Top Down or Bottom Up

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Top Down or Bottom Up:

Perspectives on Critical Success Factors of Lean in Institutes of Higher Education

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Abstract. The application of continuous improvement initiatives such as Lean in Higher Education Institutes is an emerging topic for research, as these organizations are increasingly adopting the tools and methods to improve their quality practices. Nevertheless, Institutes of Higher Education differ significantly from business organizations, which limits the applicability of previous research findings. Using Q-methodology, the present study examines the prevailing perspectives on critical success factors of Lean at Dutch and Belgian Institutes of Higher Education. Findings show that Lean implementation at Institutes of Higher Education takes place bottom-up, with relatively little management involvement and commitment, and mostly involves supporting processes. This impedes the organizational culture change that needs to take place for Lean implementation to be sustainable in the long term, as successes are less visible to management, leading to less management involvement. However, as this is due to structural difference of Higher Education from other industries, it requires a different approach than the conventional, top-down approach prescribed in the literature. A bottom-up implementation of Lean is recommended, centered on improving university-wide supporting processes, promoting cross-departmental cooperation, and overcoming the silo mentality.

Keywords: Lean Implementation, Critical Success Factors, Higher Education.

1   Introduction

Across the world, institutes of Higher Education (HE) have been increasingly embracing continuous improvement initiatives, and Lean management in particular, to improve their academic and administrative operations [1, 2]. Changes in student enrollment, reductions in national or local funding, increased competition, and a rise in student expectations are pressuring institutes of HE to do more with less [1, 3, 4]. While Total Quality Management (TQM) was initially the programme of choice, it has steadily given way to Lean management, Six Sigma, or a combination of both [2].

Lean management uses a customer perspective to identify and eliminate non-value-added activities [5]. The simplicity of its approach and tools fueled its popularity and it has now been applied to a variety of industries beyond the automotive industry,

including service industries. As not all implementations have been successful, extensive academic attention has been devoted to Critical Success Factors (CSFs) of Lean and Six Sigma implementation [6–8]. Generally accepted CSFs have included management involvement and commitment, cultural change, communication, organization infrastructure, training, project management skills, project prioritization and selection, amongst others [9].

Institutes of HE share a number of characteristics that make the implementation of such programmes less evident. First, institutes of HE rarely have a distinct and recognizable strategy that easily translates to metrics. Second, there is significant complexity in HE in defining customers [8, 10], value, and defects [11]. Third, senior leadership lacks process thinking and clarity regarding how to incorporate Lean thinking in strategy, tactics and operations [10].

Despite these issues, there is consensus that Institutes of HE could significantly benefit from continuous improvement programmes [8, 10–12]. Therefore, the purpose of this study was to examine CSFs of Lean at HEs. The findings of the study are used to formulate recommendations to Institutes of HE seeking to use Lean to improve their academic and administrative operations.

2   Lean in Higher Education

2.1   Lean in Higher Education

Academic attention has been drawn to the issue of successfully implementing Lean, Six Sigma, or Lean Six Sigma (LSS) in HE, leading to two streams of research. The first stream consists of conceptual articles, drawing from evidence of successful LSS implementation in other industries in combination with the authors' personal experience in HE, to ascertain the relevance and benefits of LSS to HE [10]; to examine readiness factors for the implementation of LSS in HE [8, 10] and to formulate frameworks for deploying LSS in HE [11, 13]. The second research stream consists of the empirical investigation of Lean, Six Sigma, and LSS implementations in HE, mostly in the form of single case studies, oftentimes drawing on the authors' personal experience in HE [12, 14].

A review of these publications on Lean in HE shows that many describe single departmental initiatives [1, 2]. Typically, a single individual, or a small group of colleagues uses Lean tools to improve a specific sub-process. This may concern a single or a small number of departments and is caused by the silos that are often characteristic of HE [10]. Focusing on sub-processes decreases the need for coordination and makes for easier appropriation [1]. This approach, referred to as bottom-up, is characteristic of a lack of leadership or broader institutional support [2].

