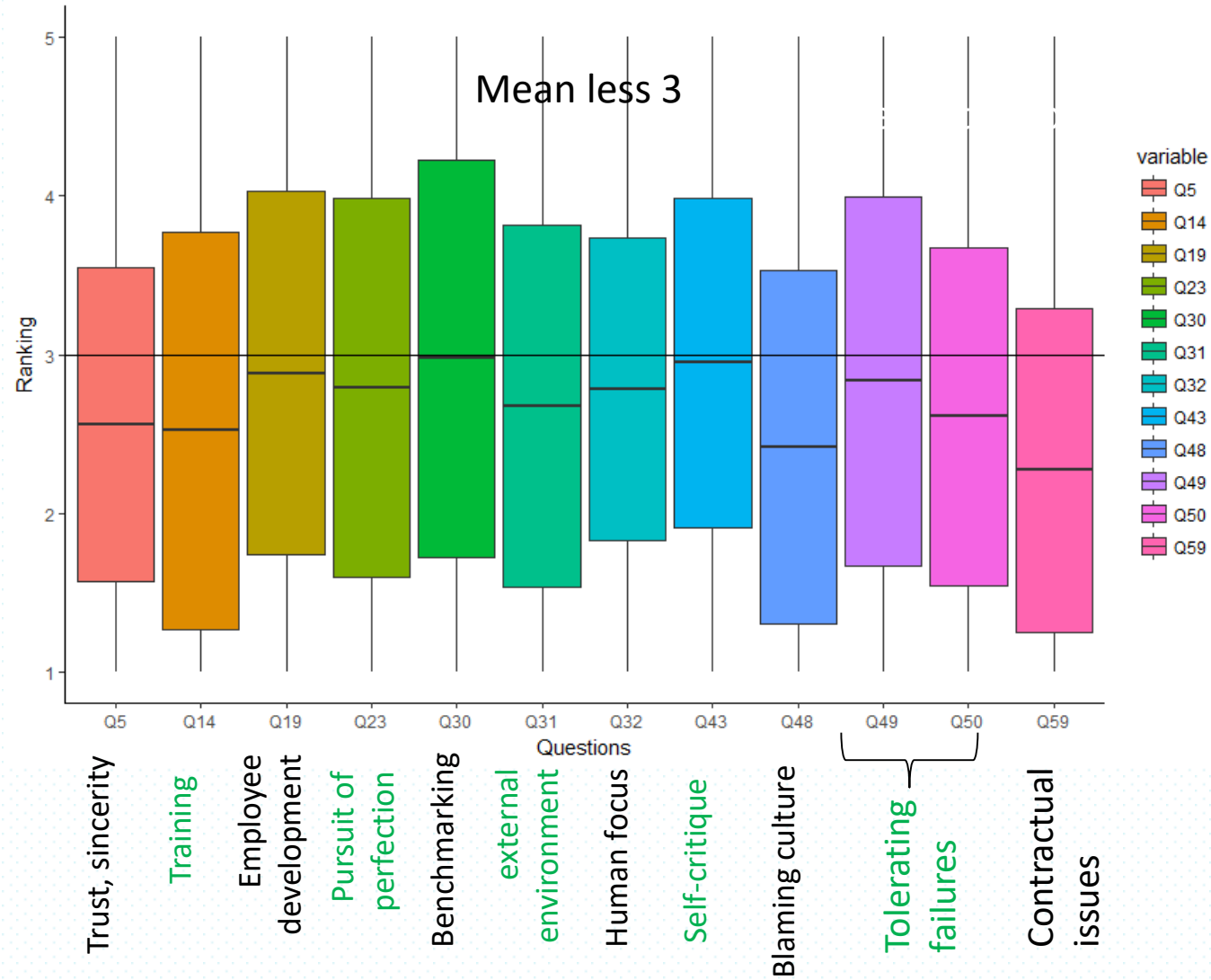

109 respondents from **20** construction sites representing 20 different companies in different Lebanese districts

