

## EASE OF IMPLEMENTATION OF LEAN TOOLS IN ACADEMIC PROCESSES ON THE EXAMPLE OF THE MACEDONIAN HIGHER EDUCATION INSTITUTIONS

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**Abstract:** Lean management has been increasingly applied in higher education institutions (HEIs), yet its use has predominantly concentrated on administrative and support processes, with less attention to academic activities. This paper addresses that gap by examining how academic staff in Macedonian HEIs perceive the applicability of eight Lean tools commonly reported in higher education context. A mixed-method survey of 210 faculty members assessed the perceived ease of implementation of these tools and gathered qualitative feedback. The results show that perceptions of applicability fall within a moderate range. More simple and visual tools such as Visual Management or Gemba Walk were rated more favourably, whereas more structured tools like Value Stream Mapping, 5S, and A3, received lower scores. Differences in evaluation across academic ranks turned out to be modest, though associate professors appear to be more accepting. The study provides a South-Eastern European country insights and highlights the importance of selecting accessible entry-point tools to build acceptance and capacity for Lean. Although the expected benefits of Lean implementation in HEIs are recognised, faculties still show certain reservations towards adopting selected Lean tools. Providing additional training and education for academic staff, combined with the gradual introduction of the Lean tools, may represent a solid foundation for starting the Lean journey within HEIs.

**Keywords:** Lean, Higher education, Academic processes, Lean tools, Implementation

### 1. INTRODUCTION

Academic processes, such as teaching, learning, assessment, and research, constitute the core of the processes in higher education institutions (HEIs), as they are directly linked to the mission of these institutions. The quality and efficiency of these processes immediately affect the primary “customers” (“clients” or beneficiaries) of the services – students and academic staff, but also all the important stakeholders: employers, governments and authorities, academic community, and the society in general (Grönroos, 2010; Vinčević & Zajmović, 2024).

Lean Management, rooted in the Toyota Production System, offers a strategic approach and structured methodology for reducing waste and continuously improving processes (Hines et al., 2004). In manufacturing, Lean has delivered substantial gains in efficiency, quality, and customer satisfaction. Over the past two decades, Lean has also been applied in services such as healthcare, logistics, governance and education (Costa & Godinho Filho, 2016; Douglas et al., 2015; Radnor, 2010; Rodgers & Antony, 2019). Lean is a management philosophy and methodology focused on maximising value for stakeholders by eliminating waste, improving processes, and fostering a culture of continuous improvement. At the operational level, Lean employs a wide variety of tools and techniques; however, organisations typically select and apply those tools that best fit their specific processes, context, and improvement goals (Begam et al., 2014; Bicheno & Holweg, 2023). Lean complements established frameworks like ISO 9001, TQM, and EFQM by enhancing their implementation through streamlined operations and value-driven performance.

In higher education, Lean is more often associated with administrative and support services (registries, finance, human resources, libraries, campus maintenance, etc.), where workflows resemble service processes in other industries (W. Balzer et al., 2016; Petrusch et al., 2019). By contrast, considerably less attention has been paid to its application in academic processes – such as teaching, curriculum design, assessment, research, and supervision – even though studies confirm that application of Lean tools in HEIs leads to higher service quality and greater efficiency in both academic and administrative work (Ciliberto et al., 2025; Emiliani, 2004; Zighan & EL-Qasem, 2020). This discrepancy can be explained by the nature of academic activities, which are highly heterogeneous, decentralised, closely tied to academic freedom and often perceived as

resistant to standardisation. As a result, the applicability of Lean tools in this domain is often questioned by the academic staff.

The application of Lean management in HE remains underexplored, particularly in South-Eastern Europe, where implementation is still in its early stages. Existing studies are largely concentrated in developed countries, leaving limited evidence on how Lean can be adapted to the specific organisational and cultural context of the region. There is limited evidence on the possible specifics of the region that will affect the implementation of Lean Management.

The presented study forms part of a broader research project that seeks to contribute to the body of knowledge on the status of application and applicability of Lean management in higher education, providing country/regional insights from South-Eastern Europe with a particular focus on Macedonian HEIs. To ensure both depth and broader understanding, the project employs two complementary research methods: the Delphi study, a commonly used technique for extracting and synthesising expert knowledge (Petrinska Labudovikj et al., in press; Schwantz et al., 2025; Stojanovska et al., 2020) and a questionnaire survey, appropriate for collecting the opinions of a broader sample (Klein et al., 2023; Psomas et al., 2023; Ranganathan & Caduff, 2023). The specific contribution of the project lies in advancing understanding of the current state of Lean in higher education, especially in relation to the barriers that may hinder its adoption and the practical methods through which it can be applied.

The study presented in this paper seeks to address this gap by examining the perception of academic staff in Macedonian HEIs towards the complexity (ease) of implementing Lean tools in academic processes. By focusing on tool-level applicability, the study aims to identify which Lean methods may serve as realistic entry points for Lean transformations in HEIs.

The paper is structured into six sections. Following the introduction, the second section reviews the relevant literature on application of Lean tools in HEIs, while the third outlines the research methodology. The fourth section presents the empirical results, which are further examined in the fifth section through discussion. The final section concludes the paper by summarising the key findings and their implications.

