The Impact of Lean Practices on Educational Performance: An Empirical Investigation for Public Sector Universities of Malaysia

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ABSTRACT

Education is considered the backbone of any country. Although Malaysia is a growing economy, this growth cannot sustain without education. In the last few decades, this factor has affected negatively, particularly due to the reduction in the budget; public sector universities have suffered significantly. However, various strategies and approaches are available in the literature that can help institutions to tackle the problems by improving efficiency and effectiveness. Lean management is considered as a crucial element for every organization. By applying lean approaches organizations can improve not only the performance for the manufacturing sector but also for service sectors as well. The purpose of the current article is to determine the probable advantages of lean approaches in the public sector of Malaysia. Three approaches were selected for this study, "total quality management (TQM), 5's services and quick change over". A questionnaire was adopted and distributed among the public sector universities of Malaysia. Meanwhile, after the screening, 367 responses were considered for data analysis. SPSS version 23 has been used for data analysis. Missing values, outliers, linearity, and normality was assessed before multiple regressions. The results revealed that all three approaches positively and significantly enhanced the educational performance of Malaysia. This study will help the administrators of the universities to understand better how they can reduce their work; build their operations more effectively and efficiently. There is a necessity to examine other approaches and conduct a qualitative study to discover the lean management in the educational system in Malaysia.

INTRODUCTION

It is the era of technology, innovation, and rapid changes; without education, it is impossible to compete. Although Malaysia is rich in resources but still due to political instability, corruption, and inflation, it failed to compete with the world in education. It has been reported that Government had cut 50% in the development budget of Higher education (Basu, Jeyasingam, Habib, Letchmana, & Ravindran, 2017; Yeap, Ramayah, & Soto-Acosta, 2016; Zwain, 2012). Thus, economic, political, and other conditions of the country have affected higher education greatly. It can also be observed from table 1 that although Malaysia is improving in Education index, still it is far aware of developed countries. Meanwhile, without higher education, no country, nation, and even society can even sustain (In'airat & Kassem, 2014; Shahbaz et al. 2018a). The goal of every country is to facilitate its people best and grow

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at the pace of the world. If a country wants to improve its human index, it must focus on education, especially in higher education.

Table 1:

Comparison of the education index among various countries (Selim Jahan, 2016)

Education ranking by UNHDI	Country	2000	2011	2012	2013	2014	2015
1	Norway	0.888	0.908	0.907	0.914	0.916	0.916
5	Singapore	0.649	0.807	0.812	0.811	0.814	0.814
10	United States	0.854	0.892	0.898	0.898	0.899	0.9
12	Hong Kong	0.686	0.762	0.789	0.806	0.809	0.819
59	Malaysia	0.619	0.608	0.684	0.691	0.694	0.699
60	China	0.481	0.481	0.535	0.592	0.586	0.599

Meanwhile, after an extensive literature review, it has been revealed that there are numerous strategies to deal with this issue, but the best one is called lean operations, to remove unnecessary elements and decrease the cost that will ultimately increase the performance (Abdallah, Obeidat, & Aqqad, 2014). It showed in the previous literature that by applying lean approaches in operations, performance could be enhanced (Abinaya & Suresh, 2017; Alsmadi, Almani, & Jerisat, 2012; Shahbaz, RM Rasi, Bin Ahmad, & Sohu, 2018b; Yadav,Yadav & Chauhan, 2011). Previously lean was only applied to manufacturing, but overtime now, it has been an essential part of all service sectors (Johnpaul, 2016). This is an empirical study; a questionnaire has been adapted and had been distributed in educational institutions in Malaysia. SPSS 23 was applied for the analysis of the data, and it has been revealed that all three approaches, TQM, 5 S services, and Quick change over, have positive effects on educational performance (Shahbaz, Chandio,Oad, Ahmed, & Ullah, 2018c).

