

Driving Operational Excellence in Higher Learning Institutions: Integrating Shingo Model, Lean Six Sigma, Hoshin Kanri

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ABSTRACT: Higher education institutions (HEIs) often struggle to implement improvement initiatives that promise significant benefits but fail to produce lasting change. This paper integrates the Shingo Model with Lean, Six Sigma, and Hoshin Kanri to cultivate a culture of continuous improvement while minimizing complexity. Through a systematic two-phase literature synthesis, we analyze core principles, perform a comparative evaluation highlighting that the Shingo Model excels in cultural focus, leadership, and change management, while Lean provides rapid implementation. Our findings also map critical failure factors (CFFs) to Shingo principles, revealing how principles like "Lead with Humility" and "Create Constancy of Purpose" address management commitment and training inadequacies. We develop the Principles-Tools-Align (PTA) framework, emphasizing the Shingo Model's foundational principles, Lean's operational tools, and Hoshin Kanri's strategic alignment. This research illustrates how the PTA framework offers distinct strategies to enhance infrastructure development, align curricula with labor market needs, and maximize resource utilization. By providing HEIs with a robust roadmap that resolves the tools-only paradox, the PTA framework facilitates sustained academic excellence through the synergy of culture, execution, and alignment, ultimately optimizing operational effectiveness and enhancing stakeholder satisfaction.

KEYWORDS: Lean Higher Education, Continuous Improvement, Organizational Excellence, Corporate Social Responsibility

INTRODUCTION

Africa is experiencing rapid population growth, resulting in a significant "youth bulge," and is projected to have the largest workforce globally by 2040. Despite increases in tertiary education enrolment, the continent's gross enrolment ratio remains the lowest worldwide, indicating persistent challenges within the sector (Ahmed et al., 2025; Mohamedbhai, 2011). These challenges include inadequate funding, insufficient infrastructure, and misalignment with labor market demands. Political instability and economic constraints further exacerbate these issues (Ahmed et al., 2025). HEIs in Africa operate in a complex environment, functioning as multifaceted organizations that integrate business, research, healthcare, entertainment, and civic engagement. Central to their mission is a commitment to education, research, and community outreach (Olo et al., 2020). Consequently, HEIs face unprecedented demands for continuous improvement and adaptability from various stakeholders, including policymakers, quality assurance agencies, industry partners, staff, and students (Edoru et al., 2025; Tsapi, 2024; Whelan et al., 2024). These demands arise from the need to enhance learning outcomes and contribute effectively to the workforce. As the sector evolves, institutions must strategically innovate to uphold core values while meeting the changing expectations of students and society. This evolution is further complicated by rising costs, administrative inefficiencies, and increasing demands for student satisfaction and successful outcomes (Akhilesh and Prashant, 2025).

To address these challenges, operational excellence (OE) methodologies offer a promising pathway to enhance institutional performance (Cudney et al., 2025). OE involves systematically identifying and eliminating waste, reducing process variation, and fostering a culture of continuous improvement. In the context of higher education, operational excellence refers to the ability of institutions to consistently deliver high-quality educational services while optimizing resources and processes (Yunus et al., 2023). A more efficient institution can enrol students more quickly, provide better advising, and allocate resources where they are needed most, all without compromising service or outcomes.

Recognizing the potential of OE, methods such as Lean, Six Sigma, Lean Six Sigma (LSS), and Hoshin Kanri have gained traction across various sectors as effective strategies for improving efficiency, quality, and stakeholder value (White, 2024; Gómez-Molina & Moyano-Fuentes, 2022; Chentoufi & Ennadi 2024). However, with intensifying competitive pressures, escalating operational costs, and diverse stakeholder expectations, today's HEIs face an urgent need for effective operational strategies. Institutions that recognize operational effectiveness as essential to achieving

excellence are increasingly adopting such as Lean, Six Sigma, Lean Six Sigma (LSS), and Hoshin Kanri are increasingly adopted (Antony et al., 2025; Balzer & Sinha, 2023).

Unique to OE methodologies is their focus on distinct organizational needs. Lean emphasizes waste elimination and process efficiency through continuous small improvements and value-stream mapping (Avilés-Noles, 2025; Khan et al., 2024; Simonyte et al., 2022). Six Sigma aims to reduce process variations and defects with structured problem-solving and data-driven decision-making (Tsapi, 2025; Alkoot & Hitn-Paaet 2019; Nadeau, 2017). In contrast, Hoshin Kanri aligns organizational objectives across all levels, ensuring cohesion between mission and operational execution (Balzer & Sinha, 2023; Rochmawati et al., 2020). Notably, many HEIs deploy these methodologies primarily as toolsets rather than frameworks for cultural and behavioural transformation, which undermines their effectiveness (Cross et al., 2024; Carvalho et al. 2022). As a result, numerous institutions struggle to meet their operational transformation goals. This disconnect highlights the need for a deeper understanding and integration of these methodologies to foster sustainable improvement in higher education.