10 large-scale and **10** medium-scale companies

Questionnaires were administered to **white-collar** employees **and** **blue-collar** employees
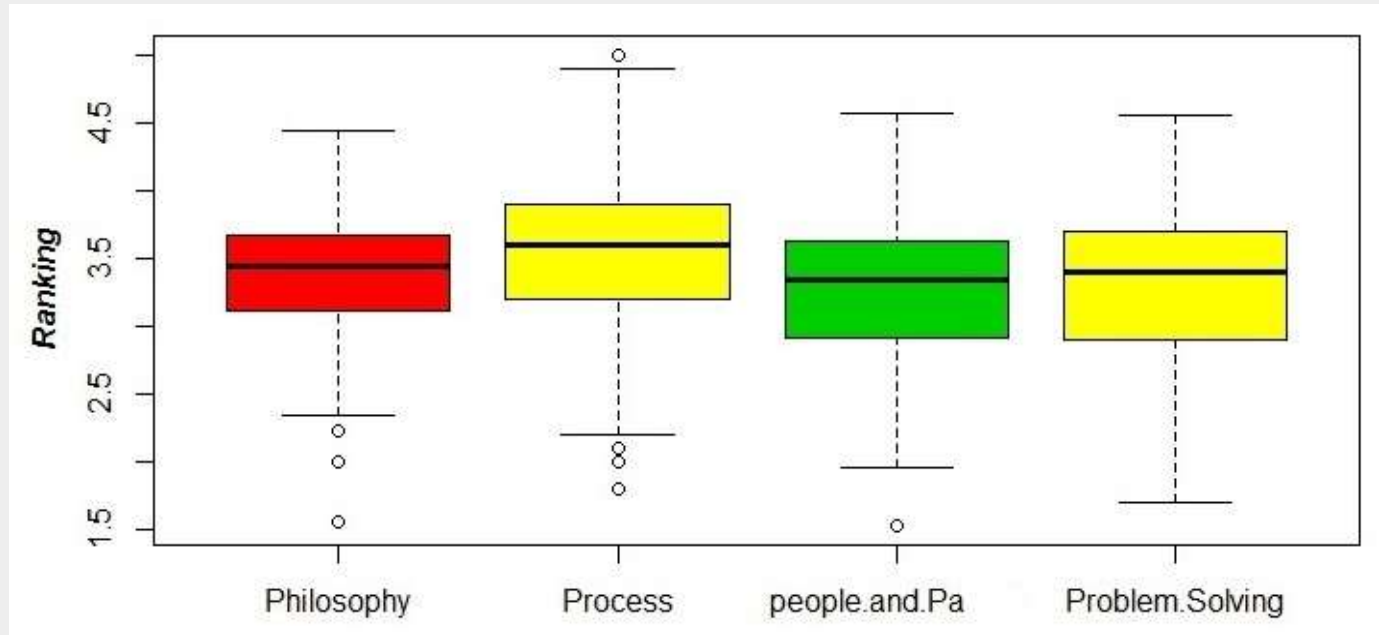
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Features of Lean Culture

DATA ANALYSIS & DISCUSSION

EVALUATING THE DIFFERENCE IN 4P'S

Process

Philosophy

People and Partners

Problem Solving

Engineers are more goal-oriented

Lean Culture Index (LCI)

Company 2							
Company	B	B	B	B	B	B	B
ID	12	13	14	15	16	17	18
WC/BC	S.E.	A.E.	S.E.	P.M.	S.E.	F	F
Q1	3	2	3	4	5	5	5
Q2	1	1	3	4	4	4	4
Q3	3	3	4	4	2	4	5
Q4	3	3	5	5	5	4	4
Q5	3	3	4	3	5	4	4
Q6	2	1	5	5	2	4	4
Q7	3	3	5	5	5	4	4
Q8	3	3	3	5	4	5	5
Q9	3	3	4	4	4	4	4
Q10	2	2	4	4	4	4	4
Q11	2	2	3	4	4	4	4
...	...	...	...	...	...	...	...
......	...	...	...	...	...	...	...
......	...	...	...	...	...	...	...
.....	...	...	...	...	...	...	...
Q60	3	3	3	4	5	4	4
Average per respondant	158	142	224	235	231	246	248
Average WC/BC			198			247	
Average company B			222.50				

1. Average per respondent
2. Average of each group (WC/BC)
3. Average per company (LCI)

LCI

Results

Lean Culture Index (LCI)