## 2. LITERATURE REVIEW

Lean is widely regarded as both a philosophy of continuous improvement and a practical toolbox of methods for waste elimination (Hines et al., 2004; Shah & Ward, 2007). Although Lean management in manufacturing offers a broad spectrum of tools, not all of them can be directly applied to service sectors, and higher education presents unique challenges in this regard. Systematic reviews provide useful insights into how Lean has been adopted in universities worldwide. Ciliberto et al. (2025), analysing studies from 2000 to 2024, conclude that Lean tools significantly improve operational efficiency in HEIs, particularly in administrative and student services. The most frequently used tools include Value Stream Mapping (VSM), which identifies and eliminates non-value-adding activities, 5S for workplace organisation and standardisation, and Kaizen for continuous improvement. Other tools, such as Process Mapping, Kanban, Waste Identification and Elimination, A3 Reports, and Visual Management, have also been applied, mainly to streamline enrolment, budgeting, and document handling, but also in academic activities such as course planning and class management. Importantly, these tools were found not only to improve processes but also to influence institutional culture, laying the groundwork for long-term transformation.

Khan et al. (2024), in their review of 76 studies published between 2019 and 2023, note that while earlier research concentrated on administrative functions (libraries, IT services, student offices), more recent studies increasingly address academic processes such as curriculum revision and teaching improvement. Tools such as DMAIC (Six Sigma tool), PDCA, Root Cause Analysis, VSM, 5S, Kanban, Kaizen, and visual management practices have proven effective when adapted to the academic context, particularly where supported by leadership and staff engagement.

Similarly, Kakouris et al. (2021), reviewing 47 studies published between 2003 and 2018, highlight VSM and Kaizen as the most prominent tools, each appearing in 17% of studies, followed by 5S and the seven wastes. Less frequently applied methods, according to their results, include Voice of the Customer, 5 Whys, and A3 reports, which are valued for their practicality and ease of use in educational settings.

Taken together, these reviews suggest that although Lean provides a rich set of tools developed in industry, higher education relies on a smaller, more adaptable subset. Tools such as VSM, 5S, Kaizen, waste elimination, and problem-solving methods dominate current practice, applied

initially in administrative units but increasingly extending into academic processes. However, the perceptions of academic staff regarding the ease of use, complexity, and benefits of these tools remain underexplored, particularly in South-Eastern Europe. The current study addresses this gap by examining Lean tool applicability in Macedonian HEIs, thereby contributing regional evidence to the global literature.

### 3. METHODOLOGY

The research methodology was structured in five main steps, providing a systematic framework for data collection and analysis. These steps are illustrated in Figure 1 and are described narratively below.

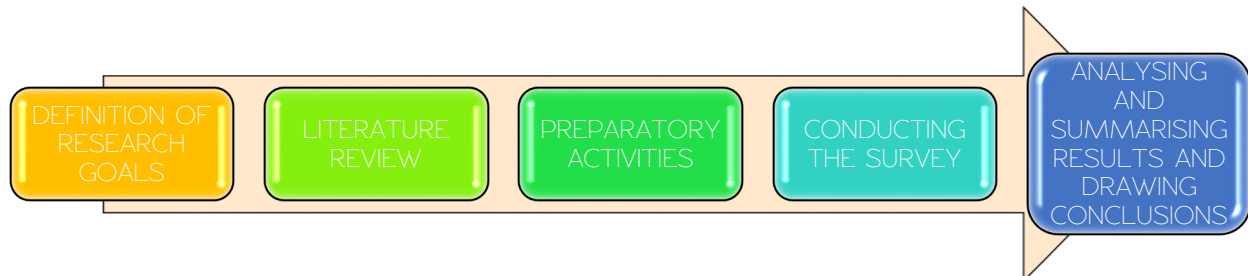


Figure 1. Research Methodology Steps

#### — Step 1: Definition of survey goals

The first step was to define the goals of the study. The primary goal was to examine the degree of applicability of Lean tools in academic processes, focusing on ease of implementation as perceived by academic staff in Macedonian HEIs.

#### — Step 2: Literature review

In the second step, a literature review on Lean tools in the higher education context was undertaken. This process enabled the identification of the most frequently applied Lean tools in HEIs, as well as theoretical and empirical findings on their benefits and limitations. The review indicated that Value Stream Mapping was the most frequently applied tool, followed by 5S and waste elimination, while Kaizen and Visual Management were also commonly implemented across institutions. The review provided the basis for selecting eight Lean tools to be included in the questionnaire: Value Stream Mapping, 5S, 5 Why, Kaizen, Visual Management, Waste Identification/Elimination, Gemba Walk, and A3 Problem-Solving. They were selected based on important works on the topic of implementation of Lean tools in HE (Antony et al., 2012; W. K. Balzer, 2020; Ciliberto et al., 2025; Doman, 2011; Douglas et al., 2015; Emiliani, 2004, 2005; Höfer & Naeve, 2017; Koromyslova et al., 2018; Maciag, 2019; Magalhães et al., 2019; Silva et al., 2021; Svensson et al., 2015; Yorkstone, 2019; Zighan & EL-Qasem, 2020), complemented by the authors' own professional judgement.

