

Operational Excellence Case Studies *in Higher Education Institutions*

OPEX

improved quality:
consistent quality in products
and services is a hallmark of
opec, leading to greater
customer satisfaction

continuous improvement:
opec is not a one-time fix but an ongoing journey of
refining processes and systems
customer focus:
prioritizing customer needs and delivering value-added
experiences is central to opec

Jiju Antony • Michael Sony • Elizabeth A. Cudney
Sandra L. Furterer • Chad Laux • Raja Jayaraman • Maher Maalouf

Operational Excellence Case Studies in Higher Education Institutions

This page intentionally left blank

Operational Excellence Case Studies in Higher Education Institutions

EDITED BY

JIJU ANTONY

Northumbria University, UK

MICHAEL SONY

Oxford Brookes University, UK

ELIZABETH A. CUDNEY

Maryville University, USA

SANDRA L. FURTERER

The Ohio State University, USA

CHAD LAUX

Purdue University, USA

RAJA JAYARAMAN

New Mexico State University, USA

and

MAHER MAALOUF

Khalifa University, UAE



Emerald Publishing Limited
Emerald Publishing, Floor 5, Northspring, 21-23 Wellington Street, Leeds LS1 4DL.

First edition 2025

Editorial matter and selection © 2025 Jiju Antony, Michael Sony, Elizabeth A. Cudney,
Sandra L. Furterer, Chad Laux, Raja Jayaraman, and Maher Maalouf.

Individual chapters © 2025 The authors.

Published under exclusive licence by Emerald Publishing Limited.

Reprints and permissions service

Contact: www.copyright.com

No part of this book may be reproduced, stored in a retrieval system, transmitted in any form or by any means electronic, mechanical, photocopying, recording or otherwise without either the prior written permission of the publisher or a licence permitting restricted copying issued in the UK by The Copyright Licensing Agency and in the USA by The Copyright Clearance Center. Any opinions expressed in the chapters are those of the authors. Whilst Emerald makes every effort to ensure the quality and accuracy of its content, Emerald makes no representation implied or otherwise, as to the chapters' suitability and application and disclaims any warranties, express or implied, to their use.

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

ISBN: 978-1-83797-850-2 (Print)

ISBN: 978-1-83797-849-6 (Online)

ISBN: 978-1-83797-851-9 (Epub)



INVESTOR IN PEOPLE

Contents

Chapter 1 Operational Excellence Methodologies in Higher Education	1
<i>Elizabeth A. Cudney, Arshia Kaul, Ranjit Roy Ghatak, Jiju Antony and Michael Sony</i>	
1. Introduction	1
2. Kaizen in Higher Education	2
3. Lean in Higher Education	3
4. Six Sigma in Higher Education	4
5. LSS in Higher Education	5
6. TOC in Higher Education	5
7. Agile	6
8. Conclusion	6
References	7
Chapter 2 Kaizen in Higher Education: A Case Study on Continuous Improvement in Academic and Administrative Processes	11
<i>Fátima Carneiro and Manuel F. Suárez-Barraza</i>	
1. Introduction	11
2. Literature Review	12
2.1. Kaizen Philosophy	12
2.2. Kaizen in HE	14
2.3. Kata in HE	15
3. Methodology	17
4. Case Study: The UM	17
4.1. The Catalyst for Continuous Improvement	18
4.2. Identifying the Core Challenges	18
4.3. Implementing Kaizen: The Journey	18
4.4. Voices of Transformation	20
4.5. Results and Lessons Learned	21

5. Discussion and Implications	22
6. Conclusion	24
7. Limitations	24
8. Future Work	25
References	26

Chapter 3 Kaizen for Higher Education 29

Chad Laux, Tim Winders, Emily Laux and Manal Alduraibi

1. Introduction	29
2. The Lean Approach and Higher Education	30
3. Factors of Success (CSFs) in Lean Higher Education Implementation	30
4. Kaizen and Higher Education	31
5. Barriers to Lean-Kaizen Success	32
6. HEI Opportunities for Improvement	33
7. Case Study on Lean Kaizen for Higher Education	34
8. Conclusions and Future Steps	37
References	38

Chapter 4 Viral Change, Lean, and Continuous Improvement at a UK University: A Hero's Journey 41