LITERATURE REVIEW

This segment provides a comprehensive review of existing literature related to lean operations in the service sector and the implementation of lean practices, as well as their effects on educational performance. After a detailed analysis of the literature mentioned above, a framework has been developed which sets the base for the empirical research. First, this study will discuss educational performance and its effects on lean operations. After that, a brief description has been mentioned about lean operations and lean approaches and three approaches have been selected namely total quality management (TQM), 5s practices and Quick change over. Lastly, before the findings and conclusion of this study methodology and data collection and analysis have been discussed.

EDUCATIONAL PERFORMANCE

Educational performance is defined as "the judgment on the learner level of quality standards and identify the strengths and weaknesses of the nemesis." The aim to measure the performance is to relate to the organization's key activities in contrast to the decision criteria (Knol, Slomp, Schouteten, & Lauche, 2018). Moreover, it is also known as "the evaluation of the performance of education depends on the application of the principles of total quality management in educational institutions (Badr, Din, & Elaraby, 2014). It has been revealed in numerous studies that lean operation positively and significantly affects the educational performance (Camello, 2014; Knol et al., 2018; Shahbaz et al. 2018d) and especially educational performance (Berger, Tortorella, & Rodriguez, 2018). Application of information technology and modern systems in the process of evaluation techniques enhance educational

performance. In the subsequent paragraphs, the effort is made to explain some essential components of education performance, which are facilities performance, students' satisfaction, and administrative performance presented as the dimensions of education performance (Duque, 2014). Many studies measure educational performance for various studies, and the current study adapts items from (Pal Pandi, Paranitharan, & Jeyathilagar, 2016) as this is the closest, comprehensive, and latest study in this field.

Lean Operations

Womack and Jones (1996) introduced the idea of lean management (Walukwe, 2016). The purpose was to present perfect services or products on time and in the amount desirable at a meaningful price. Lean practices empower organizations to produce superior, efficiency and developing customer satisfaction. It is defined as the "removal of echelons and functional interfaces to reduce time delays and information distortion" (Pradhan & Routroy, 2014; Simangunsongy, Hendry, & Stevenson, 2012). Formerly lean was applied to manufacturing only, but now it has extended its boundaries to the services sector as well (Chavez et al., 2015). There are plentiful lean practices mentioned in the literature review like 5s practices, JIT practices, TQM (Walukwe, 2016), quick changeover systems, continuous improvements (Johnpaul, 2016). However, this study will concentrate on Total quality management (TQM), 5s practices and Quick change over.

Using 5S Practices

5S's is the lean concepts resulting from the Japanese words: "seiri (sort), seiton (set in order), seiso (shine or purity), seiketsu (standardize), and shitsuke (sustain)" (Ross, 2011). It focuses on neatness to attain a peaceful environment at the workstation. 5S include better ownership of the organizations by, customers, employees, and the administration of the universities, and a good position of the organization (Walukwe, 2016). It includes the personnel with an assurance to openly device and practice cleaning. Unifying and cleaning the workstation assistances the employees in discovering problems. Refusal of 5S can mark 5D (defects, declining profits, delays, demoralized employees and dissatisfied customers) (Johnpaul, 2016). Additionally, it has proved that 5S has a significant influence on performance (Panwar, Jain, Rathore, Nepal, & Lyons, 2018). Meanwhile, another study reveals that 80% of service organizations are taking benefits from 5S (Johnpaul, 2016).

Total Quality Management

TQM can be defined as "philosophy aimed at attaining business excellence through the tender of methods and technique" (Ngadiman, Aziati, Bon, M. F, & Rasi, 2015). It aims to fulfill the customer's requirements by emphasizing measurement, continuous improvement, and control. From the literature review, it has been identifying success factors for TQM, and their study has been replicated several times (Quazi et al., 1998). After an extensive literature review, it has been revealed that 76 articles from different countries identify 18 universally applicable success factors for the implementation of TQM (Knol et al., 2018; Nanda, Gupta, Kharub, & Singh, 2013; Shahbaz, Rasi, Ahmad, & Rehman, 2017). The current study defines TQM "processing as application tools and techniques namely SPC and output as business performance." Many studies proved that the relationship between TQM practices and business performance is significant (M. F, Rasi RZ, Zakuan, & Hisyamudin, 2015), while few studies show that TQM does not improve performance (Ahmad, Zakuan, Rasi, & Hisyamudin, 2015). Thus, one of the objectives of this study is to analyze the impact of TQM and educational performance empirically.