Research on Lean and Lean Six Sigma deployment has identified numerous critical failure factors, including a lack of top management commitment, insufficient training, poor project selection, inadequate resources, and weak alignment with strategic objectives (Antony, 2014; Marin-Garcia et al., 2025). Alarmingly, resistance to culture change is a prominent barrier, with failure rates for Lean and Six Sigma initiatives ranging between 50-70%-especially in service-oriented sectors like education (Albliwi et al., 2014; Petrinska Labudovikj et al., 2025). This underscores the necessity for strong executive leadership to address cultural hurdles and resistance prevalent in HEIs.

HEIs face distinctive challenges in adopting continuous improvement methodologies, such as terminology misalignment, cultural resistance, complex stakeholder expectations, and limited awareness of operational excellence benefits. Research indicates that many institutions fail due to top-down planning without stakeholder input and a misguided focus on cost-cutting rather than service enhancement (Gajendragadkar et al., 2019). Successful transformation necessitates collaborative, bottom-up approaches that treat faculty and staff as integral partners (Marin-Garcia et al., 2025). For instance, a validation study of Lean Thinking adoption in Ecuadorian HEIs highlighted that while leadership engagement scored well, waste elimination lagged, indicating a pressing need for refining organizational readiness (Avilés-Noles, 2025).

The Shingo Model offers a distinct perspective and is the most well-known and globally accepted framework used to guide the implementation of an operational excellence system (Carvalho et al., 2019); positing that sustained excellence arises from ideal behaviours rooted in universal principles. Represented in Figure 1 as a diamond, the model delineates five interrelated components: culture, principles, systems, tools, and results (Toussaint et al., 2020). Culture resides at the model's core, serving as the foundation for behavioural change within organizations (Shingo Institute, 2025). The surrounding elements: principles, systems, tools, and results, work cohesively to foster an environment conducive to continuous improvement.