Tammi Sinha, Michael Shaw and Peter Rykowski

1. Introduction	41
2. Problem Space	42
3. Why OPEX Methodology Has Been Utilised?	43
4. Application of OPEX Methodology (Lean and Sustainability)	43
5. Call to Adventure	44
6. The Mentor and Allies	44
7. The Road of Trials: Implementing the Lean Foundations and Practitioner Programme	45
7.1. Core Principles – Gemba	47
7.2. Core Principles – Lean	47
8. The Ordeal: Achieving Breakthroughs and Overcoming Resistance	49
8.1. Core Principle – Coaching	49
9. The Transformation: Continuous Improvement and the Cultural Shift	50
10. The Return of the Elixir: Key Benefits, Lessons Learned and Broader Implications	50

11. Key Lessons Learned and Transferability to Other Processes or Operations: Case Studies of Improvement Projects	51
11.1. CI Impact – Improving the Reference Process for Applicants	51
11.2. CI & Sustainability Impact – Mobile Phones	51
11.3. Device Amnesty – Hand-in of Old Devices	52
12. Sustainability Impact – Human Resources Team Sustainability Project	52
13. Summary of the Chapter	52
References	53

Chapter 5 Adopting Then Adapting Lean: A Case Study of Three Universities **55**

Mark Robinson, Janyce B. Fadden and Bliss Adkison

1. Introduction	55
2. The Universities	56
3. What is Lean?	56
4. Why Lean at St Andrews?	57
4.1. Lean at St Andrews	58
4.2. St Andrews Lean Consulting and the Business Transformation Portfolio Office	64
4.3. Summary	65
5. The Lean Experience at the UNA	66
5.1. Beginning the Journey	66
5.2. Starting with the UNA MBA Programme	66
5.3. Expanding Our Network	67
5.4. Seeing Data as a Friend	67
5.5. Using Software in New Ways	67
5.6. Expanding the UNA Lean Journey	68
5.7. Graduate and Undergraduate Programmes Embrace Lean	68
5.8. Undergraduate Communications Gets Mapped and Improved	68
5.9. Applying Lean to Institutional Effectiveness	68
5.10. Using Lean Before New Cataloguing Software is Installed	70
5.11. Summary	70
6. Incorporating Lean at the UWA	70
6.1. Introduction	70
6.2. Transition to UWA	71

6.3. The First Rapid Improvement Project at UWA: Curriculum Change Process	72
6.4. Expansion of Lean RIE Culture at UWA	73
6.5. Summary	74
7. Conclusion	75
References	76

Chapter 6 Using Lean Methods to Diagnose and Improve the Operational Management of Postgraduate Study Programmes: A Case Study of a Public University 79

Justyna Maciąg and Dobrochna Sztajerska

1. Introduction	79
2. Rationale, Purpose, and Stages of the Project	80
3. PLAN Phase: Stage 1: Organising the Project Team	81
4. Stage 2: Diagnosing the External Context of the Postgraduate Programme Management Process – Stages, Tools, and Outcomes	81
4.1. Trends in Adult Education	82
4.2. Legal Conditions for Conducting PSPs	82
4.3. Education Courses, Postgraduate Students, and Funding Opportunities	83
4.4. Competition Analysis	83
4.5. Customer Surveys – Assessing the Quality of the Organisation and Quality of Postgraduate Programmes Offered by the Faculty	84
5. Stage 3: Diagnosing and Analysing the Internal Context of the Postgraduate Programme	89
5.1. The Universities’ Internal Regulations Relating to Postgraduate Studies	89
5.2. The University’s Cultural and Process Maturity to Implement Lean Management	89
5.3. Diagnosis of Significant Problems in the Area of Postgraduate Studies – An Affinity Diagram	91
5.4. Identification and Diagnosis of Operational Processes in the Management of the Postgraduate Programme	92
5.5. Diagnosis of Wastage	96
6. Stage 4: Developing Options for Decisions Concerning a Postgraduate Programme Management Model	99
Option 1 Decision: Termination of the Postgraduate Programme in the Faculty	99
Option 2 Decision: Further Development of the Postgraduate Programme in the Faculty	100