Quick Change Over

Quick change over is defined as "the practice of changing the production line from one type of product to another (Panwar et al., 2018)". Organizations must be flexible to adapt the modern innovation quickly. This change is to reduce the time and increase the flexibility of the operations (Sodhi & Tang, 2012) like Samsung TV, and the computer monitor lines share the same platform to allow a quick change from one to the other depending on market demand. The key interest is to analyze and isolate internal and external events in the analysis that manufacturers may change (Ross, 2011). The mixture of the product provides flexibility to the actual obligation and, as a result, it prevents the inventory construction that can increase the cost and perform a substantial amount of waste (Johnpaul, 2016; Sharma & Bhat, 2012).

Conceptual Framework

A conceptual model or framework is being organized to demonstrate the hypothesized relationships (Hair, Hult, Ringle, & Sarstedt, 2014; Solakivi, Töyli, & Ojala, 2015). After a sufficient review of the problem and previous studies, below mentioned framework is established. Figure 1 illustrates the research framework that comprises a dependent variable and three independent variables namely total quality maintenance, 5'S practices and Quick change over, while a dependent variable educational performance. Based on the previous literature, it is proposed that all three independent variables positively impact educational performance.
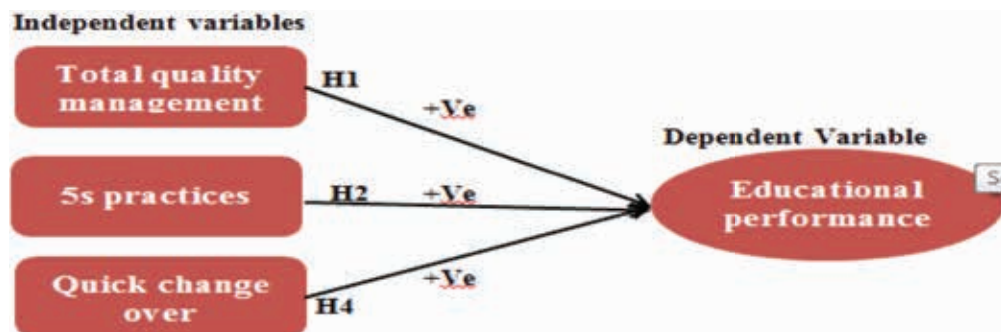

Figure 1: *Research framework*

RESEARCH METHODOLOGY

The aim of this study is to evaluate the effects of lean practices on educational performance in higher educational institutions; a questionnaire has been adopted from reputed studies as have been mentioned in table 2 and distributed among public sector Universities that are affiliated with Federal Government of Malaysia, total universities are 18 and respondents, details are mentioned in figure 2. The respondents for this study are all levels of management like strategic level, operational level, and tactical level public sector universities only Vice-Chancellor, Registrar/Deputy Registrar, Dean, and head of departments have been considered as the people are families about the strategic implications for institutions. Data were collected via the internet through email. After continuous reminders, only 372 responses have received due to limited time and economic restraints. Figure 3 shows the demographic positions of the respondents. Figure 4 shows the respondent managerial level with respect to experience in years.

