“The effect of lean tool on research culture and research performance in Indonesia’s higher education institutions”

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THE EFFECT OF LEAN TOOL ON RESEARCH CULTURE AND RESEARCH PERFORMANCE IN INDONESIA'S HIGHER EDUCATION INSTITUTIONS

Abstract

Quality Assurance in higher education is a lean tool to improve the quality and performance of HEIs, including lecturer research performance. This study examines the effect of implementing Quality Assurance in higher education as a lean tool on the research culture and research performance of lecturers at Indonesia's private HEIs. The data represent respondents' perceptions of the research variable indicators. 184 questionnaires were suitable for processing. Data were collected from 184 lecturers from approximately 25 private HEIs in Jakarta, Indonesia. A 5-point Likert scale was used to measure indicators of research variables. Statistical data analysis was carried out using Structural Equation Modeling with the Smart-PLS ™ program. The results show that Quality Assurance as a lean tool has a significant impact on research performance ($\beta = 0.643$; $p = 0.000$) and research culture ($\beta = 0.361$; $p = 0.000$). Research culture affected research performance significantly ($\beta = 0.281$; $p = 0.000$), and research culture significantly mediates the effect of Quality Assurance as a lean tool on the research performance ($\beta = 0.102$; $p = 0.010$), and the effect is strong ($V = 0.181$). Research findings reveal that the successful implementation of Quality Assurance as a lean tool is determined more by organizational readiness than individual readiness; this is reflected in the existence of effective research centers. An effective research center will support the standardization of research processes through continuous improvement so that lecturers behave more actively in scientific activities and perform research more productively.

Keywords lean, quality assurance, performance, research, culture, lecturer, Indonesia

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INTRODUCTION

Higher Education Institutions (HEIs) play a role in leading the knowledge-creation process and determining rules and boundaries through research activities (Sharma et al., 2006; DTI/DfEE, 2001; Etzkowitz & Klofttten, 2005). HEIs, as thinking actors, should be able to lead the process of knowledge creation through the utilization of available resources by defining scopes and regulations which is useful for sustainable processes (Scalia, 2018; Kusumawijaya & Astuti, 2023). Through research activities, lecturers as intellectuals are expected to be able to revitalize and produce new innovations that can support the nation's activities in various scientific disciplines, as well as being able to meet the learning achievements of graduates.

There is a peculiar circumstance that has been emerging in Indonesia where almost one-third of lecturers have not participated in publishing their scientific papers (https://theconversation.com, n.d.), and according to the Science and Technology Index (SINTA) issued by the

Ministry of Education, Culture, Research and Technology, Indonesia, knowledge-transfer activities place a high emphasis on teaching instead of research. Consequently, high-quality peer-reviewed publications are also still lacking. The percentage of publications compared to the number of Indonesian lecturers who publish scientific articles each year, according to Scimago, is approximately 15% (https://www.scimagojr.com/countrysearch.php?). The greater emphasis on teaching activities, as opposed to research, has been driving lecturers to allocate most of their time to preparing teaching materials for their classes (https://www.unnes.ac.id 2011). Lecturers' expectations in conducting research are more motivated due to extrinsic factors (Chen et al., 2006). In fact, the research culture in Indonesia is also still lacking since the mindset of the academicians has been trapped in pragmatism (Ardimen & Gustina, 2018). As a result, the competencies owned by these HEI lecturers are wasted, and these 'wasted competencies' can be incorporated as one of the eight wastes in Lean.

The lean concept can change organizational culture by changing mindsets about how to work effectively and efficiently by instilling the value of eliminating waste and ultimately improving performance (Anwar, 2014; Bergmiller & Mccright, 2009). Therefore, understanding the relationship/influence of lean implementation on culture and performance in higher education can help universities build a research culture for lecturers, which then improves their research achievements or performance.