7. Managerial Implications	101
8. Lessons Learned – Success Factors and Constraints in Project Implementation	102
9. Conclusion	102
References	103
Chapter 7 Implementing Six Sigma Project to Enhance Diploma Thesis Writing Process	105
<i>Dobrochna Sztajerska and Justyna Maciąg</i>	
1. Introduction	105
2. Description of the Entity Implementing the Project	106
3. Defining Phase	107
4. Measurement Phase	114
5. Analysis Phase	117
6. Improvement Phase	119
7. Control	126
8. Summary of the Project	129
Acknowledgements	130
References	130
Chapter 8 Teaching Six-Sigma to Engineers Using a Catapult	133
<i>Alya Majid Alketbi, Danait Bemnet Daniel, Latifa Alketbi, Alyazia Alameri, Baina Alkhuwaiter, Mohamed Allam, Maher Maalouf and Jiju Antony</i>	
1. Introduction	133
2. Six-Sigma	133
3. Role of Training in SS	134
4. Challenges Associated with the Current Methods of Teaching SS	135
5. Literature Review	136
6. Methodology	136
6.1. Experiential Learning	137
6.2. Catapult	139
7. Analysis	139
7.1. DMAIC	139
7.2. Define	140
7.3. SIPOC (Supplier-Input-Process-Output-Customer)	140
7.4. Project Charter	140
7.5. Measure	140
7.6. Analysis of the Measurement System	141
7.7. Paired T-Test and CI	143
7.8. Yellow Ball Versus Pink Ball	143

7.9. Rubber Bands	143
7.10. Current Process Baseline Performance	144
7.11. Normality Test	145
7.12. Capability Analysis	145
7.13. Analyse	145
7.14. Cause and Effect Diagram	146
7.15. Design of Experiments	147
7.16. Main Effect and Interaction Plots	147
7.17. Pareto Plot	148
7.18. ANOVA	148
7.19. Regression Analysis	149
7.20. Variability	150
7.21. Minitab Response Optimiser	151
7.22. Improve	152
7.22. Normality Test	152
7.23. Xbar–R Chart	152
7.24. Performance Comparison	152
7.25. Control	153
7.26. The Standardised Process	153
7.27. Process Normality Test	155
7.28. Performance of the Standardised Process	156
7.29. Process Capability Analysis	157
7.30. Comparison	157
8. Conclusion	158
9. Managerial Implication	159
10. Challenges	159
11. Key Lessons Learned	159
References	159

Chapter 9 Redesigning Graduate Education in Data Analytics:

A Lean Six Sigma Approach	163
<i>Elizabeth A. Cudney</i>	
1. Introduction	163
2. Relevant Literature	164
3. Research Methodology	165
4. Results	166
4.1. Define Phase	166
4.2. Measure Phase	168
4.3. Analyse Phase	172
4.4. Improve Phase	174
4.5. Control Phase	177
5. Conclusion	178
References	179

Chapter 10 Improving the New Hire Employee Appointment Scheduling and Clinic Operation with Simulation	181
<i>Suzanne Brown, Lyndsay Jozsa, Tze Sheng Yap, Theodore T. Allen and Sandra L. Furterer</i>	
1. Introduction	181
2. Methodology	183
3. Implementation of Six Sigma	183
3.1. Define Phase	183
3.2. Measure Phase	190
3.3. Analyse Phase	191
3.4. Improve Phase – Outcomes	193
3.5. Control Phase	196
4. Managerial Implications	197
5. Lessons Learned and Key Challenges	197
6. Chapter Summary	198
Chapter 11 Enhancing Engineering Education Service Quality with Lean Six Sigma: A Viewpoint	201
<i>Michael Sony and Raja Jayaraman</i>	
1. Introduction	201
2. Background Theory	203
2.1. Lean	203
2.2. Six Sigma	203
2.3. Lean Six Sigma	204
2.4. Engineering Education Service Quality	205
3. Methodology	205
3.1. Data Sources	205
3.2. Inclusion and Exclusion	206
3.3. Screening	206
3.4. Why Thematic Integrative Analysis?	206
4. Thematic Analysis	207
4.1. Research Orientation	207
4.2. Higher Order Learning	208
4.3. Personal Growth	209
4.4. Project Opportunities	209
4.5. Effective Teaching	209
4.6. Support Processes	209
4.7. Infrastructure	210
4.8. Workload	210
5. LSS and EESQ Integration	210
6. Discussion	210
7. Future Research Direction	211