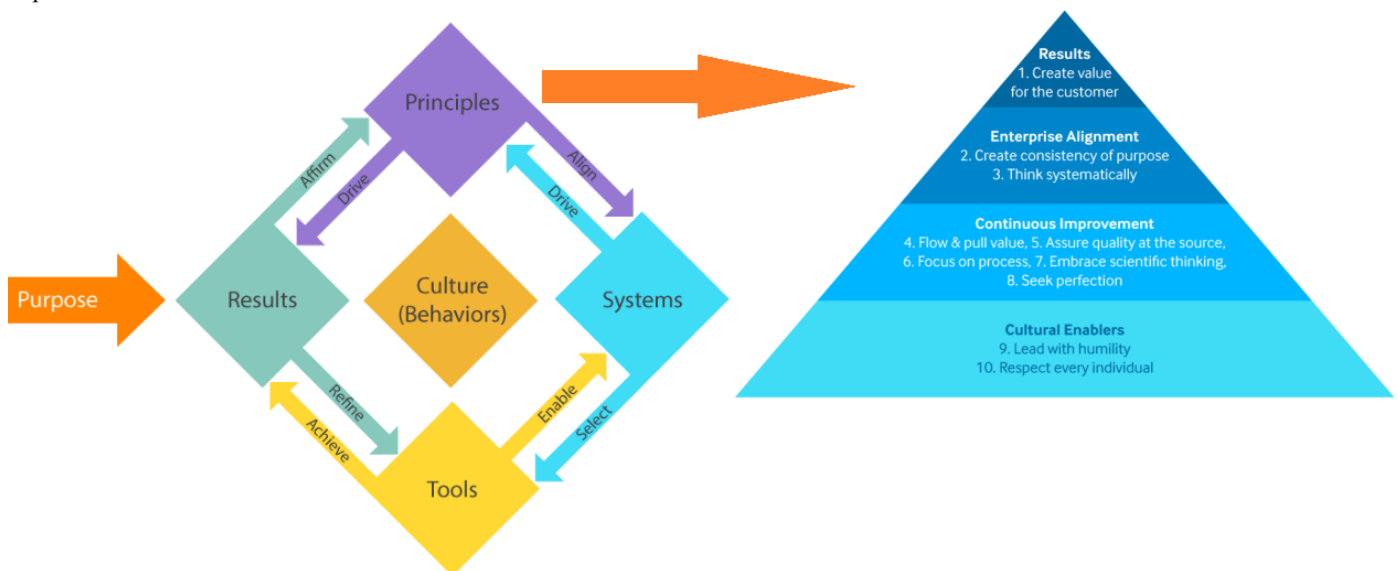


Figure 1: Shingo Model

Culture: is located at the center of the diamond and represent all behavior in an organization. As the foundation of any workplace, culture is also considered the central point on which the Shingo Model operates. Culture is leaned on so much in the model because it is the driving force of change within the workplace. For example, a workplace culture that is intent on fixing mistakes will be better off in terms of continuous improvement than another workplace culture that only focuses on output.

Principles: Going from the center of the diamond to the very top is where the Shingo's ten guiding principles reside. They are divided into four categories: cultural enablers, continuous improvement; enterprise alignment and results. The principles focus on culture development, improvement, an emphasis on understanding the organization's purpose, and the results of all their hard work.

Systems: Moving on to the right corner of the diamond are the systems used within the company to achieve the organization's purpose. The outcomes here are entirely determined by behavioral excellence as well as performance.

Tools: Moving on to the bottom corner resides the tools within those systems that are used to achieve the results the company wants. Many companies become fixated on solving their problems solely with tools. However, Shingo was adamant that the tools would be used with all other

parts of the Shingo Model. Furthermore, only focusing on tools such as 5S and Lean Six Sigma, etc. would answer the question of “how” to complete a task but would leave the workers wondering “why” it was necessary.

Results: Lastly, we have the left-hand corner where results are located. Many know them as Key Performance Indicators. Tools and workplace culture help to achieve the expected results while affirming the guiding principles and refining the tools used.

The Shingo Model rests on three core insights articulated by the Shingo Institute: (1) ideal results require ideal behaviours, emphasizing the relationship between results and organizational behaviour, (2) purpose and systems drive behaviour, highlighting the impact systems have on employee actions, and (3) principles inform ideal behaviours, enabling informed decision-making that fosters a culture of excellence (Interfacing, 2025). A case study at the University of Washington demonstrated the effective application of Shingo principles, resulting in substantial improvements in training, coaching, and financial outcomes, underscoring the importance of a supportive culture for continuous improvement (Michael et al., 2019). This success stemmed from creating a cultural foundation where continuous improvement became normal work behaviour. Despite growing research on Lean, Lean Six Sigma, and Hoshin Kanri in higher education, few studies have explored the integrated application of the Shingo Model alongside these frameworks within a principles-based approach (Sá et al., 2022). This gap is particularly pronounced in sub-Saharan African HEIs grappling with corruption, competition, rising costs, and quality demands. Thus, this paper seeks to investigate:

1. How do Shingo Model principles integrate with Lean Six Sigma and Hoshin Kanri to enhance operational excellence in HEIs? Specifically, how does a principles-based approach address cultural and behavioural deficits associated with tool-only implementations?
2. In what contexts does this integration yield maximum improvements in efficiency, culture, and stakeholder satisfaction?

By proposing a principles-centered integrated framework, this study aims to fill literature gaps, offer context-sensitive guidance, advance understanding of principles-based transformations, and support excellence initiatives within higher education institutions.

LITERATURE REVIEW

A desk review and secondary data analysis were conducted to identify key challenges and opportunities for achieving operational excellence in HEIs in Africa. The analysis highlighted significant challenges, including inadequate funding, insufficient infrastructure, misalignment between educational outcomes and labor market demands, poor resource utilization.

Funding Challenges in African HEIs

In 2021, the average public spending on education across 158 countries was 4.48%, with Namibia leading the African continent at 10.39%, while Nigeria reported the lowest at just 0.38% (World Bank, 2021). This stark disparity, as presented in **Table 1**, highlights the potential opportunity for countries to leverage increased investment in education to enhance institutional performance and service delivery. Conversely, the challenges are evident in low-spending countries like Cameroon and Nigeria, which underscores a broader issue of inadequate public funding that hampers institutions' capacity to meet quality standards and align educational outcomes with labor market demands (Devarajan et al., 2011).