Table 2.
Instrument for lean practices and educational performance

Variable	Items	Reference
Quick Changeover system	Less equipment downtime is a result of fast changeovers More frequent product changes are enabled by fast changeovers Low inventory levels are a result of small lot sizes Consistency and quality are improved by the standardized changeover	(Johnpaul, 2016)
Total quality management	Printers/Technicians are involved in solving key production related issues Production equipment is maintained as per the schedule Operators are empowered to help maintain their equipment Quality issues are specifically targeted with improvement projects fixated on removing the root cause Cross-functional teams work on resolving recurring problems.	(Johnpaul, 2016)
5S practices	Items are arranged to permit ease of access to needed materials Disposal area for the used material is marked Color coding is used for ease of identification Items not needed have been eliminated from the work area	(Johnpaul, 2016)
Educational Performance	Making the education to serve as an instrument to actualize. Knowledge sharing is the primary source of gaining competitive advantage and achieving long-term success. Raising students' satisfaction and continuous improvement, a performance-evaluation The influence of culture TQM on behavior, performance, and morale and how to understand, build and change the culture. The role in advancing society towards sustainable development. The quality of higher education services, especially in developing countries.	Pal Pandi, Paranitharan, & Jeyathilagar (2016)
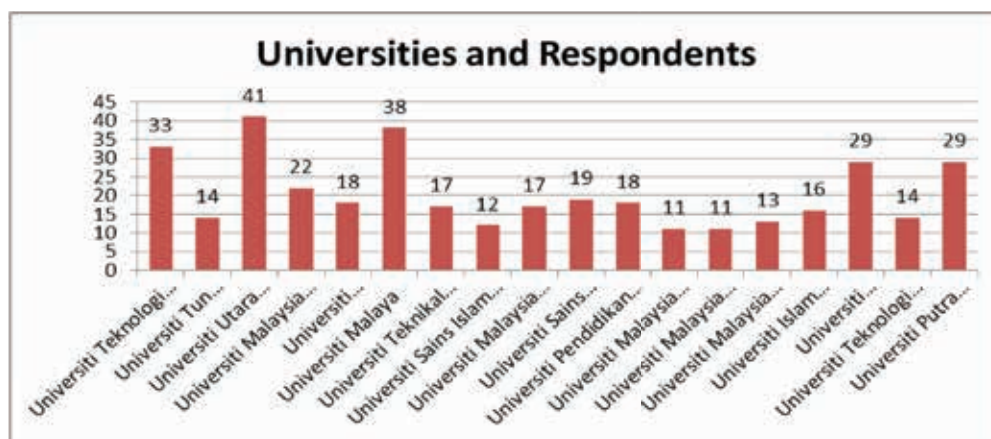
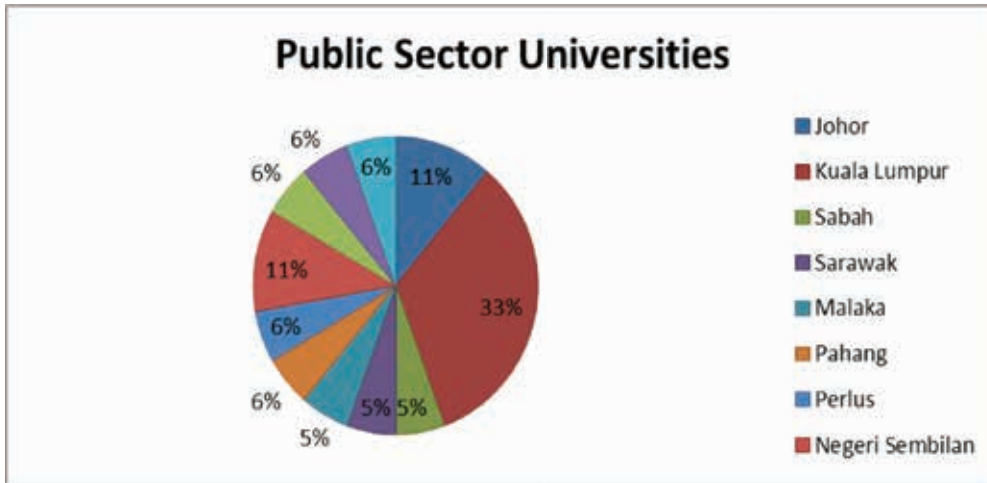**Figure 2:** *Number of respondents according to Public universities*