8. Limitation of the Study	212
9. Conclusion	212
References	212

**Chapter 12 Future of OPEX in Higher Education:
Key Findings from a Global Study** **217**

*Arshia Kaul, Ranjit Roy Ghatak, Jiju Antony,
Elizabeth A. Cudney and Michael Sony*

1. Introduction	217
2. Research Methodology	219
3. Results and Discussion	222
3.1. Definitions of OPEX in HE	223
3.2. Tools Used for OPEX in HE	223
3.3. Challenges for OPEX in HE	224
3.4. Future of OPEX	225
3.5. Skills and Competencies for Leadership for OPEX	226
3.6. Enablers and Barriers of OPEX	228
3.7. Industry 4.0 and Relation to OPEX in HE	228
3.8. Principles of OPEX and Implementation	229
3.9. Shift to Online and Hybrid for OPEX	229
4. Discussion	230
5. Summary	231
Acknowledgement	232
References	232

Index	233
-------	-----

Chapter 1

Operational Excellence Methodologies in Higher Education

Elizabeth A. Cudney^a, Arshia Kaul^b, Ranjit Roy Ghatak^c, Jiju Antony^d and Michael Sony^e

^a*Maryville University, USA*

^b*University of Melbourne, Australia*

^c*International Management Institute, Bhubaneswar, India*

^d*Northumbria University, UK*

^e*Oxford Brookes University, UK*

1. Introduction

Operational Excellence (OPEX) methodologies, including Kaizen, Lean, Six Sigma, and Lean Six Sigma (LSS), have gained recognition as effective approaches to enhancing efficiency, improving quality, and creating value in various sectors. Within higher education, these methodologies offer transformative potential to address increasing challenges such as rising costs, administrative inefficiencies, and growing demands for improved student satisfaction and outcomes. By systematically identifying and eliminating waste, reducing variation, and fostering continuous improvement, OPEX methodologies enable educational institutions to refine teaching practices, streamline administrative processes, and enhance overall institutional performance (Cudney et al., 2020).

Kaizen, meaning ‘continuous improvement’ in Japanese, is rooted in the philosophy of making small, incremental changes over time to improve processes and outcomes. This approach emphasises collaboration, employee engagement, and an ongoing commitment to identifying and eliminating inefficiencies (Emiliani, 2005). In higher education, Kaizen supports efforts to enhance curriculum design, improve administrative workflows, and create more effective student support systems (Doman, 2011).

Lean methodology focusses on identifying and eliminating waste, any activity that does not add value to the customer, while optimising processes to deliver maximum value efficiently. Originally developed within the manufacturing sector,

Operational Excellence Case Studies in Higher Education Institutions, 1–9

Copyright © 2025 by Elizabeth A. Cudney, Arshia Kaul, Ranjit Roy Ghatak, Jiju Antony and Michael Sony

Published under exclusive licence by Emerald Publishing Limited

doi:10.1108/978-1-83797-849-620251001

Lean has been adapted to numerous industries, including education (Balzer et al., 2015). By emphasising principles such as value stream mapping and continuous flow, Lean enables institutions to enhance operational efficiency and improve the student experience (Comm & Mathaisel, 2005; Hines & Lethbridge, 2008). Waterbury (2015) noted that successful Lean initiatives in higher education require careful planning, resource allocation, and stakeholder involvement.

Six Sigma is a data-driven methodology aimed at reducing variation and defects in processes. By employing the Define, Measure, Analyse, Improve, and Control (DMAIC) framework, Six Sigma allows organisations to address root causes of inefficiencies and improve process quality systematically. This methodology has been effectively applied in higher education to optimise teaching practices, streamline curriculum approval processes, and improve service delivery (Kumi & Morrow, 2006; Pryor et al., 2012; Yu & Ueng, 2012). Weinstein and Castellano (2008) emphasised the importance of integrating Six Sigma principles into academic curricula to bridge theoretical knowledge and practical applications.

LSS integrates the efficiency-driven principles of Lean with the quality-focussed methodologies of Six Sigma. This hybrid approach combines Lean's emphasis on waste elimination with Six Sigma's focus on data analysis and process improvement, creating a comprehensive framework for achieving sustainable OPEX. Antony et al. (2012) explored the critical success factors and barriers to implementing LSS in higher education, while Sunder (2016) and Kanakana et al. (2015) demonstrated its effectiveness in improving library processes, reducing costs, and enhancing teaching quality.