Table 1: Government spending on education as a percentage of GDP, Africa 2021

Country	Spending on education as % of GDP	Global rank	Country	Spending on education as % of GDP	Global rank
Namibia	10.39	2	Mauritius	4.67	70
Sierra Leone	9.44	4	Mali	4.36	79
Lesotho	7.51	10	Togo	4.23	83
Tunisia	6.68	13	Ethiopia	4.07	90
South Africa	6.55	15	Niger	3.82	101
Mozambique	6.5	17	R. of Congo	3.67	106
Cape Verde	6.04	22	Ghana	3.42	111
Morocco	5.64	28	Ivory Coast	3.33	115
Seychelles	5.62	30	Benin	3.2	118
Senegal	5.61	31	Madagascar	3.2	119
Rwanda	5.59	32	Tanzania	3.12	121
Algeria	5.51	35	Zambia	3.11	124
Burkina Faso	5.22	51	Gambia	3.04	125
Kenya	4.89	58	Cameroon	2.83	134
Burundi	4.87	59	Nigeria	0.38	158

Source : https://www.theglobaleconomy.com/rankings/Education_spending/

Further complicating the landscape, a 2022 analysis as in Table 2, indicated that the average public spending as a percentage of total government expenditure across 113 countries was 13.94%. Notably, Sierra Leone recorded the highest public spending at 29.37%, emphasizing the potential for enhanced educational frameworks when adequate resources are allocated. However, Nigeria again presented a challenge with a mere 4.3%, illustrating the persistent funding gaps that restrict higher education institutions' ability to innovate and adapt to the evolving demands of the workforce. Thus, while opportunities for operational excellence exist through strategic investments and resource allocation, the path is fraught with challenges stemming from inadequate funding and infrastructure.

Table 2: Government spending on education as a percentage of public spending, Africa 2021

Country	Spending on education as % of GDP	Global rank	Country	Spending on education as % of GDP	Global rank
Sierra Leone	29.37	1	Lesotho	15.54	38
Namibia	25.32	4	R. of Congo	15.51	39
Morocco	23.87	6	Gambia	14.48	45
Ethiopia	23.01	7	Togo	14.48	46
Senegal	22.48	8	Tanzania	14.33	47
Burkina Faso	21.96	10	Ghana	13.18	54
Burundi	20.64	14	Algeria	13.1	57
Tunisia	19.97	16	Cameroon	12.77	59
South Africa	18.65	21	Rwanda	12.77	60
Mali	18.19	22	Niger	12.37	64
Benin	16.09	32	Mauritius	12.19	66
Ivory Coast	15.9	33	Nigeria	4.3	113
Cape Verde	15.69	37			

Source : https://www.theglobaleconomy.com/rankings/Education_spending_percent_of_government_spending/

Research and development expenditure gaps

In 2021, the average R&D expenditure as a percentage of GDP across 83 countries was 1.22%, with Israel leading globally at 5.78%. Within Africa, Egypt represented the highest R&D investment at 0.91% of GDP, granting it a global rank of 41. This indicates a broader challenge: only four African countries provided data on this vital indicator. The low level of R&D investment in many African nations hinders operational excellence, as insufficient funding can limit the capacity for innovation, effective teaching, and the development of new educational methodologies.

Table 3: Research and development expenditure, percent of GDP, Africa 2021

Country	Spending on research and development as % of GDP	Global rank
Egypt	0.91	41
South Africa	0.62	48
Mauritius	0.37	57
Burkina Faso	0.25	63
Mali	0.17	70

Source : https://www.theglobaleconomy.com/rankings/Research_and_development/

Patent Activity & Innovation Deficit

In 2021, the average number of patent applications by residents across 112 countries was 20,444, with China leading at 1,426,644 applications. In contrast, Cape Verde reported only 1 patent application, indicating disparities in innovation capacity. Within Africa, only 15 countries provided data on patent applications (Table 4), representing a critical challenge in fostering an innovation-driven culture that supports the development of new technologies and solutions. This scarcity of patent activity reflects inadequate funding, insufficient infrastructure, and a lack of alignment between educational outputs and industry needs.

Table 4: Patent applications, Africa 2021

Country	Spending on research and development as % of GDP	Global rank
South Africa	1804	20
Egypt	881	34
Algeria	268	51
Morocco	254	53
Kenya	160	56
Mozambique	30	82
Rwanda	14	90
Uganda	14	91
Zambia	13	92
Madagascar	6	97
Mauritius	6	98

Botswana	3	104
Djibouti	3	105
Cape Verde	1	14

Source : https://www.theglobaleconomy.com/rankings/Patent_applications_by_residents/Africa/

Skills mismatch

A growing mismatch exists between academic programs and labor market demands (Table 5). This divergence undermines the relevance of educational offerings and hampers the employability of graduates, limiting their contributions to the workforce and the broader economy. Addressing this gap is crucial for enabling operational excellence in HEIs.