1. LITERATURE REVIEW AND HYPOTHESES

Lean is a series of management practices that focus on customer value and eliminating waste so that organizations that adopt the lean philosophy will be able to achieve high efficiency, reduce costs, and improve quality and performance (Silva et al., 2020). Around the world, academicians and industrial practitioners believe that excellent performance can be attained through the implementation of Lean (Hadid et al. 2016). According to Hadid and Mansouri (2014), Lean principles can increase the efficiency and effectiveness of an organization's operations and will produce customer service with high reliability. Lean principles are designed to improve productivity through processes/activities that consistently add values sought by customers through Value Stream Mapping (VSM). The principle of VSM is a process flow visualization that functions to map whether there is work that does not provide added value so that improvements can then be made to make it more efficient and meet customer needs (Ratter & Nader, 2022). The principle of continuous improvement through the Plan-Do-Check-Act (PDCA) cycle enables organizations to identify problems based on existing facts and make continuous improvements so that they have the potential to build organizational culture (Realyvásquez-Vargas et al., 2018). The implementation of lean principles is supported by several tools (Womack & Jones, 1996).

Lean tools identify and eliminate waste that does not add value to the process (Tyagi et al., 2015). Some of the tools that are adopted to attain better performance in a construction project may include Kanban, Quality Management, and Human Resource Management (Zhang & Chen, 2016). Total Quality Management (TQM) and other processes related to human resources (Bortolotti et al., 2015; Prabowo et al., 2022) can significantly reduce waste in higher education (HE) (Balzer, 2020). Quality management aims to maintain the desired quality. The quality that is maintained is not limited to product quality, but also the quality of other aspects, including employees. One component of quality management is quality assurance (QA), namely the stage of ensuring that the process meets the established standards so that energy, time, and cost efficiency is achieved.

Most HEIs have a quality assurance system or quality assurance agency that acts as an accreditation tool and mechanism to meet their requirements (Engebretsen et al., 2012; Sanyal & Martin, 2007; Jarvis, 2014). The quality of HEIs in Indonesia is the level of conformity between the management of HEIs and the National Standards for Higher Education. To ensure compliance and systematic improvement of quality standards and ultimately build a quality culture, the Indonesian government designed a QA System consisting of Internal and External QA (Farida et al., 2019). QA in HE is used as a lean tool to improve perfor-

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mance in higher education, including research performance. QA in HE in Indonesia, through a decision by The Director General of Higher Education, established the flow stages of lecturers' activities in carrying out their main duties. These duties must be carried out through teaching and learning activities, research, and community service. Farida et al. (2019) state that QA in HE in Indonesia has a cycle consisting of the establishment, implementation, evaluation of the implementation, control of the implementation, and improvement of standards, which can be considered as a continuous improvement process. This cycle reflects a lean principle, namely seeking perfection.

Readiness factors determine whether an organization is ready to engage in lean implementation as a catalyst for changing organizational culture (Radnor, 2010). Organizational readiness in implementing lean is a key factor in lean success, so it is necessary to consider the readiness factor (Petrusch et al., 2018). Organizational readiness and individual readiness are indicators of TQM success in the manufacturing industry in Indonesia (Farida, 2021). Individual readiness indicators were developed by Holt et al. (2007) as personal benefits, management support, change efficacy, and appropriateness. According to Antony (2014), variables related to HEI readiness factors include leadership and vision (leadership commitment to evaluating and providing resources, providing direction support, recognition of achievements, continuous improvement, routine, and programmed coordination), management and resource commitment (involvement, lean communication), connecting lean with strategy (projects aligned with university strategy, steps to achieve strategy), focusing on customers, and choosing the right people. Organizational readiness from Farida et al. (2021) includes training, support structures, adequate resources, customer focus, involvement, cross-functional teamwork, continuous improvement, and commitment to quality.

Referring to individual and organizational readiness to change developed by Antony (2014), Holt et al. (2007), and Farida et al. (2021), Table 1 describes the readiness of lecturers and HEIs to implement QA as a Lean tool.

Table 1. Indicators of QA as a lean tool

Source: Antony (2014), Holt et al. (2007), and Farida et al. (2021).

