



THE CRITICAL SUCCESS FACTORS OF LEAN MANAGEMENT IMPLEMENTATION AMONG MALAYSIAN PUBLIC SECTORS

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Abstract— This paper investigates the critical success factors for the implementation of lean management among the Malaysian public sectors as they are now consistently striving to improve their organizational performance. This cross-sectional quantitative study involved 131 public organisations that were selected through a stratified random sampling procedure. Data were analysed by using the structural equation modelling (SEM) approach with SmartPLS 4.0. Lean resources, lean culture, and lean knowledge management are found to be critical success factors for lean implementation

among public sectors in Malaysia, while lean leadership is not. Theoretically, this study is expected to extend the boundaries of knowledge in operations management by looking into public sector organisations from the perspective of the resource-based view theory. As a result, practitioners and policymakers could gain insights to strategise the implementation of lean management to improve their overall organisational performance.

I. Introduction

Since the early 1980s, the Malaysian government has implemented many steps to enhance the quality and accountability of government agencies and their members to deliver better services while maintaining better financial transparency [1]. Accordingly, lean management (LM) was introduced in the service sectors and has become popular in the Malaysian public sectors to demonstrate the improvement in financial, operational and organisational performance [2]. According to [3], LM in service sectors can also succeed as in manufacturing sectors with comparable outcomes. Previous studies have proven that LM

implementation in public sectors can help organisations to improve their performance [3 - 6].

However, despite the reforms, almost globally, many still complain that the public sector is ineffective [7]. According to the Public Complaints Bureau (PCB) under the Prime Minister's Department of Malaysia, complaints made by the public against the quality of service in government departments included delays in carrying out official duties or no action, decisions that were deemed unfair, failure to enforce the rules and laws, and the lack of public facilities to meet the customers' needs [2]. Hence,

implementing LM is crucial to improving their service performance.

From the extensive literature review, even though LM has been well studied, the idea of lean is still not well understood in most public sectors [8]. If this situation is not resolved, its implication on the performance is stagnant. In Malaysia, [9] claimed that even though LM is applied, the public sector performance remains ineffective because the public servants are not ready to change the work culture. Furthermore, the public servants could not identify their customer focus and claimed a lack of time and resources to sustain LM [3, 10]. To strengthen LM implementation in public sectors, four critical success factors have been identified. They are lean resources [11 - 13], lean leadership [14 - 17], lean culture [12, 18 - 20] and lean knowledge management [11, 21, 22].

Therefore, this paper aims to discuss the four critical success factors and whether these factors do indeed strengthen the LM implementation in Malaysia public sectors. Thus, this paper

is significant because it describes in detail the critical success factors on LM implementation in the public sector through the resources-based view theory. Moreover, it also provides knowledge and awareness of these critical success factors to the top management in an organisation or the government itself to strengthen the implementation of LM along with ways to enhance the operational performance.

II. Literature Review

A. Resource-based View

Theory

This study involved the firm's resource-based view (RBV) theory, which focuses on strategic planning that mainly depends on the resources available within the organisations. The RBV is a theoretical standpoint that describes and predicts how firms can achieve their sustainable competitive advantage by gaining and controlling internal resources [23]. Relevant to RBV in public sector studies, [24] combined tangible and intangible resources with human

resources on the ability of governments to obtain, retain and distribute open government data to the public. Hence, LM practices can be tangible and intangible, considering a firm's resources. Therefore, implementing LM may cause the organisations to outperform other public organisations [25]. This understanding is consistent with RBV, which helps achieve competitive advantage by bundling resources [26]. Therefore, LM can create strategic resources to underpin sustainable competitive advantage and their implementations must meet the requirements of valuable, rare, inimitable, and non-substitutable. On the other hand, capabilities are a firm's capacity to organise resources to achieve the desired result. It is firm-specific as it embeds in the organisation and processes [27 - 28]. Consequently, the CSFs (i.e., lean resources, lean leadership, lean culture, and lean knowledge management) in this study acts as the capabilities underpinned by RBV theory. Those factors in this study are targeted to strengthen LM

implementation in public sectors which subsequently can enhance the performance.