This chapter explores the application of these methodologies in higher education, illustrating how they can be leveraged to improve academic and administrative outcomes. Each methodology is examined in the context of its foundational principles, implementation strategies, and impact on institutional performance.

2. Kaizen in Higher Education

Kaizen emphasises incremental, ongoing changes involving all members of an organisation. In higher education, Kaizen can enhance processes ranging from curriculum development to student services. By fostering a culture of collaboration and continuous learning, Kaizen enables institutions to identify inefficiencies in academic and administrative workflows, implement small, consistent improvements with minimal disruption, and engage faculty, staff, and students in the improvement process.

Emiliani (2005) demonstrated how Kaizen was applied to improve the content of graduate business school courses by addressing improvement opportunities. This study detailed the practical steps to refine course materials and enhance teaching delivery methods. Similarly, Doman (2011) showcased the successful application of Kaizen in streamlining university administrative processes, particularly in reducing delays and improving resource allocation. The initiatives described by Emiliani (2005) and Doman (2011) highlight how Kaizen's principles lead to measurable outcomes, including reduced wait times, enhanced

student satisfaction, and optimised resource utilisation. These efforts collectively illustrate the potential of Kaizen to create a culture of continuous improvement in higher education settings. [Hasan and Hossain \(2018\)](#) focus on using Kaizen on selected students to improve the quality of engineering students.

3. Lean in Higher Education

Lean focusses on eliminating waste – activities that do not add value to the customer – while optimising processes to maximise efficiency. Originally, Lean emanated from the total quality management (TQM) and just-in-time, which was based on Ford's practices ([Cudney & Elrod, 2011](#)). Taiichi Ohno studied Ford's practices and developed the Toyota Production System ([Shah & Ward, 2007](#)). Originally derived from the Toyota Production System, Lean identifies eight forms of waste, including overproduction, waiting, and defects ([Kanigolla et al., 2013](#)). When applied to higher education, Lean principles enhance administrative processes, improve student experiences, and foster a data-driven approach to decision-making, enabling institutions to focus resources on high-value activities. Many higher education institutions are now trying to implement new ways to manage the ever-increasing costs and demand for continuous improvement by providing distance education to students ([Bandyopadhyay, 2014](#)).

One of the first academics to apply Lean principles and practices to Higher education was [Emiliani \(2004\)](#). The focus of the study was to design and deliver a graduate business course using Lean principles. Based on the implementation course based on Lean principles, it was seen that the teaching evaluation course improved. [Comm and Mathaisel \(2005\)](#) found that many universities employed Lean practices to ensure sustainability and reduce costs, often aligning these practices with broader institutional goals. Their investigation revealed that higher education institutions defined Lean thinking in terms of cost savings and operational efficiency. Similarly, [Hines and Lethbridge \(2008\)](#) identified opportunities to eliminate waste and improve customer value within higher education institutions. They emphasised the importance of engaging stakeholders in identifying inefficiencies and implementing Lean solutions. In their study, [Carvalho et al. \(2013\)](#) focussed on using Lean practices to improve engineering courses. This project was part of Lean, a collaborative project between five companies and five European universities, which developed Learning Academy, a collaborative project between five companies and five European universities that developed a training programme for engineers.

[Douglas et al. \(2015\)](#) translated Lean's eight wastes into the higher education context, offering practical examples of how these wastes could be mitigated to enhance efficiency and quality. [Waterbury \(2015\)](#) added to this by identifying challenges faced by institutions wishing to implement Lean. Their work emphasised the need for reflective planning and strategic allocation of resources to ensure the success of Lean initiatives. Together, these studies illustrate how Lean methodologies can transform administrative and academic processes, leading to improved outcomes for students and institutions.

4. Six Sigma in Higher Education

Six Sigma is a data-driven methodology designed to reduce process variations and defects, ultimately enhancing quality and consistency in organisational operations. Six Sigma has demonstrated significant potential in the higher education sector, addressing challenges in teaching effectiveness, course and curriculum development, and administrative efficiency. Kumi and Morrow (2006) highlighted the practical application of Six Sigma at Newcastle University Library, where the DMAIC framework was employed to identify inefficiencies in the book-issuing process. The subsequent interventions significantly reduced errors and improved the overall user experience. Similarly, Pryor et al. (2012) implemented Six Sigma to streamline the curriculum approval process. Applying the methodology reduced the process cycle time by 78.9%, leading to enhanced institutional efficiency and performance.