Table 5: Mismatch between education and workplace requirements, Africa 2024

Country	% of Workers with Education Above Requirements	% of Workers with Education Matching Requirements	% of Workers with Education Below Requirements
Angola	3.2	28.1	68.8
Botswana	31.5	47.7	20.7
Mozambique	2.1	14.8	83.0
Namibia	17.0	42.9	40.1
South Africa	32.8	49.0	18.2
Zambia	8.8	48.8	42.4
Zimbabwe	28.2	56.2	15.7
Cameroon	6.0	32.2	61.8
Kenya	26.6	41.6	31.8
Madagascar	23.4	36.6	40.0
Mauritius	11.1	56.4	32.5
Rwanda	8.9	52.7	38.4
Egypt	8.2	37.3	54.5
Benin	4.3	15.3	80.5
Côte d'Ivoire	3.9	9.6	86.5
Ghana	6.8	48.0	45.2
Nigeria	7.7	48.2	44.1
Togo	2.8	12.9	84.4

Source: International Labour Organization – ILOSTAT (Ahmed et al., 2025)

Poor resource utilization

Higher education institutions (HEIs) in Africa face significant challenges in resource utilization. The inefficient use of financial, human, and infrastructural resources often undermines institutional effectiveness and hinders the quality of education. Key challenges identified for 21st-century higher education practitioners include:

1. **Leadership and governance challenges:** In many African HEIs, ineffective governance structures result in poor decision-making, ultimately affecting resource distribution and institutional priorities (Kiboij & Wosyanju, 2022; Jali & Lekhanya, 2017). Kiboij and Wosyanju (2022) highlight issues such as power struggles, compromised autonomy, and corruption that negatively impact leadership and resource management in Kenyan higher education.
2. **Curriculum relevance and modernization:** The disconnect between academic programs and labour market needs leads to suboptimal resource allocation, as institutions struggle to keep curricula updated with relevant skills (Vieriu & Petrea, 2025; Dyantyi, 2025; Agbaje, 2023; Jafarov, 2023; Asante, 2020).
3. **Digital divide and technological integration:** A significant disparity in access to technology impacts HEIs' ability to utilize digital resources efficiently, further complicating the allocation of existing infrastructure (Van Der Merwe, 2023; Egbeleo & Sodokin, 2025).

These challenges restrict the effective utilization of resources, which significantly impedes educational quality and institutional effectiveness. To address these issues, implementing operational excellence strategies can enhance resource management by optimizing processes and improving overall effectiveness (Kaul et al., 2025). This shift can lead to improved educational outcomes and greater institutional resilience.

MATERIALS AND METHODS

Research Object

This study investigates the integration of the Shingo Model's principles-based approach with Lean Six Sigma and Hoshin Kanri to address the tools-only paradox identified in the introduction, where 50-70% of continuous improvement initiatives fail due to cultural and behavioural deficits. The research design employs a systematic literature synthesis framework comprising three interconnected phases: analysis (individual model examination), comparative evaluation (synergy identification), and integrative synthesis (framework development). This methodological approach

aligns directly with the paper's theoretical positioning: moving from tool-centric implementations to principles-driven cultural transformation in HEIs, while addressing the two central research questions.

Data collection

Data were collected from diverse secondary sources, including books, academic journal articles, and industry reports focused on total quality management, educational management, Lean Six Sigma, Hoshin Kanri, and the Shingo Model. We implemented a comprehensive desk research strategy, involving an extensive literature review to identify the foundational frameworks of each operational excellence model and explore their applicability in higher education settings. Electronic databases such as Taylor & Francis, Springer, Web of Science, and Scopus were consulted to ensure a robust and well-rounded examination of existing knowledge. Search terms included combinations of "Shingo Model," "Lean Six Sigma," "Hoshin Kanri," "higher education," "operational excellence," and "integration."

Data were systematically collected from secondary sources using a structured desk research protocol adapted from higher education operational excellence literature reviews. The protocol comprised three sequential steps:

1. Database Selection: Targeted academic databases including Scopus, Web of Science, Taylor & Francis Online, SpringerLink, Emerald Insight, and Google Scholar, supplemented by Shingo Institute publications.
2. Search Strategy: Boolean search strings combined core terms: ("Shingo Model" OR "Shingo principles") AND ("Lean Six Sigma" or "Lean" or "Six Sigma") and ("Hoshin Kanri" OR "policy deployment") and ("higher education" or university). Additional filters included "operational excellence", "continuous improvement", "change management", and "culture transformation".
3. Inclusion Criteria (PRISMA-inspired):
 - Peer-reviewed articles
 - Books and frameworks on methodology integration
 - HEI case studies (especially University of Washington benchmark)
 - Systematic reviews on LSS failure factors and change management
 - Exclusion: Pure manufacturing studies without service/education transferability