B. Lean Management in Public Sectors

In this paper, LM is defined as one of the approaches in service context, where the process of waste elimination that helps to reduce operating costs and improve the quality of service performance. Based on analyses from previous studies, [29] claimed that lean adoption in the public sector is mainly focused on individual efforts aimed at specific processes, implying a somewhat basic lean approach aimed at removing waste in government offices. Given that lean service has positively affected operational and financial performance, [30] viewed lean service as the socio-technical system (STS) that involves two components (technical and social). Both systems are distinct yet interrelated, so improving one requires improving the other to get optimal results [31]. Shah and Ward [32] supported the argument who proposed that the lean bundles complement each

other to improve operational performance. Eight types of waste can be translated to a service context which involves over-production, over-processing, waiting, motion, transportation, inventory, defects, and skills [33 - 35]. Thus, LM need to be implemented to eliminate waste and improve service performance. The LM practices including TQM, JIT, TPM and HRM was developed by [26, 32], which are likely to be referred to as lean bundle that defined a collection of practices that work together synergistically to provide a high-quality service at the speed of customer demand. However, Human Resources Management (HRM) is excluded in this study because the practices will be redundant with the critical success factors in LM implementation. Therefore, the researcher has listed the lean practices in public sectors and identified the most used lean practices applied in the public sectors. The practices include Total Quality Management (TQM), Just-in-time (JIT) and Total Preventive Maintenance (TPM).

C. Critical Success Factors

Critical success factors (CSFs) are the limited number of areas that lead to successful competitive performance [36]. CSFs are the factors that organisations must do to succeed in their mission, and as for government sectors, these involve the rules and regulations that they must abide, things they must do and must not do as they provide the services [37]. In this paper, CSFs stress the implementation of LM in the public sector. [38] claimed that the deployment of LM in the public sector has failed due to the over-focusing on tools and applications, which lacks attention to the business functions that support the primary strategy. Moreover, a lack of references to governmental or executive vision and continuous improvement initiatives reinforces the notion that lean has been adopted in a fragmented and random manner in the public sector [39]. Therefore, the government must achieve the goals and the performance level they have set, and the skills to survive in their

rapidly changing political environment that they need. This paper identifies the four CSFs commonly used to strengthen the LM implementation in public sectors and categorises them according to the appropriate themes.

Lean Resources

Resources in organisations involve all assets, capacities, organisational processes, qualities, information, and knowledge owned by organisations that enable them to conceive and implement plans that increase their efficiency and effectiveness [40]. Lean resources (LR) in organisations involve allocating sufficient resources to operate lean management to its fullest extent [41]. To improve the LM implementation, the efficient use of resources is also crucial besides waste elimination and continuous improvement strategy [42]. The availability of the appropriate resources and expertise inevitably affects the process and results of LM implementation in public sectors [11]. In this study, human resources, flexible resources,

and financial resources are success factors in implementing LM in public sectors. Thus, the hypothesis formulated for H_1 which is “*LR have a significant effect on LM implementation*”.

Lean Leadership

Lean leadership (LL) refers to leadership skills, techniques, and behaviours that enable an organisation to successfully implement and utilise an LM system [43]. Leadership is particularly crucial when a company undergoes transition, which is unavoidable when adopting lean [44]. In a lean context, the leader's role is to accept all kinds of self-development required to cultivate leadership skills, develop subordinates, eliminate barriers, and set challenges and objectives [43]. Thus, LL involves crucial factors such as top management commitment, management coaching and communication. Thus, the proposed hypothesis in H_2 is “*LL has a significant effect on LM implementation*”.

Lean Culture

Lean culture (LC) is a summarised concept that

includes the beliefs, values, behaviours, and practices of the members of an organisation to eliminate waste and continuously improve [18]. LC may motivate employees to implement LM effectively, providing organisations with an opportunity to protect their lean operations. In many studies, culture is a critical success factor in implementing LM [12, 20, 45]. [46] justified that culture can affect employee work behaviours, affecting organisational productivity levels. Therefore, the main factors in LC are employee engagement and continuous improvement. LC can negate the effects of change, such as LM implementation, when the change effort's directive component is eased [20]. This proved that LC is a critical success factor for LM implementation if the organisation can undo the employee resistance to change. Hence, the hypothesis in H_3 is “*LC has a significant effect on LM implementation*”.