This contrasts with the prescribed top-down implementation approach recommended to Institutes of HE implementing Lean or Lean Six Sigma [8, 11, 12]. This approach, also coined 'institution-wide Lean in HE' [2], advocates first building top-level commitment, and focusing on cultural change in the organization. Several authors argue that the integration of Lean and Six Sigma is most appropriate for HE [10–12], as the

Lean approach allows for the tackling of low hanging fruit, and Six Sigma can thereafter be used to reduce variation in processes [10]. Yet, few academic papers have documented the successful implementation of this top-down, integrated approach [1, 12]. A possible explanation for this is that Institutes of HE are structurally different from other industries and thus continuous improvement methodologies need to be adapted to account for these differences [15].

2.2 Success Factors of Lean in Higher Education

An extensive body of research has examined the CSFs of Lean Six Sigma across industries [6, 7]. The consensus is that leadership and management involvement and commitment, linking LSS to the business strategy, and customer orientation are the most important CSFs for organizations implementing Lean Six Sigma. In the context of HE, these same CSFs, also called readiness factors, have been recognized, namely (i) leadership and vision, (ii) management involvement, commitment and resources, (iii) link between LSS and strategy, and (iv) customer focus [8]. However, there is a stark contrast between these CSFs that assume a top-down approach and documented implementations of Lean that show a bottom-up approach.

2.3 Perspectives on CSFs using Q-methodology

Traditionally, research on CSFs of Lean has employed a quantitative approach, using surveys requiring participants to rate the importance of a set of CSFs using 5-point Likert scales [6, 16]. This approach has two limitations. First, this approach allows respondents to rate many, or all CSFs highly, and thus does not discriminate between CSFs that are more important than others. For example, in Antony's [6] survey of UK service enterprises, six of thirteen CSFs had a mean rating above 4, making the interpretation of which CSFs are truly important quite arbitrary. Second, this approach assumes that there is consensus about which CSFs are important and does allow for multiple viewpoints. Yet, there is sufficient evidence to suggest that CSFs are context specific. The relative importance of CSFs may depend on the industry [15], organizational culture [17], national culture [18], or stage of implementation of the Lean programme.

Q-Methodology, a qualitative approach that seeks to objectively and scientifically observe subjectivity [19], can overcome these two limitations. A Q-methodology study starts with compiling a set of statements that participants are asked to sort according to their viewpoint or preference, following a prescribed normal distribution. In the context of CSFs, this implies that, while a participant may believe them all to be important, he or she may will still have to rate some as more important than others. This research approach thus supports discriminating between more or less important CSFs [20].

Q-methodology "employs a by-person factor analysis in order to identify groups of participants who make sense of a pool of items in comparable ways" [21]. In other words, Q-methodology helps identify patterns in individuals' subjective viewpoints about a particular topic [22]. These different perspectives can be linked to organizational, cultural and other characteristics, leading to new theoretical insights and better tailored practical recommendations [20].

3 Methodology

For the purpose of investigating CSFs of Lean in HE, the conventional steps of Q-methodology were followed. First a set of statements about CSFs of Lean Six Sigma were compiled from previous research on the topic [7, 9, 23]. This resulted in 42 statements that each included a statement about the importance of a single CSF. These CSFs were purposefully diverse and encompassed the subjects of leadership, training, resources, rewards etc. In a second step, participants to the study were asked to sort the 42 statements according to their agreement as to whether the particular CSF was more or less important, according to a forced normal distribution. The output thereof is called a Q-sort. In a third step, each participant's Q-sort was converted to numerical data for subsequent analysis. In this step, the two most important statements were assigned a score of +4, the next three most important statements were assigned a score of +3, all the way to the two least important statements which were assigned a score of -4.

Participants were recruited from the network of Lean HE Netherlands and Belgium. Lean HE is "the peer led community of practice for people working to apply lean and similar approaches in Higher Education." [24] Lean HE Netherlands and Belgium, the local division of the global network allowed access to their network, an active group of practitioners involved in implementing or executing Lean at their home institution. In total, 28 participants, representing 15 institutes of HE in the Netherlands (12) and Belgium (2) participated in the study.