Data Analysis

The collected data were analysed using a two-stage process:

1. *Comparative Evaluation*: A comparative analysis was conducted to identify similarities, differences, and potential synergies between the three models. This involved creating a comparative grid that evaluated each model against pre-defined parameters, including focus areas, implementation challenges, cultural implications, and expected outcomes. Key insights were drawn on how integrating principles from the Shingo Model could address the limitations of Lean Six Sigma and Hoshin Kanri when they are used strictly as toolsets.
2. *Synthesis and Integration*: The final stage synthesized findings from the individual analyses and comparative evaluations to develop a comprehensive integrated framework. This framework illustrates how the principles of the Shingo Model can be cohesively integrated with Lean Six Sigma and Hoshin Kanri to enhance operational excellence in HEIs. Additionally, case studies and examples from the literature were employed to discuss practical applications, emphasizing contexts where this integrated approach could yield maximum improvements in efficiency, cultural alignment, and stakeholder satisfaction.

RESULTS AND DISCUSSION

Comparative analysis

The comparative matrix (see Table 6) systematically evaluates synergies and gaps across the Shingo Model, Lean, Six Sigma, and Hoshin Kanri by decomposing operational excellence into distinct capability dimensions critical for higher education transformation. This directly addresses the paper's core themes: tools-only paradox resolution, cultural transformation, HEI applicability, change management integration, and sustained excellence. This analysis draws from systematic reviews, case studies, and framework analyses (Whittaker & Montgomery, 2022; Shingo model handbook, Kuwaiti, 2019; Antony, 2014), highlighting each methodology's unique strengths and weaknesses.

Table 6: Comparative matrix

Dimension	Shingo Model	Lean	Six Sigma	Hoshin Kanri	Integration Potential
1. Core Philosophy	Principles → Behaviors → Results	Eliminate waste, create flow	Reduce variation/defects	Strategy deployment	Shingo principles anchor all; resolves tools-only focus
2. Cultural Focus	High: Respect every individual, humility	Low-Medium: Kaizen culture	Low: Data-driven	Medium: Consensus building	High: Shingo enables Lean culture sustainability
3. Strategic Alignment	Medium: Enterprise alignment principle	Low	Low	High: X-matrix, catchball	Hoshin deploys Shingo vision
4. Tactical Tools	Behavioral assessment	High: VSM, 5S, Kaizen, etc	High: DMAIC, SPC, etc	Low: Policy deployment	High: LSS tools operationalize Shingo behaviours

5. Change Management	High: 7 ideal behaviours	Low (34 CFFs)	Low	Medium	High: Addresses #1 CFF (management commitment)
6. HEI Applicability	High: UW case	Medium (admin success)	Medium (curriculum)	Emerging	High: Principles resolve HEI barriers
7. Sustainability	High ("improvement = work")	Low (50-70% fail)	Low	Medium	High: Culture-first sustains gains
8. Leadership Role	High: Humility, respect	Medium	Low-Medium	High: Top-down vision	High: Shingo transforms leadership behaviour
9. Measurement Focus	Behaviour/process alignment	Flow efficiency	High: Statistical (3.4 DPMO)	Goal achievement	High: Six Sigma metrics validate Shingo behaviours
10. Implementation Speed	Medium-Long (cultural)	High (quick wins)	Medium (DMAIC cycles)	Medium (annual cycles)	Balanced: Lean quick wins → Shingo sustainability
11. Cost of Implementation	Medium (training)	Low	High (Black Belts)	Low-Medium	Medium: Shingo scales Lean cost-effectively
12. Risk of Failure	Low (principles-based)	High (34 CFFs)	High	Medium	Low: Integration mitigates top CFFs

Matrix Legend: High: Core strength/expertise; Medium: Adequate capability; Low: Weakness/limited focus; Integration Potential: Synergistic opportunities.