Lean Knowledge Management

Nowadays, knowledge

management (KM) has become an essential tool for enhancing the quality of all processes and improving the organisations' performance by applying the KM practices that are assisted by KM methods, including lean tools and techniques [47 - 49]. Lean knowledge management (LKM) is to help organisations to address change efficiently and effectively by helping in the preparation phase, supporting new processes and procedures of lean implementation and maintaining the transformation with continuous improvement actions [21]. Hence, the practices can be carried out, such as providing lean knowledge and experience to the employees and organising regular training or lean workshops. Thus, the hypothesis formulated in H_4 was “*LKM has a significant effect on LM implementation*”.

III. Methodology

This study used a quantitative cross-sectional design approach. The data were collected using a closed-ended questionnaire. During the measurement development, three academicians and two

practitioners have validated the content of the measurement items. In this study, the unit of analysis is an organisation. The target population for this study is government public organisations in Malaysia, encompassing all federal, state, and local governments. By using G*Power software, the minimum sample size of 98 was calculated. Therefore, the surveys were distributed to 650 targeted public organisations using stratified random sampling to get an acceptable response rate. After four months, 155 surveys were completed, leading to a 23.85% response rate. However, 24 survey responses were discarded due to straight-lining issues; thus, only 131 surveys were used.

IV. Research Findings

A. Demographic Profile

Table 1 shows the type of public organisations in Malaysia

which are federal, state and local. From each tier, the stratum for each level of the public sector was obtained proportionally based on the number of organisations. Furthermore, the number of years of organisation operation as shown in Table 2, the majority of the respondents' organisations has been operating more than 10 years and have more than 100 employees.

B. Data Analysis

The Structural Equation Modelling (SEM) approach was used to analyse the data. The SEM approach is a second-generation technique that allows the simultaneous modelling of relationships among multiple variables [50]. Consequently, this study used the PLS-SEM approach and focused on the analysis of variance (construct validity, reliability and hypothesis testing) that can be carried out using the SmartPLS software [51].

Table 1: Type of Public Organisations

Type of Organisations	Population		Sample	
	N	%	n	%
Federal Public Sector	173	21.07	51	38.93
State Public Sector	496	60.41	37	28.24
Local Authority	152	18.51	43	32.82
Total	821	100.00	131	100.00

Table 2: Number of Years of Organisation Operation

Demographic	Count	%
Years of operation		
Less than 5 years	12	9.16%
More than 10 years	103	78.63%
Within 5 to 10 years	16	12.21%
Number of employees		
Between 50 to 100 employees	18	13.74%
Less than 50 employees	22	16.79%
More than 100 employees	91	69.47%
Total	131	100.00%

Measurement Model

Assessment: Construct Validity

The initial PLS path model has identified that some of the loadings in JIT construct were below 0.4 which leads to low reliability. Thus, items JIT1 and JIT5 were deleted to ensure the adequate convergent validity [52

- 53]. Therefore, the modified PLS path model as shown in Figure 1 where all loadings are acceptable.

The convergent validity, which measures the correlation between items from the same construct [54], is tabulated in Table 3. Convergent validity and