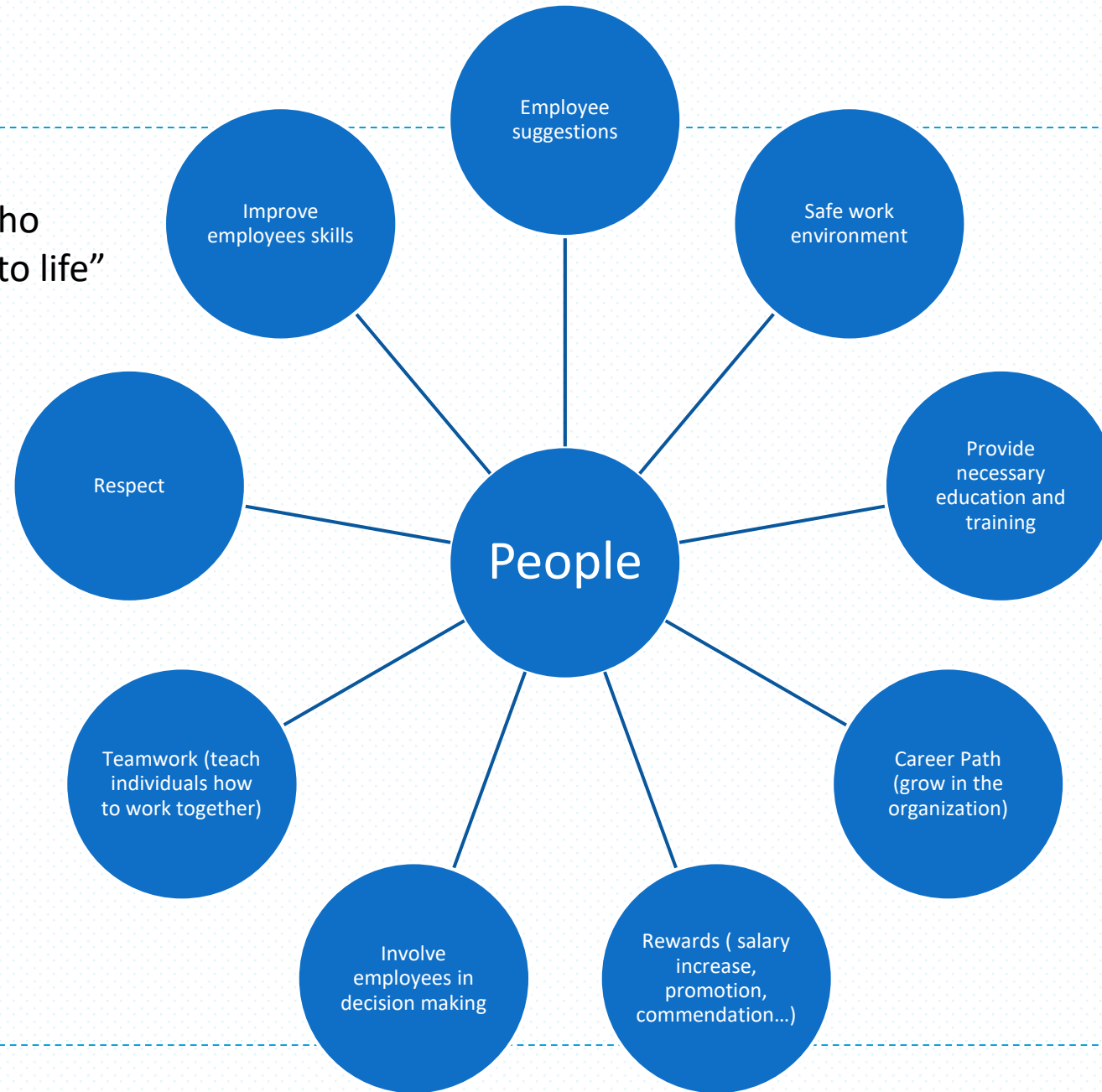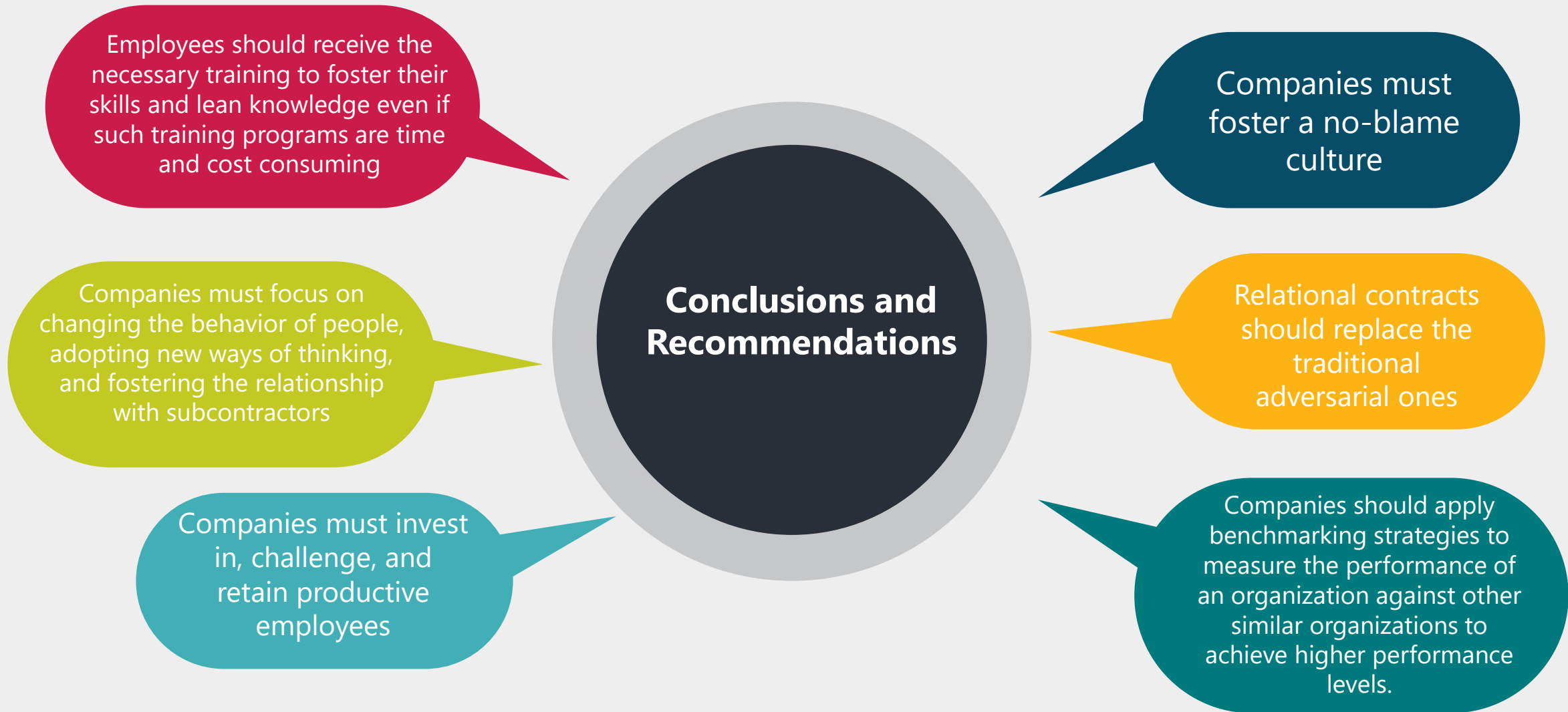| Average Score	Interpretation	Large scale companies	Medium scale companies
<180	Companies are not yet ready to implement lean.	-	N (154.00) O (179.50) P (150.33) S (178.00)
181-210	Excessive changes in the company are needed before implementing lean	A (195.75) B (198.00) C (202.50) E (192.60) F (205.25) G (201.75) H (208.75) J (196.25)	L (194.00) M (203.50) Q (189.50) R (190.50) T (203.67)
211-240	Several improvements in the company are needed before implementing lean	D (235.17) I (224.00)	K (227.70)
241-270	Companies are ready to implement lean	-	-
271-300	Companies are already applying lean well	-	-