The role of Six Sigma in bridging theoretical knowledge and practical application in academia has also been emphasised. Weinstein and Castellano (2008) demonstrated the integration of Six Sigma principles into Master of Business Administration (MBA) curricula, enabling students to engage with real-world process improvement projects. This approach reinforced theoretical learning through practical exposure, fostering deeper understanding and skill development. Yu and Ueng (2012) further expanded the application of Six Sigma in higher education by employing the DMAIC model to develop a systematic feedback system for improving teaching quality. Their study underscored the value of Six Sigma in promoting continuous improvement in pedagogical methods.

In recent years, research has expanded to validate the broader applicability of Six Sigma in various academic contexts. Antony et al. (2012) reviewed the critical success factors and barriers to Six Sigma implementation in higher education institutions, identifying its utility in minimising inefficiencies across administrative and academic processes. Thomas et al. (2017) explored using Six Sigma to optimise student admission and registration processes, resulting in reduced wait times and improved student satisfaction. These studies demonstrate the growing recognition of Six Sigma as a valuable tool for continuous improvement in higher education.

Sunder and Mahalingam (2018) empirically investigated the applicability and implementation of Six Sigma in higher education institutions. Using a five-phased approach and a multiple case study method, the study examined the implementation of Six Sigma in two international university colleges. The research highlights the practical challenges and benefits of Six Sigma in higher education institutions (HEIs), emphasising the use of the Six Sigma toolkit, change management strategies, and the involvement of student teams in project management. Davidson et al. (2020) explored Six Sigma's application in quality assurance frameworks within higher education. Their research demonstrated how Six Sigma tools, such as process mapping and control charts, ensure consistency in academic processes, including examination systems and accreditation preparation.

These studies collectively highlight the versatility and effectiveness of Six Sigma in higher education. By fostering a culture of continuous improvement and

leveraging data-driven methodologies, institutions can streamline administrative processes, enhance teaching quality, and adapt to the evolving needs of students and stakeholders.

5. LSS in Higher Education

LSS integrates the efficiency-driven principles of Lean with the quality-focused methodologies of Six Sigma, forming a robust framework for continuous improvement. In higher education, LSS offers a structured approach to addressing complex challenges, aligning institutional processes with strategic objectives, and fostering collaborative problem-solving among cross-functional teams.

[Antony et al. \(2012\)](#) investigated the critical success factors and barriers to implementing LSS in higher education institutions, emphasising the pivotal roles of leadership commitment and stakeholder engagement. They identified essential tools such as process mapping, cause-and-effect analysis, and rapid improvement workshops as instrumental in driving successful change. [Kanakana et al. \(2015\)](#) demonstrated the effectiveness of LSS in reducing costs and enhancing quality within South African universities. Their framework addressed the costs associated with poor quality, including internal and external failure costs, and proposed improvements such as staff quality assessments and modifications in lecturing styles.

[Sunder \(2016\)](#) presented a case study on implementing LSS in university library processes, highlighting significant efficiency gains. The study underscored the adaptability and impact across diverse institutional functions, enabling higher education institutions to achieve substantial and sustainable improvements in performance and stakeholder satisfaction. [Hess and Benjamin \(2015\)](#) identified areas where LSS could enhance institutional functions, including curriculum delivery, admissions, and research.

Recent studies have further explored LSS applications in higher education. From an international perspective, [Kokkinou and van Kollenburg \(2023\)](#) identified critical success factors for Lean implementation in higher education institutions, highlighting the importance of employee empowerment, sharing success stories, and training. Their findings suggest that LSS methodologies can be effectively applied to streamline operations and improve service quality in various academic and administrative domains.

[Yadav et al. \(2024\)](#) explored barriers to implementing Green LSS in higher education institutions. They proposed strategies to mitigate these challenges, emphasising the significance of organisational culture and continuous assessment. These examples illustrate the versatility and efficacy of LSS in addressing multifaceted challenges within higher education, fostering a culture of quality and continuous improvement.

6. TOC in Higher Education

The Theory of Constraints (TOC), conceptualised by Eliyahu M. Goldratt, provides a strategic approach for identifying and addressing bottlenecks that hinder

an organisation's ability to achieve its objectives. In higher education, TOC is a robust framework for improving operational efficiency, streamlining institutional processes, and aligning resources with strategic goals.