IR1	Get incentives
IR2	Commitment to consistently fulfilling research performance
IR3	Confidence in being able to carry out research obligations to enrich teaching materials
IR4	Believes that QA in HE is useful in determining the direction and targets of lecturers' research
OR1	Effectiveness of the 'research center' function
OR2	Regular training in research skills
OR3	Training opportunity
OR4	Information systems support the process of research and publication activities
OR5	Communicating the process and evaluation of research activities
OR6	Commitment to improving research performance
OR7	Emphasis on research as teaching materials and solving community problems
OR8	Having a Research Master Plan university level as a guide in conducting research
OR9	Having a research road map as a guide to research direction
OR10	Rewards for continuous improvement in research achievements
OR11	Cross-disciplinary and institutional research award

Implementation of lean in Higher Education enables educational institutions to meet society's demands for efficiency and effectiveness, especially in utilizing accessible resources for the vision of higher education (Balzer et al., 2016). The goal of lean is to maximize value for customers and increment productivity by eliminating waste of activities. According to Cudney and Agustiady (2016), one form of waste among the 8 types of waste is not utilizing employee talents. Cadden et al. (2020) prove that lean has a correlation with organizational culture. Lean implementation will instill a culture of continuous improvement and increase flexibility (Lopes et al., 2015). The implementation of lean can improve employee workplace perceptions and reduce waste, time, movement, and other improvements (Veres, 2020). Lean principles can integrate changes between processes and mindsets, as well as instill values about how to work correctly and efficiently (Vukadinovic et al., 2016), and can create a culture that is more productive, resulting in increased organizational productivity. This is in accordance with research by Zhang (2014) which proves that cultural factors most significantly influence research productivity. Lean implementation prioritizes the involvement and development of employees who will be able to increase the enthusiasm of academ-

ics to be involved in research projects (Vlachos & Siachou, 2018). In addition, implementing lean, namely continuous improvement can be a way to conduct research in an institution (Bortolotti et al., 2015). Facilitating employees combined with employee involvement will help behaviors related to self-development efforts such as sharing knowledge (Eldor & Harpaz, 2016).

According to Jones (2013), organizational culture controls the interactions of organizational members with stakeholders inside and outside the organization based on norms and shared values. Organizational culture can be used to improve organizational performance and effectiveness by controlling the way people behave in the organization. There are two types of values, namely terminal and instrumental values. The terminal value is the expected final state, while instrumental values are the expected way of behaving. Quality is a form of terminal value. Research quality and research quantity in accordance with National Higher Education Standards are the terminal values of the quality assurance system. An environment that directs academics to research productivity is an instrumental value of research culture. This type of environment is an instrumental value of research culture (Naoreen & Adeeb, 2014).

Research culture is a specific environment that directs academicians towards better research productivity in HE. Research culture can be interpreted as a way of conducting research (Naoreen & Adeeb, 2014). Research culture includes an environment in which researchers can develop themselves, as well as the enthusiasm of academics to be involved in research projects (Evans, 2007). The group socialization process can encourage young researchers to improve their research performance (Broström, 2019). Scientifically, stronger research groups have a greater chance of starting a successful research career (Waldinger, 2010). Researchers who co-author with seniors can benefit from the resulting publications, namely getting better attention (higher citations) from reputation effects (Petersen et al., 2014). In addition, the amount of individual and group funding can influence research activities (Maxwell & Smyth, 2011). Naoreen and Adeeb (2014) developed research culture indicators, including research environment, collaboration, research support and incentives, as well as audits (research road maps to guide the direction and feasibility of research targets). The ultimate goal of research culture is to achieve and maintain high performance in research (Adapa, 2013). The indicators for the Research Culture in this study were measured by referring to the Research Culture developed by Naoreen and Adeeb (2014) (Table 2).

Table 2. Research culture indicators

Source: Naoreen and Adeeb (2014).

RC1	Active discussion forum
RC2	Collaborative research to achieve learning competency
RC3	Collaborative research to solve community problems
RC4	Regular training program
RC5	HEIs have a Research Master Plan as a reference for research planning
RC6	Lecturers have a research roadmap as a reference for research planning
RC7	Accustomed to publishing research results
RC8	Active in a research group

Bates and Holton (1995) consider performance as a multidimensional variable related to all parts of the organization including activities, processes, and individual employees. So, performance is defined variously. Individual performance is a key variable in work and organizations (Sonnentag & Frese, 2009). Performance is what an organization expects of someone to do a job and do it well. Only activities that can be measured are considered performance. Conceptualizations of performance must distinguish between activity aspects (behavior) and outcome aspects of performance (Campbell et al., 1990). It was further explained that the behavioral aspect refers to what a person does in a work situation that is in line with organizational goals, while the performance results aspect refers to the consequences of individual behavior which also depends on factors other than individual behavior. In general, the performance of a lecturer involves teaching, research, publications, and community engagement (Sukirno, 2020). From the results aspect, scientific research performance in HE has several forms, including research projects, project grants, monographs, scientific papers, publications, research contracts, and awards (Kang & Liu, 2021). The research performance indicators in this study refer to Kang and Liu (2021) and the Operational Guidelines for Lecturer Workloads in Indonesia (Table 3).