#### — Step 3: Preparatory activities

The preparatory phase involved several activities. The target population was defined as full, associate, and assistant professors employed at Macedonian HEIs, including both public and private universities (N = 3170, according to the data from State Statistical Office for the academic 2024/2025). A comprehensive list of accredited higher education institutions was compiled using data published by the Macedonian Ministry of Education and Science. This list served as the basis for identifying institutional websites and obtaining staff contact details. Then, a systematic strategy was designed for survey distribution.

This study adopted a mixed-method, cross-sectional survey design in order to explore the applicability of Lean tools in academic processes of Macedonian HEIs. The questionnaire was developed in Google Forms and structured into 46 questions. It included six main sections: (1) introduction, (2) demographic and institutional data, (3) familiarity with Lean and ISO 9001, current QMS and subjective evaluation of institutional performance, (4) perceptions of eight Lean tools, (5) mapping of Lean tools to ISO 9001 phases, and (6) open-ended comment section. Pilot testing with three university professors and a psychologist to reviewed the clarity, language, and potential ambiguities of the items. Their feedback was used to refine wording, sequence, and formatting, resulting in the final version of the instrument.

The design combined quantitative measures of ease of implementation with qualitative insights from open-ended responses - besides the open-text field at the end of the questionnaire, a comment field was provided after each Lean tool section. Each tool was briefly described and

accompanied by an illustration and example. A link to more detailed description was added to each tool. Ease of implementation was rated on a five-point ordinal scale (1 = very difficult, 5 = very easy).

In advance of data collection, statistical methods for analysis were determined. For the part of the study presented in this paper, descriptive statistics (means, standard deviations, medians, variances) were selected to summarise responses. Qualitative responses were thematically coded to capture recurring views and contextual insights, using Taguette qualitative research tool.

— Step 4: Conducting the survey

The survey was distributed online via e-mail. Where personal email addresses of academic staff were publicly available, invitations were sent directly. Where this was not possible, invitations were forwarded to general institutional email addresses with a request to disseminate them to eligible staff members. The responses (210 submitted questionnaires) were collected in the period June-August 2025. Participation was voluntary and anonymous. No personal information was collected, except for optional email addresses provided by respondents wishing to receive the final survey results. These addresses were stored and used solely for dissemination of results, in accordance with applicable data protection regulations and were not linked to responses.

— Step 5: Analysis, summary, and conclusions

Quantitative data were analysed using SPSS and Excel. Descriptive statistics (mean, standard deviation, median, mode, and variance) were calculated for each Lean tool. Qualitative responses from open-text fields were thematically coded using Taguette tool and integrated into the interpretation of results. Finally, results were synthesised into conclusions and recommendations for Lean implementation in academic processes.

#### 4. RESULTS

##### Quantitative analysis

A total of 210 valid responses were analysed, representing 6.6% of the academic population in Macedonian HEIs. The margin of error was estimated at  $\pm 7\%$  at the 95% confidence level, meaning that the results can be generalized to the wider academic community. Full professors represented by far the largest group in the survey (73.3%), followed by associate professors (15.2%) and assistant professors (10.5%). College professors accounted for 1.0%.

Respondents assessed the ease of implementing eight Lean tools in academic processes on a five-point scale (1 = very difficult, 5 = very easy). Table 1 summarises the descriptive statistics for each of the tools.

Table 1. Descriptive Statistics for Ease of Implementation of Academic Processes

Tool	Mean	SD	Median	Mode	Variance
Value Stream Mapping	3.04	0.99	3.00	3.00	0.98
5S	3.21	1.01	3.00	3.00	1.03
5Why	3.47	1.11	3.00	3.00	1.23
Kaizen	3.44	1.14	3.00	3.00	1.30
Visual Management	3.80	1.13	4.00	5.00	1.27
Waste Identification/Elimination	3.30	1.09	3.00	3.00	1.19
Gemba Walk	3.57	1.23	4.00	5.00	1.52
A3	3.27	1.14	3.00	3.00	1.31

The results indicate that the perceived ease of implementation of Lean tools in academic processes lies within a narrow range of 3.0 to 3.8 on a five-point scale. Value Stream Mapping received the lowest mean score ( $M = 3.04$ ), indicating that respondents found it the most difficult tool to apply. This perception is reinforced by its relatively low variability ( $SD = 0.99$ ), suggesting a broadly shared view. The low score may reflect the relative complexity of the tool and scepticism about the relevance of workplace organisation methods in academic processes. Despite this, VSM is one of the foundational Lean tools and the results demonstrate the need for targeted training and careful introduction if Lean is to be implemented comprehensively in HEIs.

The 5S method was rated moderately ( $M = 3.21$ ;  $SD = 1.01$ ). While somewhat easier to apply than VSM, opinions were more dispersed, reflecting both recognition of its benefits for organisation and concerns about its applicability in academic contexts.

The 5 Why tool received a relatively high score ( $M = 3.47$ ;  $SD = 1.11$ ). Respondents appeared to value its simplicity and adaptability, though the standard deviation suggests varying views on how easily it can be applied in academic processes.