Pacheco Lacerda et al. (2010) investigated the application of TOC in higher education service operations, integrating process engineering and TOC thinking processes. Their study pinpointed bottlenecks in administrative workflows and recommended targeted solutions that significantly enhanced operational efficiency. Similarly, Kumaran et al. (2015) demonstrated the effectiveness of TOC in postgraduate research programmes, illustrating how addressing resource constraints and prioritising critical projects led to improved programme outcomes, reduced delays, and optimised resource utilisation.

Willson (2018) explored the impact of systemic managerial constraints on the information behaviour of early career academics in the humanities and social sciences. By applying TOC principles, the study provided actionable strategies to mitigate these challenges, ultimately enhancing academic productivity. These studies underscore the growing recognition of TOC as an effective framework for addressing challenges in higher education. By systematically identifying and addressing constraints, higher education institutions can optimise their operations, improve academic and administrative outcomes, and enhance the overall student experience.

7. Agile

Some researchers have considered integrating agile methods into different forms of teaching. Various adaptations have been made based on the Agile manifesto for educational institutions (Krehbiel et al., 2017; Madhuri & Prakash, 2018). As Otero et al. (2020) discussed, many use agile tools such as Scrum and educational programming in teaching. Salza et al. (2019) highlight that agile methods are used in the higher education sector for projects, lab classes, and courses.

8. Conclusion

Adopting OPEX methodologies such as Kaizen, Lean, Six Sigma, and LSS in higher education represents a transformative opportunity for institutions to enhance their operational effectiveness, academic quality, and overall value delivery. These methodologies enable higher education institutions to adapt to evolving challenges, including rising costs, increasing demands for efficiency, and the need to meet diverse stakeholder expectations.

Kaizen provides a foundation for continuous improvement, fostering a culture where incremental changes yield substantial long-term benefits. Lean methodologies emphasise waste reduction and process optimisation, enabling institutions to reallocate resources effectively and focus on activities that create maximum value for students and staff. Six Sigma contributes a rigorous, data-driven approach to reducing variation and improving process quality, ensuring consistency and reliability in institutional operations. Finally, LSS integrates these principles into

a comprehensive framework, addressing complex challenges and aligning institutional efforts with strategic goals.

By integrating these methodologies, institutions can achieve measurable improvements in administrative efficiency, academic delivery, and student satisfaction. For example, implementing LSS has demonstrated reductions in curriculum approval times, teaching quality enhancements, and library service optimisations. The systematic application of these approaches supports not only immediate improvements but also the development of sustainable practices that drive long-term success.

As higher education continues to evolve in response to technological advancements, globalisation, and sustainability concerns, OPEX methodologies will play an increasingly critical role. Institutions that embrace these practices will be better positioned to innovate, adapt, and thrive in a competitive and dynamic educational landscape. The future of higher education will depend on the ability of institutions to implement these methodologies effectively, leveraging their full potential to create value and enhance the quality of education for all stakeholders.

References

- 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(8), 940–948.
- Balzer, W. K., Brodke, M. H., & Kizhakethalackal, E. T. (2015). Lean higher education: Successes, challenges, and realizing potential. *International Journal of Quality & Reliability Management*, 32(9), 924–933.
- Bandyopadhyay, J. (2014). A framework for designing, developing, and delivering high-quality online higher education program in the U.S. using the Six Sigma approach. *Journal of Business Behavioral Sciences*, 26(3), 43–53.
- Carvalho, C., Lopes, M., Ramos, A., Avila, P., Bastos, J., Fonseca, L., & Martens, I. (2013). Lean learning academy: An innovative framework for lean manufacturing training. In *1st international conference of the Portuguese Society for Engineering Education (CISPEE)* (pp. 1–4). IEEE.
- Comm, C. L., & Mathaisel, D. (2005a). An exploratory study of best lean sustainability practices in higher education. *Quality Assurance in Education*, 13(3), 227–240.
- Cudney, E., & Elrod, C. (2011). A comparative analysis of integrating lean concepts into supply chain management in manufacturing and service industries. *International Journal of Lean Six Sigma*, 2(1), 5–22.
- Cudney, E., Venuthurumilli, S., Materla, T., & Antony, J. (2020). Systematic review of Lean and Six Sigma practices in higher education. *Total Quality Management*, 31(3), 231–244.
- Davidson, J. M., Price, O. M., & Pepper, M. (2020). Lean Six Sigma and quality frameworks in higher education – A review of literature. *International Journal of Lean Six Sigma*, 11(6), 991–1004. <https://doi.org/10.1108/IJLSS-03-2019-0028>
- Doman, M. S. (2011). A new lean paradigm in higher education: A case study. *Quality Assurance in Education*, 19(3), 248–262.