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Table 3. Research performance indicators

Source: Kang and Liu (2021) and the Operational Guidelines for Lecturer Workloads in Indonesia.

RP1	Unpublished research
RP2	Published in a reputable national journal
RP3	Published in a reputable international journal
RP4	Published in a non-reputable journal
RP5	Book or monograph
RCol1	Collaborative research
RCol2	Received a research grant from the government

Osborn et al. (2013) consider that there is still a need for lean exploration, especially in the public service sector. In-depth research on the impact of lean on industry and public service sectors, which involves the role, function, and dimensions of Human Resources in implementing lean, is important research. Because aspects related to people and culture are often the cause of failure in implementing lean. So, there is a need for further research to examine lean practices and their influence in building a research culture, as well as improving the research performance of lecturers in higher education environments.

The objective of this study is to determine the influence of Lean tool implementation (in this case QA in HE) on research culture and research performance in higher education in Indonesia. The hypotheses in this study are formulated as follows:

H1: The influence of QA in HE as a lean tool on research culture is positive and significant.

H2: The influence of QA in HE as a lean tool on research performance is positive and significant.

H3: The influence of research culture on research performance is positive and significant.

H4: Research culture mediates the influence of QA in HE as a lean tool on research performance.

2. METHOD

This study's unit of analysis was lecturers of private HEIs in Jakarta, Indonesia. Jakarta was chosen as a sample because Jakarta, as the capital of Indonesia, is a barometer for private HEIs in Indonesia. The research employed quantitative approaches. The data in this study are respondents' perceptions of research indicators.

According to The Higher Education Database, the number of active lecturers in Jakarta in 2021 will be approximately 28,000 people. Slovin's formula was used to obtain the sample size. Assuming a sampling error of 7%, the sample size is 200 respondents. The data in this study were collected through a survey method by distributing questionnaires to lecturers from 25 private HEIs in Jakarta, Indonesia. A total of 250 questionnaires were distributed, 184 questionnaires were returned and were suitable for processing. Indicators of the lean variable refer to Antony (2014), Farida et al. (2021), and Holt et al. (2007) (Table 1). Research culture indicators refer to research culture indicators from Naoreen and Adeeb (2014) (Table 2), which include research environment, collaboration, research support and incentives, and audits (research road maps to guide the direction and feasibility of research targets). The research performance variable indicators refer to Kang and Liu (2021), and Operational Guidelines for Lecturer Workloads in Indonesia (Table 3). Indicators are measured using a 5-point Likert scale.

Statistical analysis of data was conducted using Structural Equation Modeling (SEM) with the Smart-PLS ™ program. To assess the results of the outer model and inner model, practical rules from Hair et al. (2017) are used. Outer model analysis is used to measure the validity of indicators and the validity of research variables. Research variable indicators with a loading factor greater than 0.7 are considered valid. Variable reliability is measured based on the variant extract value; that is, if the average variant extract value is greater than 0.5, the rho A and the composite reliability value is above 0.7, then the research variable is considered to meet the reliability requirements. To find out whether one variable is really different from other variables, discriminant validity is assessed. Discriminant validity is determined to be good if the Heterotrait-Monotrait Ratio (HTMT) is below 0.90.

The next step is an inner model analysis to predict causal relationships between research latent variables based on the p-value with a significance score below 0.05. The indirect influence of research cul-

ture in mediating the relationship between lean tools and research performance is calculated using the V effect (Ogbeibu & Gaskin, 2023). The V effect formula is as follows.

$$V = \beta MX \cdot \beta YMX, \quad (1)$$

where βMX = coefficient of influence of Lean Tool to Research Performance; βYMX = coefficient of influence of Research Culture to Research Performance.