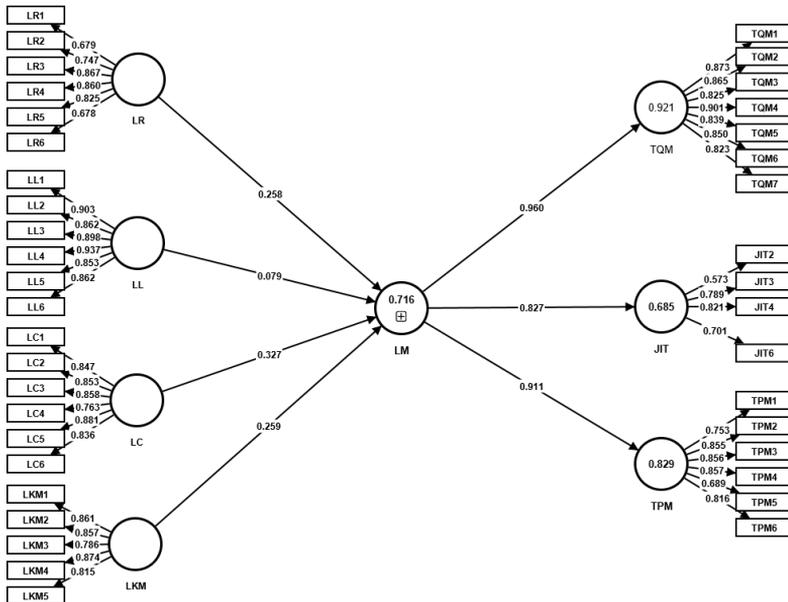


Figure 1: Modified PLS Path Model

internal consistency were assessed based on the outer loadings, composite reliability (CR) and average variance extracted (AVE). In summary, all outer loadings, AVE and CR values are acceptable within the threshold.

Table 3: Convergent Validity and Internal Consistency Reliability

Construct	Item Code	Item	Outer Loadings	CR	AVE
LR	LR1	Our department is aware of the importance of staff development programs.	0.679	0.902	0.609
	LR2	Our department gives employee a broader range number of specific tasks.	0.747		
	LR3	If one employee is absent, another employee can perform the same responsibilities.	0.867		
	LR4	Our teams consist of employee with diverse skills and are responsible for several functions or responsibilities.	0.86		
	LR5	Our employees are trained to perform several different tasks.	0.826		
	LR6	Our department allocates adequate financial resources to eliminate non-value-added activities.	0.678		
LL	LL1	Our top management leads the agenda of continuous improvement in our organization.	0.903	0.956	0.786
	LL2	Our top management strives to achieve organizational excellence.	0.862		
	LL3	Our top management shows high commitment to eliminating waste (non-value-added activities).	0.898		
	LL4	Our top management dedicates time and resources for work system improvement.	0.937		

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Construct	Item Code	Item	Outer Loadings	CR	AVE
LC	LL5	Our top management coach the employees to improve operational performance	0.853	0.935	0.707
	LL6	There are effective two-way communications (i.e., top-down and bottom-up) in our organization.	0.862		
	LC1	All departments in our organization strive to eliminate waste (non-value-added activities).	0.847		
	LC2	Our employee participates in many of the decision-making processes.	0.853		
	LC3	There are horizontal and vertical communication channels throughout the organization.	0.858		
	LC4	We prioritize gradual improvements rather than drastic changes in work processes.	0.763		
	LC5	Continuous searching for possible improvements is part of the daily routine.	0.881		
	LC6	All employees participate actively in work process improvement efforts.	0.836		
LKM	LKM1	Our employees are encouraged to apply their knowledge to solve our organizational problems (e.g, elimination of non-added-value activities).	0.861	0.922	0.705
	LKM2	Our employees have adequate knowledge and know-how.	0.857		
	LKM3	Our employees are educated in subjects related to their specialty and daily work.	0.786		
	LKM4	Our employees are adequately trained on eliminating non-value-added activities.	0.874		

Construct	Item Code	Item	Outer Loadings	CR	AVE
	LKM5	We facilitate our employees to engage in lean continuous improvement-related events (e.g., training, competitions, exhibitions, etc.).	0.816		
TQM	TQM1	We strive to continuously improve our work process to minimize operational costs.	0.873	0.95	0.729
	TQM2	We standardize tasks in most areas in our department.	0.865		
	TQM3	Our work procedures are properly documented.	0.825		
	TQM4	We visualize our work procedures to show how works are to be done.	0.901		
	TQM5	We visualize important information (e.g., progress of works, current problems, issues, or deviations) in our workplace.	0.839		
	TQM6	All employees are responsible for ascertaining the quality of each operation.	0.85		
	TQM7	Our employees control the quality of works independently before completing any jobs.	0.823		
JIT	JIT2	We use a work signalling system (e.g., verbal signal, light flashing, electronic messages, etc.) to authorize a job.	0.572	0.815	0.529
	JIT3	Our processes are located close together to smooth workflow.	0.789		
	JIT4	We focus on eliminating non-value-added activities in workplace.	0.822		
	JIT6	We perform multiple types of jobs from day to day.	0.7		
TPM	TPM1	We apply 5S (i.e., Public Sector Conducive Ecosystem/EKSA) to ensure our stuffs are properly arranged in our workplace.	0.753	0.917	0.651