Kaizen scored in the upper-moderate range ( $M = 3.44$ ;  $SD = 1.14$ ), showing that respondents generally perceive it as one of the more applicable Lean tools in academic processes. The standard deviation score indicates moderate variation - while many respondents find Kaizen applicable, opinions are not entirely uniform, similarly to 5 Why.

Visual Management achieved the highest mean score ( $M = 3.80$ ;  $SD = 1.13$ ). This confirms that staff perceive it as highly applicable, even if some variability in opinion remains. Its visual, transparent nature likely aligns well with academic communication practices.

Waste Identification and Elimination received a moderate score ( $M = 3.30$ ;  $SD = 1.09$ ). Comments indicate scepticism about resource limitations, suggesting that while respondents recognise the concept, they are unsure how it fits their institutional realities.

Gemba Walk had the second-highest mean ( $M = 3.57$ ) but also the highest standard deviation ( $SD = 1.23$ ). This divergence indicates different views among academics on the feasibility of direct process observation in academic processes and points to the need for careful interpretation of the results.

The A3 method was scored moderately ( $M = 3.27$ ;  $SD = 1.14$ ). The mean score places A3 in the lower part of the moderate range, suggesting that academic staff view it as applicable but not particularly easy to implement. While structured, it may be perceived as bureaucratic in an academic context, explaining the middling evaluation.

Figure 2 (a and b) illustrate the distribution of the eight Lean tools according to their mean scores and standard deviations of perceived ease of implementation. The graphs provide a visual representation of both central tendency and variability, showing that while all tools fall within a moderate applicability range, some (e.g., Gemba Walk and Visual Management) combine higher mean values with greater variability, whereas others (e.g., Value Stream Mapping) score lower but with more consistent responses.

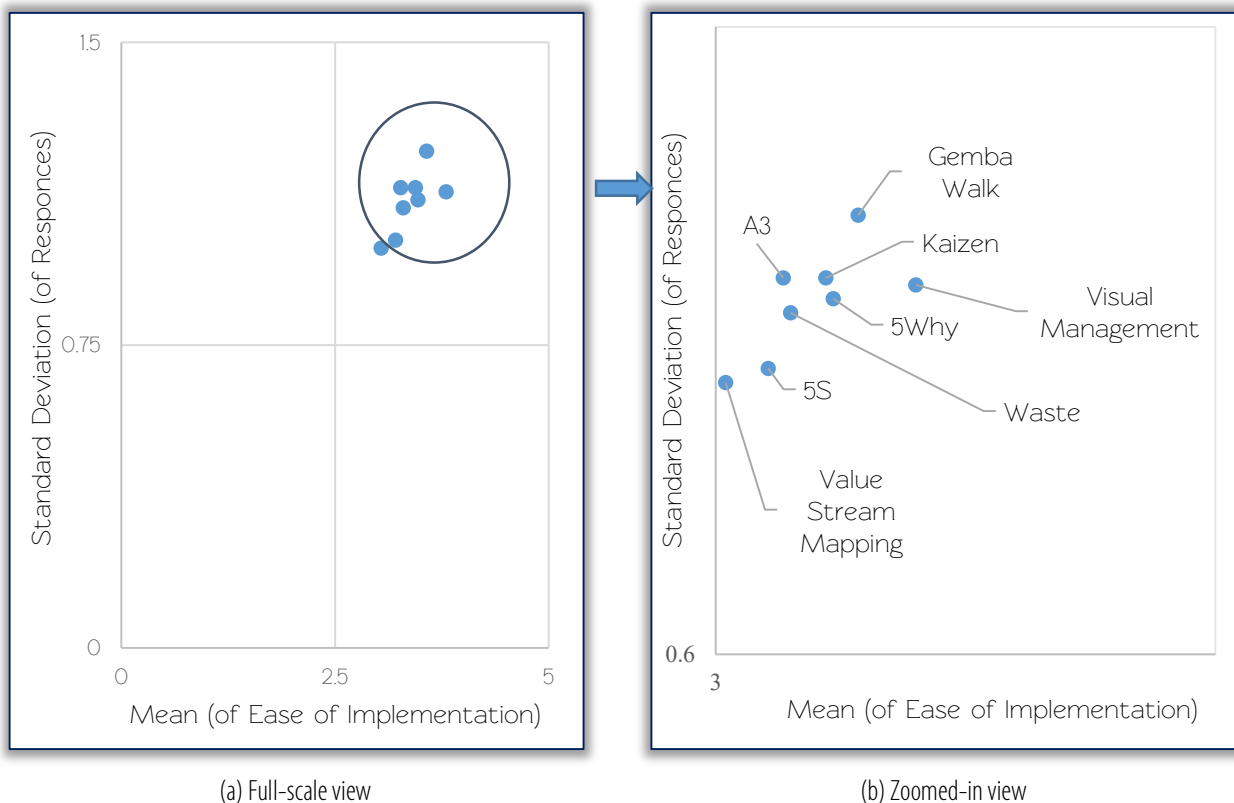


Figure 2. Mean Scores and Standard Deviation across Lean Tools

Tools with higher mean values and lower standard deviations, indicating that they were seen as both easier to apply and evaluated more consistently across respondents, emerge as the most applicable in the academic context. This means that Visual management, Kaizen and 5 Why are perceived as the best candidates for implementation, since they have high mean value and acceptably small variations among the participants in the survey. On the other side, the most problems are perceived with Value Stream Mapping and 5S, since they have the lowest mean values, while still obtaining the smallest variations in the perceptions of the participants.