The criteria for the indirect effect value are 0.01, which is small; 0.075, which is medium; and 0.175, which is large. The model quality criteria in this study were used to test the goodness-of-fit of the structural model using predictive relevance (Q^2), Standardized Root Mean Square Residual (SRMR) < 0.08, Normed Fit Index (NFI) 0 – 1 and squared Euclidean distance (d_ULS) > 0.95 (Hair et al., 2017). $Q^2 > 0$ indicates that the model has a predictive relevance value. Meanwhile, if $Q^2 < 0$, then the model has little or no predictive relevance (Chin, 1998).

3. RESULT

Figure 1 shows the loading factor value for each indicator which explains its relationship with the latent variable.

Figure 1 shows that IR1, IR2, IR3, IR4, RC5, RP1, RP3, RP4, RP5, and RCol2 were invalid due to the loading factor values of < 0.7. Individual Readiness in implementing a QA in HE as a lean tool (IR1, IR2, IR3, and IR4) is less able to reflect lean variables. The implementation of lean tools in Indonesian HEIs is more correlated with Organizational Readiness than Individual Readiness. Research plans that refer to the Research Master Plan (RC5) are less able to reflect Research Culture. Only research involving students (RCol1) and publications in reputable national journals (RP2) can reflect Research Performance well. Therefore, the indicators were then removed from the model. Then the model becomes model 2 (Figure 2).

Figure 2 shows that all indicators have a loading factor > 0.7, meaning that all indicators can well reflect their variables. Organizational Readiness indicators with high loading factor values include continuous improvement (OR10), commitment to improving research performance (OR6), and regular research skills training (OR2), which respectively have loading factor values of 0.863, 0.847, and 830. This means these three indicators have a large correlation with Organizational Readiness.

Indicators of research culture with high loading factor values are research plans referring to the research road map (RC6) and active training

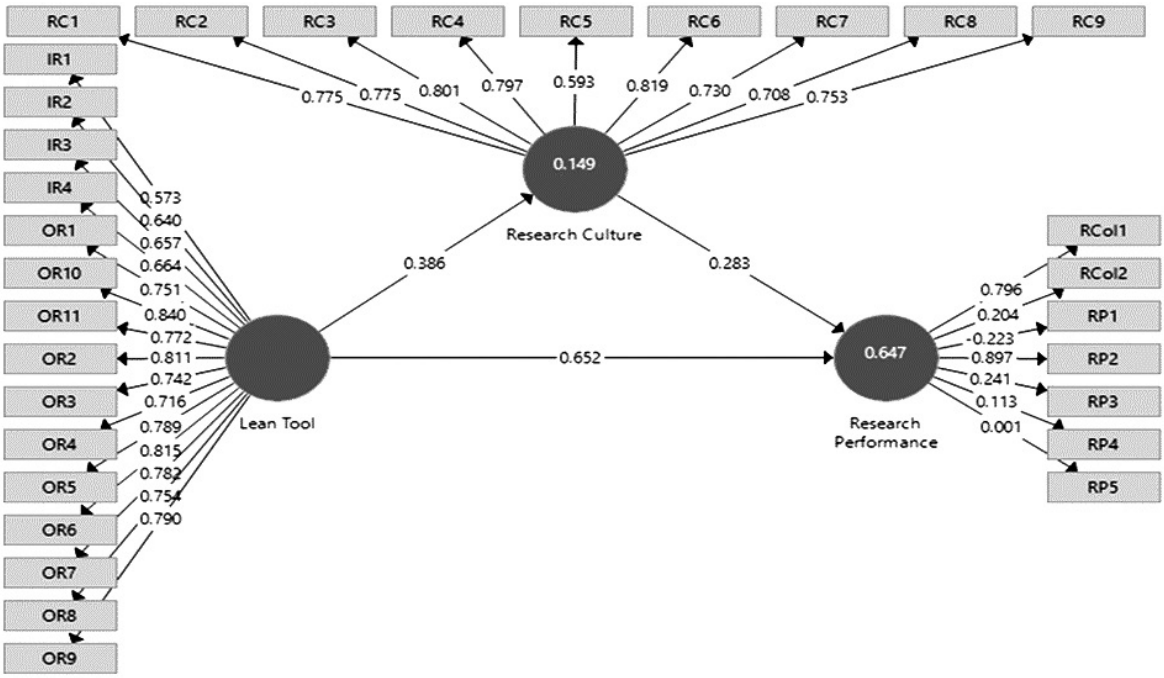

Figure 1. Implementation of QA in HE as a lean tool to research performance (Model 1)