Each participant received an e-mail with instructions on how to complete the Q-sort, a personalized link to the online platform Miro, and a link to post-sort survey in Qualtrics. The online platform Miro was used to facilitate the sorting procedure. Participants first read and pre-sorted the statements by dragging them to three areas on the board representing, agree, neutral, and disagree. In a second step, they could sort each group of statements in a pre-formatted grid. This two-step reduced the cognitive complexity of the task. Participants were also asked by means of a survey in Qualtrics to provide information about themselves (training and experience with Lean), information about their home institution (type of implementation, time since implementation started), and provide some clarification about the choices they made during the Q-sort. Finally, in-depth interviews with a sub-sample of participants were used to add context to the quantitative findings. The interviews were conducted online and recorded. The study findings were presented to the Lean HE Netherlands and Belgium network in March and June 2021.

4 Findings

The survey findings, Q-sorts, and interview transcripts were analyzed separately. The Qualtrics survey was used to collect data about participants and their home institution. The 28 participants represented 15 Institutes of HE in the Netherlands and Belgium. Of the 15 Institutes of HE surveyed, 14 had been implementing Lean or an equivalent continuous improvement programme for less than 5 years. For six Institutes of HE, the implementation was qualified as structured, while for 12 Institutes of HE it was

described as a Bottom-Up approach. A third of the Institutes of Higher Education defined their continuous improvement programme as Pure Lean. Another third defined it as Lean with some or many Six Sigma influences. The remaining third defined it as an own amalgamation of various continuous improvement programmes, oftentimes encompassing lean tools.

Individual participants similarly exhibited varied experiences with Lean. Consistent with the relatively short duration of implementation of Lean in the Institutes of HE sampled, two thirds of participants had 5 or less years of experience with Lean and other continuous improvement programmes. Almost all had at least a Lean or Lean Six Sigma Green Belt, with eight participants indicating they had a Lean or Lean Six Sigma Black Belt.

4.1 Quantitative Findings.

To analyze the Q-sorts, the procedures as described by Zabala were used [25]. Q-methodology does not have strict guidelines and thus there is no 'right' number of factors. Instead, several quantitative criteria (such as eigenvalues and number of Q-sorts loading on each factor) and qualitative criteria (factor interpretation) are used to compare different solutions [21, 22]. Using these criteria, a three-factor solution was identified as most suitable (see Table 1). Specifically, the eigenvalue exceeded one for each factor. Each factor represented the viewpoint of at least four respondents. The total variance explained by the three-factor solution was 51.85%.

The next step was to examine which statements distinguished each perspective from the others. For this, the z-score of each perspective was compared to the z-scores of the other perspectives. Figure 1 compares selected statements per perspective. The z-scores were converted back to the original Q-sort values (ranging from -4 to +4) for better interpretation. Thee three perspectives could then be described based on their distinguishing statements.

Table 1. Factor Characteristics

	Customer	Top-Down	Bottom-Up
Average reliability coefficient	0.8	0.8	0.8
Number of loading Q-sorts	14	7	5
Eigenvalues	7.03	4.33	3.16
Percentage of explained variance	25.10	15.45	11.30
Composite reliability	0.98	0.97	0.95
Standard error of factor scores	0.13	0.19	0.22

The first perspective, representing the views of fourteen participants, was named the customer-driven perspective as according to this perspective, it is important to consult customers often, and LSS projects should be linked to what is important to the customer. Participants in this perspective also placed a lot of importance on top management empowering employees.

The second perspective, named Top-Down, represented the views of seven participants. This perspective mirrored the customer-orientation of the first perspective, but also placed great importance to projects being aligned with the business strategy. Similarly, while underwriting the importance of empowerment, the Top-Down perspective also considered it important that top management take responsibility for quality performance, and that middle managers participate in the execution of projects.