The ranking of the tools according to their mean (average score) is presented in Figure 3. The ranking of tools based solely on mean values is almost identical to that based on both mean and standard deviation, differing only in the relative position of Waste Identification/Elimination and A3.

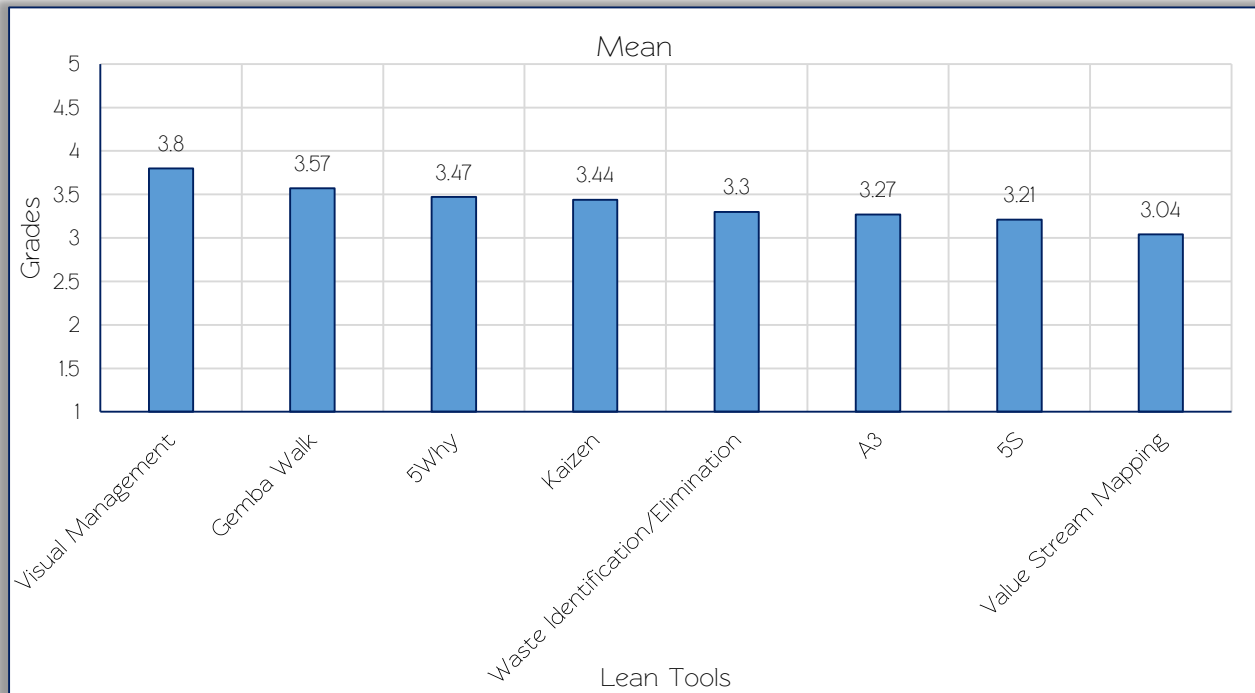


Figure 3. Ranking of Lean Tools by Ease of Implementation in Academic Processes

Figure 4 illustrates the distribution of responses across the five-point scale for each Lean tool. Presenting the data in percentages provides a clearer view of how respondents evaluated the ease of implementation.