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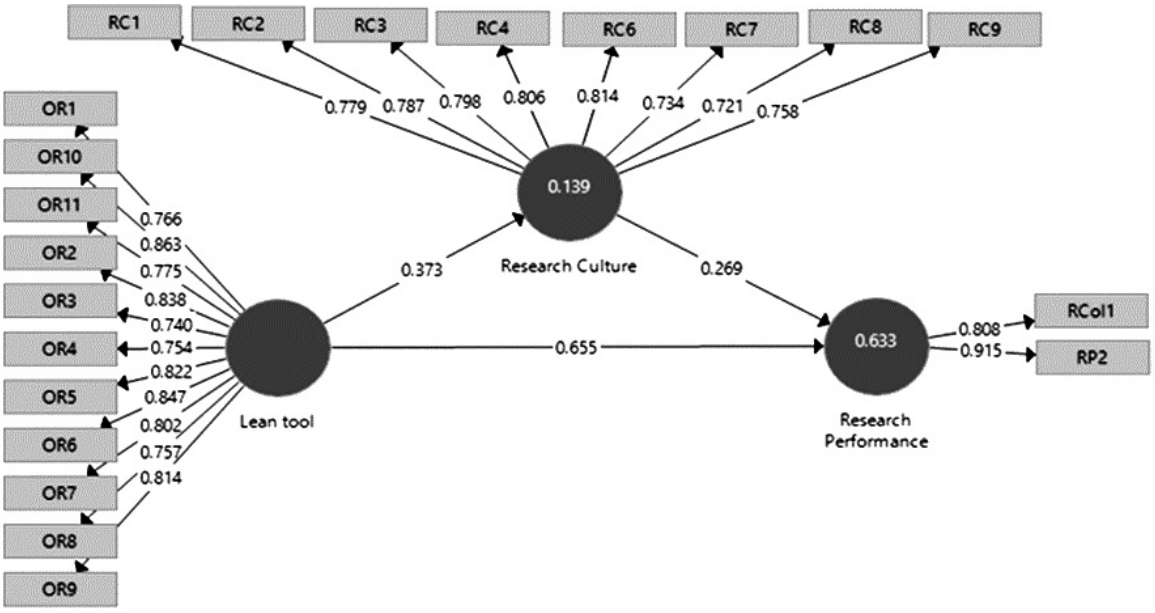

Figure 2. Implementation of QA in HE as a lean tool to research performance (Model 2)

(RC4), which respectively have loading factor values of 0.814 and 0.806. These two indicators have the strongest correlation with Research Culture. Meanwhile, Research Performance has the strongest correlation with research involving students (RCol1) and publications in reputable national journals (RP2) indicators.

Outer model analysis also involves testing the reliability and validity of each research variable. Table 4 shows the construct reliability and validity values.

Table 4. Construct reliability and validity

	rho_A	CR	AVE
Research Culture	0.913	0.923	0.601
Research Performance	0.731	0.853	0.744
QA in HE as a Lean Tool	0.945	0.951	0.638

Table 4 shows that the rho A and Composite Reliability (CR) values are higher than 0.7, and AVE values are higher than 0.5 for all variables. AVE greater than 0.5 indicates that the variable can explain more than half of the indicator variance. These values prove that Organizational Readiness (OR1, OR2, OR3, OR4, OR5, OR6, OR7, OR8, OR 9, OR 10, and OR11) has measured the Lean tool accurately and consistently. Likewise, the research environment, collaboration, research support and incentives, and audits (RC1, RC2, RC3, RC4, RC6, RC7, RC8, and RC9) have measured Research Culture accurately and consistently. The results of collaborative research with students (RCol1) and publications in reputable national journals (RP2) can also measure Research Performance accurately and significantly.

Table 5. HTMT value in discriminant validity

Variable	Research Culture	Research Performance	QA in HE as a Lean Tool
Research Culture	–	–	–
Research Performance	0.672	–	–
QA in HE as a Lean Tool	0.390	0.908	–

Table 5 shows that the QA in HE as a Lean tool and Research Performance have a discriminant validity (HTMT) of 0.908. This means these two variables have a fairly high correlation. To overcome this problem, Hair et al. (2017) suggested eliminating indicators that have the lowest loading factor values that measure the same latent variable.