Construct	Item Code	Item	Outer Loadings	CR	AVE
	TPM2	We scrupulously clean workspaces (including tools and equipment) to maintain an orderly workplace.	0.855		
	TPM3	We keep maintenance records for all equipment (e.g., computer, printer, etc.) used in our workplace.	0.856		
	TPM4	Our equipment (e.g., computer, printer, etc.) is maintained as per the schedule.	0.857		
	TPM5	Our staff are empowered to maintain their own equipment.	0.689		
	TPM6	We implement preventive maintenance (i.e., planned maintenance of equipment to prevent failure) for all equipment used in our workplace.	0.816		

Note: JIT1 and JIT5 have been deleted due to low outer loadings

Furthermore, LM are categorised as higher-order measurement models where the relationships between constructs are measured at different levels of complexity simultaneously. In this case, LM is a second order construct indicated by three reflective constructs: TQM, JIT and TPM. The outer loadings, AVE and CR values of TQM, JIT and TPM are considered acceptable.

In assessing the empirical criteria, discriminant validity refers to how different a construct is from other

constructs [55]. The correlations' heterotrait-monotrait (HTMT) ratio is used to examine discriminant validity. [56] claimed that if the value of the HTMT is higher than 0.90, one can conclude that there is a lack of discriminant validity. Therefore, Table 4 shows that all values are within the threshold except for the path model construct from LKM to LC and path model construct from LL to LC, which are higher than 0.9. However, according to [57], if HTMT is higher than 0.9, bootstrapping is applied with the

HTMT statistic to derive standard errors for the estimates used to develop bootstrap confidence intervals. A confidence interval containing the value of 1 indicates a lack of discriminant validity [54]. Nevertheless, discriminant

validity is satisfactory if the value 1 falls outside the confidence interval range. Based on Table 5, the path model construct from LKM to LC and path model construct from LL to LC are considered satisfactory.

Table 4: Discriminant Validity: Heterotrait-Monotrait Ratio (HTMT)

	JIT	LC	LKM	LL	LR	TPM	TQM
JIT							
LC	0.785						
LKM	0.873	0.944					
LL	0.631	0.905	0.834				
LR	0.755	0.800	0.817	0.846			
TPM	0.790	0.754	0.757	0.760	0.784		
TQM	0.886	0.850	0.828	0.786	0.776	0.861	

Table 5: HTMT – Confidence Intervals

Path	HTMT	Std. Error	Confidence interval	
			5.00%	95.00%
LKM -> LC	0.944	0.943	0.900	0.981
LL -> LC	0.905	0.903	0.857	0.947

Structural Model Assessment: Hypotheses Testing

The structural model assessment involves the effects and relationships between the constructs, which will typically be latent variables. In order to determine the hypothesis, bootstrapping method is used.

Based on the results presented in Table 6, all hypotheses are supported except for H_2 , the relationship between LL and LM.

The coefficient of determination (R^2) shows the model's predictive accuracy [54]. According to [58], the R^2 value according to the rule of thumb

indicates 0.75 as substantial, 0.50 as moderate and 0.25 as weak. The value of R^2 for LM is 0.716 which indicates a moderate level of predictive accuracy. The effect size is assessed using f^2 . Guidelines for assessing f^2 are that values of

0.02 is small, 0.15 is medium, and 0.35 is large [55]. Effect size values of less than 0.02 indicate that there is no effect. Thus, the effect size for H_1 (0.086), H_3 (0.067) and H_4 (0.056) are small while there is no effect on H_2 (0.005).

Table 6: Summary of Hypothesis Testing

Hypothesis	Path	Std. Beta	Std. Dev	t-values	p-values	Confidence Interval		Decision
						5.00%	95.00%	
H1	LR -> LM	0.257	0.092	2.809	0.005	0.112	0.420	Supported
H2	LL -> LM	0.082	0.102	0.779	0.219	-0.078	0.256	Not supported
H3	LC -> LM	0.319	0.117	2.788	0.002	0.135	0.516	Supported
H4	LKM -> LM	0.264	0.098	2.643	0.007	0.086	0.403	Supported

Note: $p \leq 0.05$ (one-tailed test)

V. Discussion and Conclusions

The outcomes of this study illustrate four CSFs on LM implementation in public sectors. H_1 shows the path from LR to LM, and the outcome indicates that the decision is supported. The management can plan to hire adequate experts to motivate the employees to embrace the change with LM implementation and keep it going to improve the service performance. In addition, [59] reported that employees who can perform multiple tasks can

improve the efficiency of the whole process and produce a lean organisation. Therefore, success factors involving human, flexible, and financial resources can act as capabilities to implement LM in public sectors.