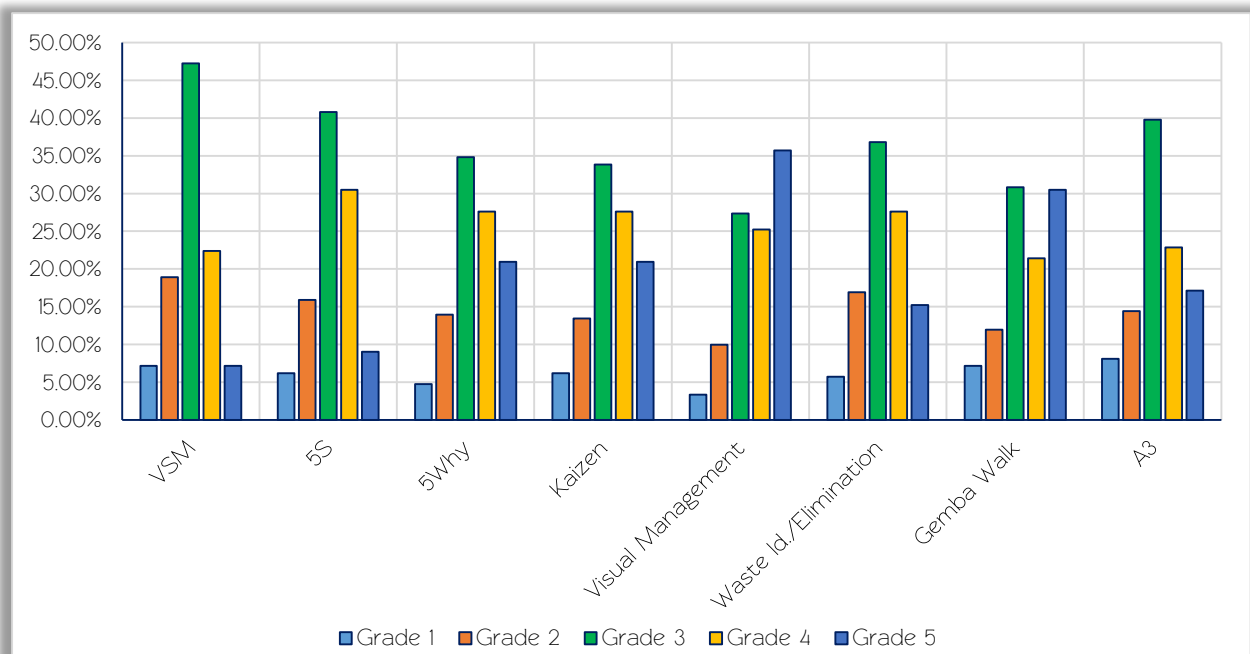


Figure 4. Percentage of Responses per Grade (1-5) for Each Lean Tool

In addition to the overall analysis, a separate examination was conducted to explore differences across academic ranks, as presented in Table 2. Among the university professors, associated professors indicated the most positive perceptions of Lean tool applicability, with an overall mean of 3.69. They scored higher on all the tools but Visual Management. They are followed by assistant professors with mean of 3.45 and full professors with 3.31. Taken together, the results suggest that while minor differences by rank are visible, the overall pattern reflects broadly consistent

perceptions of Lean tool applicability across the academic community. Across all ranks, Visual Management emerged as the highest-rated tool, while Value Stream Mapping was consistently the lowest.

Table 2. Average Applicability of Lean Tools in Academic Processes by Academic Rank

Tool:	Full Prof.	Assoc. Prof.	Assist. Prof.	College Prof.	Overall Mean
VSM	2.99	3.25	3.14	3	3.04
5S	3.14	3.50	3.23	3.5	3.21
5Why	3.41	3.78	3.36	4	3.47
Kaizen	3.35	3.81	3.50	4	3.44
Visual Management	3.70	4.06	4.14	4	3.80
Waste Ident./Eliminat.	3.20	3.69	3.41	4	3.30
Gemba Walk	3.48	3.91	3.64	4	3.57
A3	3.23	3.53	3.14	4	3.27
Mean:	3.31	3.69	3.45	3.81	

Analysing differences by academic title provides insights into how career stage may influence perceptions of Lean. The results indicate that associate professors expressed the most positive views, suggesting that they have good balance between the openness to change and professional experience compared to full professors and assistant professors. This finding points to associate professors as potential key actors in Lean adoption within HEIs and it indicates that associate professors could serve as important change agents in Lean initiatives within higher education institutions. All these should be especially considered when designing the Lean teams.

#### ■ Qualitative analysis

The qualitative feedback confirms the quantitative finding that Lean tools are seen as moderately applicable. Participants recognise potential benefits, especially from simple and visual tools, but also point to serious barriers: lack of familiarity, resistance to change, scarce resources, and rigid institutional frameworks. Entrenched academic autonomy was also identified as an important barrier. Visual Management was widely praised for improving communication and transparency, whereas VSM and 5S were criticised for being too bureaucratic or difficult to apply in the teaching and research context. Importantly, the comments suggest that Lean may gain legitimacy if positioned as an extension of existing quality assurance and accreditation practices, rather than as an imported management trend.

### 5. DISCUSSION

The results indicate that the perceived ease of implementation of Lean tools in academic processes lies within a narrow range of 3.0 to 3.8 on a five-point scale. This suggests that academic staff regard the selected Lean methods as moderately applicable in academic processes, rather than either highly feasible or entirely unsuitable. Importantly, the variation between tools points to a certain hierarchy of perceived applicability. Tools that are simple, visual, and discussion-based, such as Visual Management, Gemba Walk, 5 Why, and Kaizen, were rated higher, while more structured tools, such as A3, 5S, and VSM, were rated lower (probably are perceived as more complex or production-related).

When these findings are compared with previous studies, which consistently highlight Value Stream Mapping (VSM) and 5S as among the most frequently applied Lean tools in higher education (e.g., Ciliberto et al., 2025; Kakouris et al., 2021), an important implication emerges. In this study, both tools received relatively lower ratings in terms of ease of implementation, which suggests that their practical use (at least in Macedonian HEIs) may be more challenging. This points to the need for targeted attention to their application, particularly through training and capacity building. By equipping academic staff with the necessary knowledge and skills, institutions may overcome initial perceptions of difficulty and unlock the potential of these tools to improve academic processes.

The qualitative comments provide further depth to these results. Respondents expressed a cautiously positive tone, acknowledging potential benefits of Lean while simultaneously raising concerns about cultural resistance, scarce resources, and rigid governance frameworks.