DATA ANALYSIS

	Questions	Null Hypothesis	Sign test + p-value	Decision	Topic Discussion
High variability	Q19	Population median of question 19 = 3	p-value = 0.410	Fail to reject H0	**Employee development**: some companies invest in the development of the employees' skills
	Q23	Population median of question 23 = 3	p-value = 0.2	Fail to reject H0	**Pursuit of perfection**: some companies have annual reviews to measure improvement, others do not.
	Q30	Population median of question 30 = 3	p-value = 0.519	Fail to reject H0	**Benchmarking**: some companies benchmark other top performers
	Q31	Population median of question 31 = 3	p-value = 0.081	Fail to reject H0	Only some companies pay **attention to the external environment**
	Q43	Population median of question 49 = 3	p-value = 1	Fail to reject H0	**Self-critique**: not all employees do their own self-evaluations.
	Q49	Population median of question 49 = 3	p-value = 0.220	Fail to reject H0	**Tolerating failures**: some employees try to hide mistakes instead of fixing them
Low variability	Q28	Population median of question 28 < 3	p-value = 1.957e-10	Reject H0	**Flexibility**: the company can respond rapidly to the changes implemented by the owner.
	Q34	Population median of question 34 < 3	p-value = 2.135e-11	Reject H0	**Treating employees as partners** : people in the organization take pride in the company's products and services
Median < 3	Q5	Population median of question 5 < 3	p-value = 1	Fail to reject H0	**Trust**: respondents do not trust the promises made by their subcontractors
	Q14	Population median of question 14 < 3	p-value = 0.997	Fail to reject H0	**Training**: shows the companies' lack of training for their employees.
	Q32	Population median of question 32 < 3	p-value = 0.9818	Fail to reject H0	**Human focus**: respondents agreed that companies do not value employees.
	Q48	Population median of question < 3	p-value = 1	Fail to reject H0	**Blaming culture**: respondents agreed that the culture leans towards blame.
	Q50	Population median of question 50 < 3	p-value = 0.9991	Fail to reject H0	**Tolerating failures**: respondents agreed that employees feel that a shortcoming is someone else's responsibility
	Q59	Population median of question 59 < 3	p-value = 1	Fail to reject H0	**Contracts**: respondents agreed that contracts are written in a way that put the parties in adversarial relationship.
Median > 4	Q16	Population median of question 16 >4	p-value = 5.551e-16	Reject H0	**Consistency**: respondents agreed/strongly agreed that the company strives to deliver same/better-quality products

Results

"It's the **people** who bring the system to life" – (Liker,2004)