Conversely, the decision is not supported on the path from LL and LM which is presented in H_2 . These findings are insignificant with previous studies by [16, 43]. In Malaysian public sectors, the leadership practices are inadequate to strengthen the implementation of LM. According to [60], there is still a

lack of empirical research done specifically on government ministries on leadership practices. Thus, research on leadership practices in most developing countries are still in the early stages. In order for LL to be a CSF, top management must gain a thorough understanding of lean so that they can facilitate the need to transition to lean and thus give their full support and dedication to the proposed change [22].

Besides, H_3 shows the path from LC to LM where the outcome indicates that the decision is supported. Thus, employee engagement and continuous improvement are the success factors in this study. [19] justified that having LC can motivate employees to implement lean practices effectively, allowing firms to sustain their lean operations. It is also supported that LC is a capability to strengthen the LM as resources in public sectors.

Finally, the path from LKM to LM in H_4 shows the result that the decision is supported. Practices such as providing lean knowledge and experience to the employees and organising

regular training or workshops on LM are crucial as they can positively affect lean sustainability [49]. Lean training or workshops can have more significant impacts when adopted a combination of traditional teaching and active learning [61]. Exposure to various quality programs such as lean through workshops and seminars can be done to encourage government bodies or agencies to implement quality improvement in their organizations. Accreditation from related authorities such as the Malaysian Productivity Corporation (MPC) and International Standard for the organization (ISo) may enhance the public image of the organization and increase employee motivation in implementing lean [3].

VI. Implications of Study

This study has several implications. The implications contribute to the field of operations management in the public sectors and serve as a recommendation to practitioners to improve service performance. In the theoretical aspect, this

study shows how the RBV theory can be applied where LM practices act as resources for competitive advantage in the public sectors and how CSFs can strengthen the LM implementation. The result of this study shows that LR, LC and LKM as the capabilities that can enhance the resources of LM implementation.

This study also provides a practical viewpoint for practitioners to understand and validate the potential benefits that LM can sustain if implemented with the CSFs. Besides that, the practitioners and policymakers can identify the critical factors as strategies to successfully leverage their overall organisational performance through LM implementation.

Thirdly, according to the statistical analysis using Importance-Performance Map Analysis (IPMA), this study stipulates the importance and performance of CFSs on LM construct as shown in Figure 2 and Figure 3. Figure 2 shows that LC and LKM are important and have high LM performance. On the other hand, LR and LL

are important, but LL has a lower performance than LR. Therefore, practitioners need to focus on improving LC followed by LKM and LR to improve the LM implementation.

Furthermore, IPMA is not restricted to the construct level, as it can also be used to discover important and even more specific areas for improvement at the indicator level. In Figure 3, it is shown that the result indicates that LC3, LC5, LC1, LR4, LC2, LKM4, LKM5, LKM1, and LKM2 have high importance and low performance, and thus it is suggested to focus on those areas for improvement.

VII. Limitations and Recommendations for Future

The limitations occur when there are constraints in terms or methodology or research design. Therefore, it is important to take note on the limitations so it can be improved in the future research. As this study focuses on a single country, the findings only apply to Malaysian public sectors and may not be generalisable to other countries.