Table 6. New HTMT value in discriminant validity

Variable	Research Culture	Research Performance	QA in HE as a Lean Tool
Research Culture	–	–	–
Research Performance	0.672	–	–
QA in HE as a Lean Tool	0.378	0.895	–

Figure 2 shows that the smallest loading factor for the Lean tool and Research Performance is OR3, so OR3 is removed from the model. Table 6 shows that all variables have discriminant validity (HTMT) below 0.9. Thus, now all variables have been considered reliable and valid. Research Performance is validly reflected through publications.

Next, the inner model is evaluated. The inner model is a structural model that predicts causal relationships between variables. Structural model evaluation is carried out to test hypotheses that have been built based on the substance of the theory.

The test results (Table 7) prove *H1* that QA in HE as a Lean Tool has a significant positive effect on Research Culture (β = 0.361; p = 0.000), *H2* that QA in HE as a Lean Tool has a significant positive effect on Research Performance (β = 0.643; p = 0.000); *H3* that Research Culture has a significant positive effect on Research Performance (β = 0.281; p = 0.000); and *H4* that Research Culture mediates a positive and significant relationship between QA in HE as a Lean tool and Research Performance (β = 0.102; p = 0.010). The V value obtained was 0.181, which means that Research Culture has a large indirect influence value (Ogbeibu & Gaskin, 2023).

Table 8 shows that the predictive relevance value (Q^2) for all exogenous variables is above the value 0. So, it can be concluded that the exogenous latent variable is good (suitable) as an explanatory variable that can predict the endogenous variable (Chin, 1998).

Based on the results in Table 9, the current model can be accepted as a good model.

4. DISCUSSION

The current study demonstrates that lean tools significantly influence organization culture in the service industry, i.e., Higher Education. The findings of this study support the study by Cadden et al. (2020) which showed that lean practices are positively correlated with organizational culture in the manufacturing industry. This is also in accordance with the findings of Lopes et al. (2015), which confirmed the significant effects of lean tools on the culture of continuous improvement in the food and beverage industry. Urban (2015) explained that organizational culture is a reflection of lean management, i.e., if the lean concept is truly being implemented in an organization. Based on the perspective of Human Resources, lean management aims to change the organizational culture, thus, is capable of producing excellent performance because scientific environments assume a critical role as a place to develop a career in academics (Conti et al., 2014).

Table 7. Structural model result

Variable	ß	Std. dev	t-stat	p-values	Support
QA in HE as a Lean Tool → Research Culture	0.361	0.080	4.502	0.000	Yes
QA in HE as a Lean Tool → Research Performance	0.643	0.077	8.330	0.000	Yes
Research Culture → Research Performance	0.281	0.079	3.551	0.000	Yes
QA in HE as a Lean Tool → Research Culture → Research Performance	0.102	0.039	2.591	0.010	Yes

Table 8. Predictive relevance (Q^2)

Variable	Q^2
QA in HE as a Lean tool	
Research Culture	0.067
Research Performance	0.439

Table 9. Model fit

Goodness-of-Fit	Saturated Model	Estimated Model	Cut off value
SRMR	0.079	0.079	< 0.08
d_ULS	1.309	1.309	> 0.95
NFI	0.789	0.789	0-1

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The application of QA in HE as a lean tool, which aims to ensure systematic and sustainable fulfillment of research standards, could foster and develop Research Culture. Because the application of lean principles or philosophy supports process standardization and continuous improvement goals (Spear & Bowen, 1999; and Cua et al., 2001). The implementation of QA in HE as a lean tool is more correlated with Organizational Readiness than Individual Readiness. Total commitment at all levels of the organization is a success factor for lean implementation (Worley & Doolen, 2015). All individuals in an organization must be optimally coordinated, and this is the leader's responsibility (Alefari et al., 2017). Lean is a management approach that has a series of critical success factors (Mohammad & Oduoza, 2019), and one of the important success factors is Organizational Readiness (Petrusch et al., 2018).