The third perspective, representing the views of five participants, was conversely named the Bottom-Up approach and represented a much more internal focus. Participants in this perspective rejected the notion that customers had to be consulted often and did not consider it important that projects be linked to what the customer wanted. Instead, in this perspective, stronger emphasis was given to project leaders' project management skills and ensuring that employees understood how LSS worked. In this perspective, the role of top management was limited to providing financial resources.
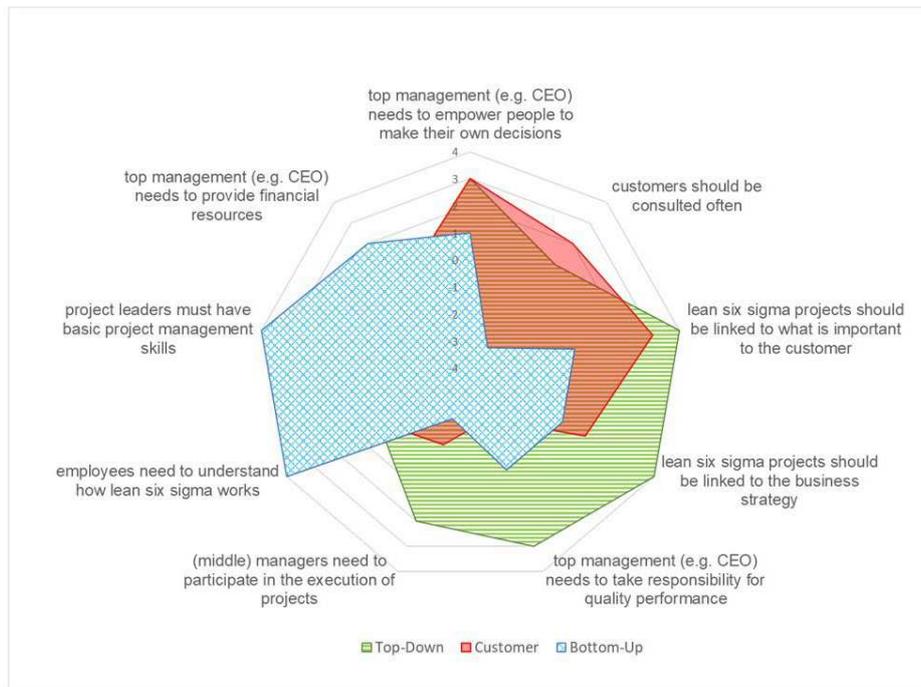

Fig. 1. Comparison of Perspectives of CFSs of Lean in HE for selected statements

4.2 Qualitative Findings

The in-depth interviews conducted with participants of the Q-sort helped sketch a picture of the organizational context of Institutes of HE in which Lean was being implemented. Three main topics that recurred across interviews were the lack of involvement from (top) management, the lack of process ownership impeding the improvement of

end-to-end processes, and the difficulty of applying lean to the primary educational and research processes.

The leadership and top management at Institutes of Higher Education in the Netherlands was described as neither enthusiastic nor skeptical about the added-value of Lean for their institution. Instead, respondents described HE leaders that did not have a process mindset and thus had difficulty appreciating how improved processes could lead to improved outcomes for stakeholders. A related issue was the lack of recognizable strategy to link Lean to. In other words, interviewees found their institution's strategy too vague to be able to link clear performance metrics to.

Instead, respondents described Lean implementations that were initiated by an individual or a group of colleagues, by applying Lean tools to improve a departmental or inter-departmental process. However, as the processes tackled became bigger and more stakeholders were involved, the lack of process ownership became an impediment, as no one was able or willing to take responsibility of changes that may affect more than one department.

All process improvement projects discussed during the interviews concerned supporting or administrative processes. These processes were easier to observe, and thus also better suited to the application of Lean tools. Interviewees expressed the desire to apply continuous improvement methods to the primary processes of research and teaching but were finding it difficult to involve lecturers and researchers. They also found the education and research processes to be more complex and less tangible, and thus less suited to the application of Lean.