Table 7: Shingo Vs Top CFFs

No	CFF (Papers)	Shingo Principle(s)	Mechanism	UW Proof
1	Lack of top management attitude, commitment and involvement (20)	Lead with Humility; Create Constancy of Purpose	Servant leadership behaviours	Leadership invested in more than 8,000 training hours
2	Lack of training and education (15)	Respect Every Individual; Embrace Scientific Thinking	Capability development	Developed 47 internal coaches from staff
3	Poor LSS project selection and prioritisation (12)	Focus on Process; Create Value for the Customer	Principle-based prioritization	80,000 targeted improvements
4	Lack of Resources (10)	Respect Every Individual; Think Systemically	Internal waste elimination	\$328M from existing staff
5	Weak Link between CI Projects and Strategic Objectives (9)	Create Constancy of Purpose; Think Systemically	Purpose-driven alignment	4-phase model
6	Resistance to Culture Change (9)	Respect Every Individual; Lead with Humility	Behaviour → Results	Culture transformation

The pivotal paper "Critical Failure Factors of Lean Six Sigma: A Systematic Literature Review" by Albliwi et al. (2014) analyzed 56 studies from various sectors and identified 34 CFFs contributing to the 50-70% failure rate of Lean Six Sigma implementations. Among these, the top five CFFs were cited in 9 to 20 papers each, accounting for a significant portion of implementation challenges. Notably, the Shingo Model's 10 Guiding Principles systematically address these CFFs, establishing a principles-based cultural foundation often lacking in tool-centric Lean/Lean Six Sigma strategies. The analysis summarised in Table 7 uses direct evidence from the paper by Albliwi et al. (2014) mapped to Shingo principles and the University of Washington case study benchmark.

Each Shingo principle targets the root causes of Critical Failure Factors (CFFs), establishing a cultural foundation that is often absent from tool-only Lean Six Sigma deployments (Sá, 2022). For instance, the principles "Lead with Humility" and "Create Constancy of Purpose" address the Lack of Top management commitment. Executives adopt vulnerability by engaging in daily gemba walks and huddles, personally removing obstacles (Lead with Humility). Concurrently, they establish unwavering alignment with the institution's mission, ensuring it transcends leadership transitions (Create Constancy of Purpose). This dual approach transforms sporadic sponsorship into a consistent, observable form of servant leadership, generating a sustainable commitment among faculty. The University of Washington's implementation of over 8,000 training hours, yielding \$328 million in benefits and a Shingo Publication Award, exemplifies how this mechanism effectively eliminates the dominant CFF.

The Shingo Principles "Respect Every Individual" and "Embrace Scientific Thinking" specifically address the Lack of Training and Education. By reorienting training to prioritize problem-solving capabilities over tool certifications, "Respect Every Individual" elevates personnel development to the forefront (Mayo & Larke, 2011). In tandem, "Embrace Scientific Thinking" incorporates PDCA cycles into the academic culture, transforming faculty from tool users into systematic experimenters who test hypotheses daily into systematic experimenters who test hypotheses routinely. This approach fosters internal coach development, empowering staff rather than relying on external consultants. The University of

Washington's success in training 47 internal coaches from existing personnel, through structured PDCA experimentation underscores how a focus on respect and scientific rigor generates sustainable capabilities, effectively countering chronic training neglect in higher education institutions. To combat Poor Lean Six Sigma project selection and prioritization, the principles "Focus on Process" and "Create Value for the Customer" establish mechanisms that ensure academic relevance in project selection. "Focus on Process" shifts from arbitrary administrative metrics to behavioral assessments that identify principle violations, such as exclusion of faculty from selection processes and poor workflow. Simultaneously, "Create Value for the Customer" positions student experience as the primary criterion for project selection, ensuring that curriculum quality and teaching excellence take precedence over registration logistics. The University of Washington's implementation of over 80,000 improvements illustrates how this principle-based approach yields significant, targeted gains across both academic and administrative domains, thoroughly addressing this CFF.

The principles "Respect Every Individual" and "Think Systemically" work to overcome the Lack of Resources by introducing self-funding mechanisms that navigate chronic budget constraints. "Respect Every Individual" prioritizes people development, ensuring that all staff receive adequate training and coaching before project execution. Meanwhile, "Think Systemically" highlights opportunities for waste elimination within existing budgets, enabling the reallocation of funds toward high-return investments in personnel. At the University of Washington, the \$328 million in financial benefits derived from the development of internal coaches illustrates how a focus on respect and resource reallocation effectively resolves this CFF.

"Create Constancy of Purpose" and "Think Systemically" tackle the weak link between Continuous Improvement Projects and Strategic Objectives by ensuring alignment from mission to execution. Create Constancy of Purpose aligns projects with the institutional mission, integrating purpose across all levels of the organization. This alignment is further enhanced by Think Systemically, which connects daily improvements to observable mission outcomes via value stream mapping. The University of Washington's four-phase model demonstrates how over 80,000 tactical improvements contribute cohesively to strategic cultural transformation, thereby completely addressing this CFF.