When examining differences across academic ranks, associate professors reported slightly higher ratings overall, while full and assistant professors clustered closer to the lower end of the moderate range. Given that full professors formed the largest share of the sample (73.3%), their relatively cautious views exerted a strong influence on the overall means. This suggests that professional role and institutional context may shape openness to Lean, but the overall variation

across ranks remains modest, indicating mainly consistent views. The findings suggest that associate professors may be particularly well positioned to act as early adopters and champions of Lean, combining openness to new approaches with sufficient professional experience. Institutions could therefore prioritise their involvement when forming Lean implementation teams, while also engaging other ranks to ensure broad-based support.

Several limitations should be taken into consideration. First, the study relies on self-reported perceptions, which may differ from actual experiences of tool implementation. Respondents might evaluate tools differently if they had practical exposure rather than relying on theoretical descriptions. Second, the analysis is confined to academic processes in Macedonian HEIs, and results may differ in non-academic services or in institutions with more established quality management systems.

Despite these limitations, the study contributes novel empirical evidence on Lean in academic processes, a domain less frequently studied than administrative or other supporting services in HEIs. By showing that opinions were mostly situated in the middle of the scale, and that visual and dialogue-based tools are most accepted, this research highlights both the potential entry points for Lean in academia and the barriers that must be addressed for successful implementation.

## 6. CONCLUSION

This study provides empirical evidence on the applicability of Lean tools in academic processes of HEIs, an area that has received far less attention than administrative services in the Lean higher education literature. While respondents' feedback reflected a degree of precaution and limited hands-on experience with Lean tools, the overall view on potential implementation was predominantly positive. Academic staff generally regarded the eight Lean tools as applicable to academic processes, though with varying degrees of ease. Although the differences were not pronounced, a rank of perceived applicability emerged: visual, simple, and dialogue-oriented tools such as Visual Management, Gemba Walk, 5 Why, and Kaizen were evaluated more favourably, while more strictly structured tools, such as VSM or A3 were viewed with greater caution.

The findings contribute to the scientific discourse by showing that Lean in academia is neither uniformly accepted nor rejected, but rather selectively adopted depending on organisational culture, familiarity, and perceived relevance. This insight advances understanding of Lean's transferability into complex professional domains where autonomy, academic values, and governance structures play a decisive role. Importantly, the study adds a Western Balkan perspective, where empirical evidence on Lean in higher education remains limited, thereby filling a regional gap in the literature.

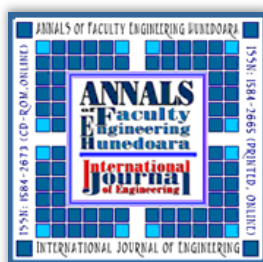
From a practical standpoint, the results suggest that Lean initiatives in HEIs should begin with entry-point tools that foster dialogue and reflection, creating a foundation of trust and engagement before progressing to more complex methods. By embedding these tools within existing quality assurance and accreditation frameworks, institutions may reduce resistance, demonstrate early gains, and prepare the ground for broader Lean adoption. In addition, although Lean implementation teams should include representatives from all academic ranks and positions to ensure broad ownership and diversity of perspectives, the results suggest that teams may particularly benefit from the involvement of associate professors, whose balance of experience and openness positions them as valuable facilitators of change.

Future research should move beyond perceptions to investigate actual implementation cases, examine differences between academic and non-academic processes, and undertake comparative studies across countries to better assess the conditions under which Lean tools can deliver tangible benefits in higher education.

## References

- [1] Antony, J., Krishan, N., Cullen, D., & Kumar, M. (2012). Lean Six Sigma for higher education institutions (HEIs): Challenges, barriers, success factors, tools/techniques. *International Journal of Productivity and Performance Management*, 61, 940–948
- [2] Balzer, W., Francis, D. E., Krehbiel, T. C., & Shea, N. (2016). A review and perspective on Lean in higher education. *Quality Assurance in Education*, 24, 442–462.
- [3] Balzer, W. K. (2020). *Lean higher education: Increasing the value and performance of university processes (Second edition)*. Routledge.
- [4] Begam, M. S., Swamynathan, R., & Sekkizhar, J. (2014). A brief overview of current trend on Lean management practices in manufacturing industries. *Annals of Faculty Engineering Hunedoara – International Journal of Engineering*, 12(2), 35–42. <https://annals.fih.upt.ro/pdf-full/2014/ANNALS-2014-2-04.pdf>
- [5] Bicheno, J., & Holweg, M. (2023). *The lean toolbox: A sourcebook for process improvement (Sixth edition)*. Production and Inventory Control, Systems and Industrial Engineering (PICSIE) Books.