Organizational Readiness in implementing QA in HE as a lean tool is reflected through the availability of the 'research center', which will coordinate, implement, monitor, and evaluate research standards. Through the research center, training is carried out, information systems are built to support the process of research and publication activities, aligning each lecturer's research road map with the HEIs Research Master Plan, emphasis on customer-focused research results, and rewards are held. An effective 'research center' will support the standardization of research processes through continuous improvement so that lecturers behave actively in discussion forums, research groups, collaborative research, and publications with clear research directions.

The three most important indicators (which have the highest loading factor) of an Organizational Readiness to implement QA as a lean tool are rewards for continuous improvement in research achievements, regular research skills training, and commitment to improving research performance. Rewards for improving research achievements are important considering that lecturers' expectations in conducting research are more motivated due to extrinsic factors (Chen et al., 2006). Providing rewards will stimulate lecturers to continuously improve their research achievements. Furthermore, this change in behavior instills a research culture, because lecturers become active in discussion forums, research groups, research collaborations, and publications, which improves research performance. Through regular research skills training, lecturers' skills and abilities in conducting research will increase and will then increase the research competence of lecturers. Competence can influence motivation (Ommering et al., 2018, so lecturers who have better research competence will be motivated to be active in research activities, including being active in scientific forums, discussions, research groups, collaborative research and more productive in publications. This can be successful if there is a strong commitment from the leadership.

Another finding is that the lean tool significantly affected the Research Performance in a positive manner. These results are in accordance with Garza-Reyes et al. (2014), who concluded that lean tools have a significant influence on environmental performance in manufacturing organizations. Purushothaman et al. (2020) stated that there is a strong correlation between lean tools and environmental performance (waste reduction). Prabowo et al. (2022) confirmed that there is a significant correlation between Lean Management Systems on Lean Business Result variables. Emiliani (2004) explained that lean principles and practice in the service industry resulted in better achievement results. In the academic field, Balzer et al. (2016) found that lean management can significantly improve academic and administrative operations. Organizational Readiness through Internal QA makes it easier for lecturers to carry out research activities so that Research Performance increases. Research Performance is related to the quality of lecturers. Research performance will determine the number of lecturers who are certified, as well as determining the functional position level of lecturers such as professors (Hidayah et al., 2023). Achievement of lecturers' Research Performance standards will be assessed by External QA as a basis for determining higher education accreditation status. Therefore, through Organizational Readiness, HEIs will encourage lecturers to improve their research performance to obtain good accreditation.

This study shows that Research Culture significantly mediates the influence of QA in HE as a lean tool on Research Performance, and the influence is large. These findings are in line with a study by Cadden et al. (2020), which indicated that organizational culture mediates the effect of lean principles on manufacturing performance. Broström (2019) and Waldinger (2010) stated that an active research group can encourage researchers to improve research performance. Petersen et al. (2014) and Maxwell and Smyth (2011) explain that research collaboration can provide benefits, including resulting publications in the form of higher citations, including reputation effects. This includes funding, which can influence research activities (Maxwell & Smyth, 2011). Leadership commitment (Organizational Readiness) in activating the research center function, carrying out regular training, establishing a clear research roadmap, providing resource support, emphasizing research results, and providing incentives has been able to activate discussion forums, research collaboration, research plans direction, and the spirit of publication which is ultimately able to improve research performance.

CONCLUSION

The current study highlights the implementation of a Lean tool (QA in HEIs) in a branch of the service industry, i.e., higher education, particularly its effects on lecturers' Research Culture and Research Performance in Indonesia's HEIs. Lean tools (QA in HEIs) have a significant influence on developing Research Culture and improving Research Performance. Research Culture plays a large and significant role in mediating the influence of lean tools on Research Performance.

Organizational Readiness, through an effective 'research center', supports the standardization of the research process through continuous improvement, makes lecturers behave actively in scientific activities, makes it easier, and motivates lecturers to carry out research activities well so that they are more productive. R^2 is 0.633 or 63.3%. This means that QA as a Lean tool and Research Culture is able to explain 63.3% of the variation in Research Performance, 27.7% is explained by variables other than QA as a Lean tool and Research Culture. The findings of this study open opportunities for further research by examining other factors that can expand the literature by involving individual aspects such as competence and motivation in influencing research performance.

AUTHOR CONTRIBUTIONS

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