Lastly, the principles "Respect Every Individual" and "Lead with Humility" confront Resistance to Culture Change. By reframing faculty members as valued problem-solvers, "Respect Every Individual" integrates continuous improvement into the academic framework as core scholarly activity rather than administrative duties. "Lead with Humility" compels executives to engage in daily gemba walks alongside faculty, fostering psychological safety that mitigates skepticism. The University of Washington's culture transformation, which garnered the Shingo Publication Award, exemplifies how a commitment to humility and respect can normalize continuous improvement, thereby resolving the sixth top CFF and enhancing academic engagement.

Strategic Integration Model

The comparative matrix (Table 1) highlights the distinct strengths and weaknesses of the Shingo Model, Hoshin Kanri, and Lean Six Sigma, revealing that their true power lies in integration. Together, they form a perfect strategic-tactical-cultural triad, with Shingo providing the foundational principles, Lean Six Sigma delivering execution, and Hoshin Kanri ensuring alignment. This collaboration creates the PRINCIPLES-TOOLS-ALIGN (PTA) framework, which facilitates comprehensive transformations in HEIs by leveraging the strengths of each methodology for effective and cohesive change.

Principles (Shingo) + Tools (LSS) + Alignment (Hoshin) = PTA Framework

- *Shingo (Principles)*: Anchors the transformation with a strong focus on principles that promote behaviors leading to results.
- *Lean, Six Sigma (Tools)*: Provides operational efficiency through tactical execution with a focus on eliminating waste and reducing variation.
- *Hoshin Kanri (Alignment)*: Ensures that all strategies are aligned with the institutional vision and goals.

The proposed framework for operational HEIs leverages Shingo, Lean, and Hoshin Kanri to directly address key challenges. Each methodology offers unique strategies that can significantly enhance operational efficiency and effectiveness in ways distinct from current practices. To address infrastructure deficiencies, the Shingo model emphasizes a culture of continuous improvement and operational excellence. Rather than relying on sporadic funding for infrastructure development, HEIs can instill an organizational philosophy that prioritizes quality improvements at every level. Specifically, Shingo principles advocate for empowering faculty and staff to identify infrastructure needs directly related to educational excellence. By fostering a culture where all stakeholders are actively involved in decision-making processes regarding infrastructure, institutions can better align investments with the needs of students and the job market. Additionally, this proactive approach can facilitate innovative responses to the challenges posed by the digital divide, ensuring equitable access to technology and resources across diverse student populations.

The misalignment between educational outcomes and labour market needs can be effectively addressed through Hoshin Kanri, or policy deployment. This strategic planning process aligns an organization's long-term vision with short-term actions through a systematic approach to goal setting and performance metrics. By implementing Hoshin Kanri, HEIs can engage in a continuous feedback loop with industry partners to identify skill gaps and adjust curricula accordingly. Currently, institutions may revise programs infrequently and reactively, leading to a disconnect with labour market demands. Hoshin Kanri encourages a more proactive strategy, where curriculum development is routinely aligned with real-time labour market data, ensuring that graduates possess relevant and in-demand skills. This can help reduce the skills mismatch reported across various countries and engage advisory boards in regular curriculum reviews to maintain necessary relevance.

To enhance resource utilization, a dual application of Lean practices and Shingo principles can be particularly effective. Current governance structures in many HEIs often lack transparency, leading to inefficient resource allocation. Lean practices can streamline administrative processes to reduce time and resource wastes, while the Shingo model promotes a cultural shift towards accountability and continuous improvement. Institutions can establish clear performance metrics that not only monitor financial but also human and infrastructural resource utilization, ensuring that resources are directed towards areas of most significant impact. By training university leaders in these methodologies, HEIs can foster a governance culture that emphasizes responsible resource management and strategic alignment with institutional goals.

CONCLUSION

In this study, we aimed to integrate the Shingo model, Lean Six Sigma, and Hoshin Kanri to create a comprehensive framework for transformative change in HEIs. Our findings indicate that this integration forms a robust PTA framework, effectively addressing challenges inherent in tool-centric approaches by focusing on principles, cultural transformation, and strategic alignment. Specifically, the Shingo principles tackle critical failure factors in Lean Six Sigma implementations, fostering a sustainable culture that enhances both student outcomes and operational excellence. This new framework for operational excellence HEIs provides distinct strategies to comprehensively address the multifaceted challenges highlighted in the literature review, such as streamlining funding processes, enhancing infrastructure development, aligning curricula with labor market needs, and maximizing resource utilization. Our research presents a significant theoretical and practical contribution, paving the way for sustainable development in the African higher education landscape. Moving forward, open questions remain regarding the refinement of the PTA framework in various educational contexts and the potential integration of additional quality improvement methodologies.

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