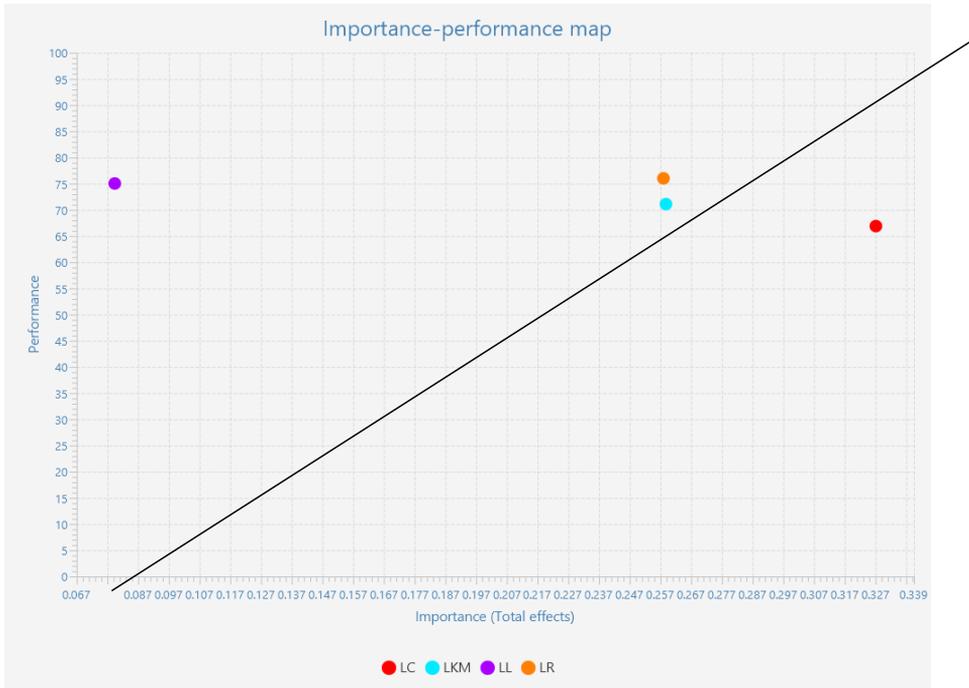


Figure 2: Importance-performance map of the targeted construct LM

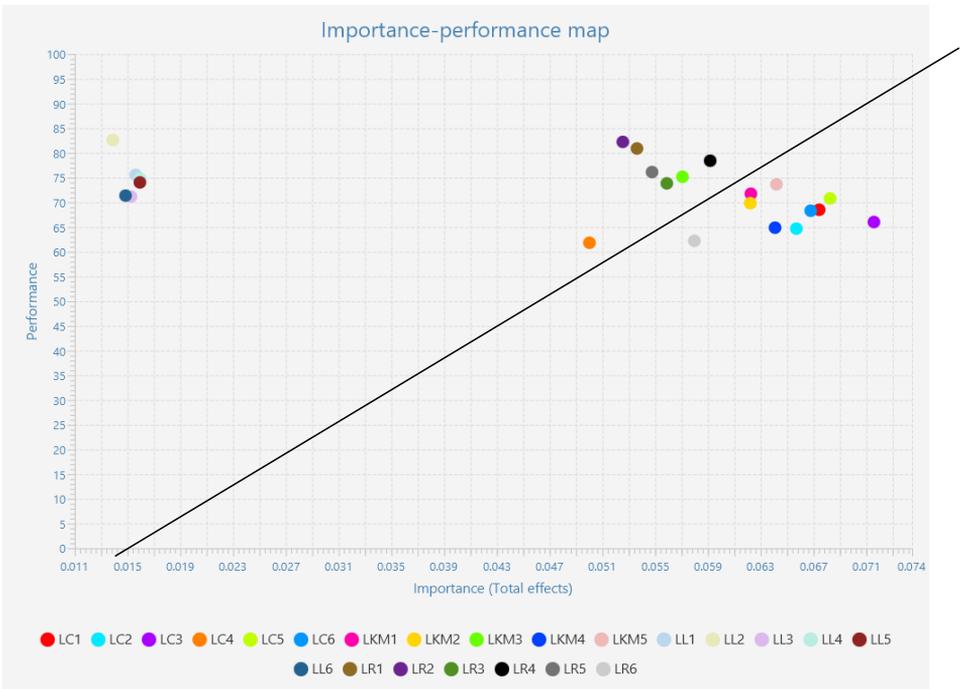


Figure 3: Indicators' importance-performance map of the targeted construct LM

Future research should expand the LM study in public sectors of other countries as they might approach or implement LM differently. Also, future studies may consider doing an in-depth study using a qualitative research design that may help identify and explore the other critical factors since this study was survey-based research in which the questions were closed-ended, thus limiting the respondents' answers.

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