- Douglas, J. A., Antony, J., & Douglas, A. (2015). Waste identification and elimination in HEIs: The role of lean thinking. *International Journal of Quality & Reliability Management*, 32(9), 970–981.
- Emiliani, M. L. (2004). Improving business school courses by applying lean principles and practices. *Quality Assurance in Education*, 12(4), 175–187.
- Emiliani, M. L. (2005). Using kaizen to improve graduate business school degree programs. *Quality Assurance in Education*, 13(1), 37–52.
- Hasan, Z., & Hossain, M. S. (2018). Improvement of effectiveness by applying PDCA cycle or kaizen: An experimental study on engineering students. *Journal of Scientific Research*, 10(2), 159. <https://doi.org/10.3329/JSR.v10i2.35638>
- Hess, D. J., & Benjamin, A. (2015). Applying Lean Six Sigma within the university: Opportunities for process improvement and cultural change. *International Journal of Lean Six Sigma*, 6(3), 249–262.
- Hines, P., & Lethbridge, S. (2008). New development: Creating a lean university. *Public Money and Management*, 28(1), 53–56.
- Kanakana, G., Wyk, B., & Pretorius, J. (2015). Framework assessment for costs of poor quality in higher education processes. In *Proceedings of 2015 international conference on management of engineering and technology (PICMET '15)* (pp. 1133–1136). IEEE.
- Kanigolla, D., Cudney, E., & Corns, S. (2013). Employing project-based learning in Six Sigma education. *The Journal for Quality and Participation*, 36(1), 45–61.
- Kokkinou, A., & van Kollenburg, T. (2023). Critical success factors of lean in higher education: An international perspective. *International Journal of Lean Six Sigma*, 14(6), 1227–1247. <https://doi.org/10.1108/IJLSS-04-2022-0076>
- Krehbiel, T. C., Salzarulo, P. A., Cosmah, M. L. J., Forren, G., Gannod, D., Havelka, A. R., Hulshult, & J. Merhout (2017). Agile manifesto for teaching and learning. *The Journal of Effective Teaching*, 17(2), 90–111.
- Kumaran, S. R., Othman, M. S., & Yusuf, L. M. (2015). Applying theory of constraints (TOC) in business intelligence of higher education: A case study of postgraduates by research program. In *2015 international conference on science in information technology (ICSITech)* (pp. 147–151). IEEE. <https://doi.org/10.1109/ICSITech.2015.7407794>
- Kumi, S., & Morrow, J. (2006). Improving self-service the six sigma way at Newcastle University Library. *Program: Electronic Library and Information Systems*, 40(2), 123–136.
- Madhuri, G., & Prakash, G. (2018). Adopting agile values in engineering education. In *2018 IEEE 6th international conference on MOOCs, innovation and technology in education (MITE)* (pp. 103–106). IEEE.
- Otero, T. F., Barwaldt, R. T., Topin, L. O., Vieira Menezes, S., Ramos Torres, M. J., & de Castro Freitas, A. L. (2020). Agile methodologies at an educational context: A systematic review. In *2020 IEEE frontiers in education conference (FIE)* (pp. 1–5). IEEE.
- Pacheco Lacerda, D., Augusto Cassel, R., & Henrique Rodrigues, L. (2010). Service process analysis using process engineering and the theory of constraints thinking process. *Business Process Management Journal*, 16(2), 264–281. <https://doi.org/10.1108/14637151011035598>
- Pryor, M., Alexander, C., Taneja, S., Tirumalasetty, S., & Chadalavada, D. (2012). The application of Six Sigma methodologies to university processes: The use of student teams. *Journal of Case Studies in Accreditation and Assessment*, 2, 1–14.
- Salza, P., Musmarra, P., & Ferrucci, F. (2019). Agile methodologies in education: A review. In D. Parsons & K. MacCallum (Eds.), *Agile and lean concepts for teaching and learning* (pp. 25–45). Springer.