5 Discussion

The present study used Q-methodology, a combination of qualitative and quantitative research methods, to identify and describe various perspectives on the CSFs of Lean in HE. Three perspectives were identified. The first two perspectives, "Customer-Oriented" and "Top-Down" reflect commonly accepted best practices of Lean implementation in business organizations, namely a focus on customer value, and the need for support from the top [10]. The second perspective "Top-Down" is also consistent with conceptually based LSS implementation in HE frameworks [8, 10, 11] that argue that, for Lean to succeed in HE, visionary leadership and management commitment are imperative and thus the focus should be on cultural change, starting at the top [13]. The second, "Top-Down," perspective identified through the Q-Methodology is therefore an idealistic view of how Lean should be implemented in HE, with only limited documented applications in HE [2]. This viewpoint does not do justice to the structural differences of the HE domain [15] and stands in stark contrast with documented implementations in HE, which follow a bottom-up approach.

Instead, our findings support the existence of a third perspective on CSFs of Lean in HE, namely a "Bottom-Up" perspective, that advocates for top management to provide resources, but then step aside and let project managers and employees take the lead in improving processes. According to this perspective, top management is perceived as lacking the process mindset needed to appreciate Lean [13]. This also hinders the

process of assimilating Lean in the organizational strategy of institutes of HE. The "Bottom-Up" approach is characterized by processes being improved locally, within a single department, or between two departments. As HE is characterized by silos [10], this implies that a sub-process can be made more efficient, while decreasing overall efficiency for the organization. This is where the lack of leadership becomes a hindrance, as the lack of process ownership for end-to-end processes means requires management to get involved.

Our findings also showed that, contrary to common wisdom about applying Lean, Lean implementation in HE primarily involves supporting processes. While these supporting processes such as course enrolment and exam may be visible and important to customers and other stakeholders, teaching and conducting research are the primary activities of HE. There are several possible explanations for the lack of Lean projects concerning these primary activities. First, as Lean is not typically incorporated in HE organizations' strategy, project selection will not be either. This is linked to the second explanation, namely that in the context of HE it is difficult to define who the customers are and what their requirements are [1]. Third, education processes, and teaching in particular, are co-creation processes, requiring the input and interaction of two parties: teacher and student [15].

6   Recommendations for Practitioners

Our findings underscore the startling gap between empirical and conceptual studies of Lean implementation on HE, and support Wiegel and Hadzialic's [15] position that the structural differences between the domains in which Lean was developed on the one hand, and HE on the other hand, require Lean to be adapted for use in HE. Therefore, we propose that the focus of early-stage Lean implementation in HE should be on how to replicate the local departmental successes across the institution, with limited involvement from senior leadership and management.

For organizations of HE having initiated Lean implementation locally, it is recommended to keep the project selection to supporting processes, but remove silos [13] by improving key end-to-end supporting processes such as student enrolment. While ensuring that processes will not only be improved locally, this will also highlight areas with a lack of process ownership. This will furthermore create an opportunity to involve more senior management as their input will be needed to resolve this lack of ownership. To improve these end-to-end processes, a multi-disciplinary, multi-departmental team will be needed. This will create bridges across departments, further reducing silos across the organization. The successes of these projects should be brought to the attention of senior leadership, as a evidence-based way to pique their interest further.

7   Limitations and Further Research

The present study employed Q-Methodology, a combination of qualitative and quantitative methods to identify viewpoints, or perspectives of CSFs in HE. This method's results are primarily qualitative and descriptive in nature and cannot be generalized

across a population. Furthermore, the sample used for this study consisted of employees at institutes of HE in the Netherlands and Belgium. While the use of this combination of method and sample was consistent with the purpose of this study, future research should investigate whether the various perspectives identified are also relevant in other cultures, and whether their prevalence differs from our study results.

An important topic to emerge from this study was the perceived difficulty of applying Lean management principles to the primary processes of HE, namely teaching and research. A possible reason for this, meriting further investigation, is the co-creation characteristic of these processes [15]. Future research should therefore examine whether Lean can also be applied to processes that are heavily reliant on co-creation, such as diagnostic evaluations by healthcare providers and teaching at HEs.

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