- [6] Ciliberto, C., Antony, J., Chakraborty, A., Sony, M., Bhat, S., Sordan, J. E., & McDermott, O. (2025). Lean Tools in Higher Educational Institutions and Their Impact on Operational Performance: A Scoping Review. In O. McDermott, K. Cormican, J. Antony, M. Sony, C. Laux, E. Cudney, J. C. Sá, B. Lameijer, & A. Rosa (Eds), *Advances in Operational Excellence in the Higher Education Sector* (pp. 95–109). Springer Nature Switzerland
- [7] Costa, L. B. M., & Godinho Filho, M. (2016). Lean healthcare: Review, classification and analysis of literature. *Production Planning & Control*, 27(10), 823–836.
- [8] Doman, M. S. (2011). A new Lean paradigm in higher education: A case study. *Quality Assurance in Education*, 19, 248–262.
- [9] Douglas, J., Antony, J., & Douglas, A. (2015). Waste identification and elimination in HEIs: The role of Lean thinking. *International Journal of Quality & Reliability Management*, 32, 970–981
- [10] Emiliani, M. (2004). Improving business school courses by applying lean principles and practices. *Quality Assurance in Education*, 12, 175–187.
- [11] Emiliani, M. (2005). Using kaizen to improve graduate business school degree programs. *Quality Assurance in Education*, 13, 37–52.
- [12] Grönroos, C. (2010). *Service management and marketing: Customer management in service competition* (3. ed., reprinted). Wiley.
- [13] Hines, P., Holweg, M., & Rich, N. (2004). Learning to evolve: A review of contemporary lean thinking. *International Journal of Operations & Production Management*, 24(10), 994–1011
- [14] Höfer, S., & Naeve, J. (2017). The application of Lean Management in higher education. *International Journal of Contemporary Management*, 16, 63–80.
- [15] Klein, L. L., Vieira, K. M., Marçal, D. R., & Pereira, J. R. L. (2023). Lean management practices perception and their influence on organizational performance in a public Higher Education Institution. *The TQM Journal*, 35(3), 673–697
- [16] Koromyslova, E., Steinlicht, C., Hall, T., Yordanova, A., & Garry, B. (2018). Implementing Lean practices in an academic department: A case study. 2018 ASEE Annual Conference & Exposition Proceedings, 30623
- [17] Maciąg, J. (2019). *Lean Culture in Higher Education: Towards Continuous Improvement*. Springer International Publishing.
- [18] Magalhães, J. C., Costa, N., & Rodrigues, A. R. (2019). Improving processes in a postgraduate office of a university through Lean office tools. *International Journal for Quality Research*, 13(4), 797–810
- [19] Petrinska Labudovikj, R., Minovski, R., Jovanoski, B., & Kochov, A. (in press). Perspectives on Lean implementation challenges and potentials in higher education institutions: Insights from South-East Europe (SEE). *International Journal of Lean Six Sigma*, (in publication).
- [20] Petrusch, A., Vaccaro, G., & Luchese, J. (2019). They teach, but do they apply? *International Journal of Lean Six Sigma*,
- [21] Psomas, E., Keramida, E., Bouranta, N., & Kafetzopoulos, D. (2023). The adoption of Lean in the Greek public sector. An employee perspective. *International Journal of Lean Six Sigma*, 14(7), 1518–1543
- [22] Radnor, Z. (2010). Transferring Lean into government. *Journal of Manufacturing Technology Management*, 21(3), 411–428.
- [23] Ranganathan, P., & Caduff, C. (2023). Designing and validating a research questionnaire—Part 1. *Perspectives in Clinical Research*, 14(3), 152–155.
- [24] Rodgers, B., & Antony, J. (2019). Lean and Six Sigma practices in the public sector: A review. *International Journal of Quality & Reliability Management*, 36(3), 437–455
- [25] Schwantz, P. I., Klein, L. L., Douglas, J. A., & Douglas, A. (2025). Types of waste in higher education institutions based on the lean system: Development of an assessment instrument. *International Journal of Sustainability in Higher Education*
- [26] Shah, R., & Ward, P. T. (2007). Defining and developing measures of lean production. *Journal of Operations Management*, 25(4), 785–805.
- [27] Silva, M. E. A. D., Santos, A. C. D. S. G. D., Reis, A. D. C., & Santos, G. N. (2021). Systematic review of lean thinking in education institutions. *Independent Journal of Management & Production*, 12(9), s865–s882
- [28] Stojanovska, J., Minovski, R., & Jovanoski, B. (2020). Motivation or patenting—Delphi method approach. *Annals of Faculty Engineering Hunedoara – International Journal of Engineering*, 18(2), 83–89. <https://annals.fih.upt.ro/pdf-full/2020/ANNALS-2020-2-09.pdf>
- [29] Svensson, C., Antony, J., Ba-Essa, M., Bakhsh, M., & Albliwi, S. (2015). A Lean Six Sigma program in higher education. *International Journal of Quality & Reliability Management*, 32(9), 951–969
- [30] Vinčević, V., & Zajmović, M. (2024). Quality models and web application validation methods. *Annals of Faculty Engineering Hunedoara – International Journal of Engineering*, 12(4), 13–21. <https://annals.fih.upt.ro/pdf-full/2024/ANNALS-2024-4-01.pdf>
- [31] Yorkstone, S. (Ed.). (2019). *Global Lean for Higher Education: A Themed Anthology of Case Studies, Approaches, and Tools*. Productivity Press.
- [32] Zighan, S., & EL-Qasem, A. (2020). Lean thinking and higher education management: Revaluing the business school programme management. *International Journal of Productivity and Performance Management*, null



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