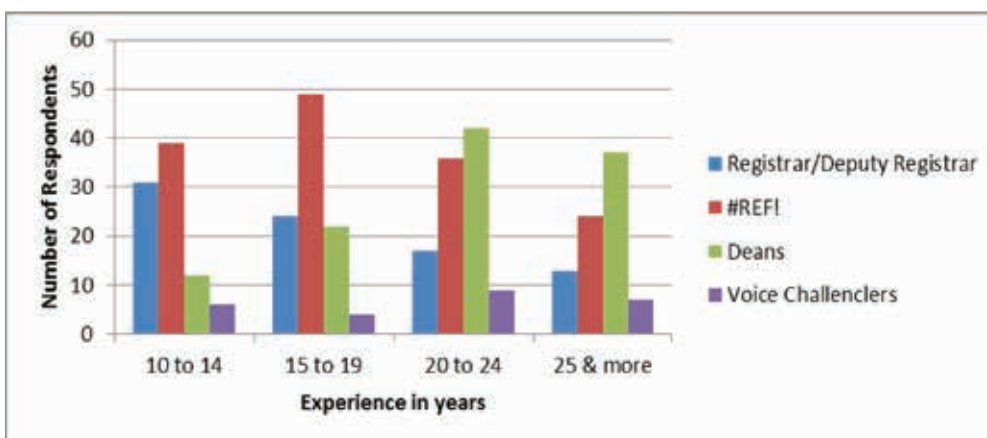**Figure 3:** *Number of respondents according to the demographic*

Figure 4: *Number of respondents according to their experience and managerial level*

Data Analysis and Discussion

Data has been analyzed through SPSS 23 version. First special codes have been assigns to analysis, then the manual screen of data has been performed, and responses with high mission values and the same responses have been deleted. Furthermore, by the histogram, Q-Q plot and skewness and kurtosis data have been clean from missing values and outliers. Additionally, data reliability has been checked through Cronbach's σ. Table 3 offerings the value of Cronbach's σ, mean and standard deviations. 5S yield the highest mean is 5.0743, using TQM practices mean is 5.0234, QCO has mean 4.6921, whereas, educational performance mean is 4.8060.

Table 3:
Validity and Reliability

Variable	Cronbach's α	Mean	SD
TQM	0.876	5.0234	1.24662
5S	0.877	5.0743	1.28653
QCO	0.899	4.6921	1.37250
EP	0.894	4.8060	1.20448

Correlation is a relationship among variables; one tail Pearson correlation has been calculated to decide the relationship between lean approaches and educational performance. Analysis of correlation shows that TQM and 5S are significant while QCH is not significantly affecting the EP; it can be seen in table 4. The correlations between TQM and educational performance are 0.8001**, which means there is a significant relationship between the two. Correlation of 5S practices is 0.602** indicates the positive relationship among members, but this relationship is not strong. The value of the correlation of QCO is 0.310 that also explains the week relation between QCO and educational performance.

Table 4:
Correlation analysis

		TQM means	S means	QCO means	EP means
TQMmean	Pearson Correlation	1	.750**	.684**	.761**
	Sig. (1-tailed)		.000	.000	.000
	N	367	367	367	367
Smean	Pearson Correlation	.750**	1	.652**	.762**
	Sig. (1-tailed)	.000		.000	.000
	N	367	367	367	367
QCOmean	Pearson Correlation	.684**	.652**	1	.676**
	Sig. (1-tailed)	.000	.000		.000
	N	367	367	367	367
EPmean	Pearson Correlation	.761**	.762**	.676**	1
Sig. (1-tailed)	.000	.000	.000		
	N	367	367	367	367

**. Correlation is significant at the 0.01 level (1-tailed).

Furthermore, multiple regression analyses confirm that normality, independence of residuals, linearity, homoscedasticity and revealing that the residuals are acceptable. Multiple regression analysis allows for determining the degree of strength and the direction of the linear relationship among research variables (Qureshi, Waseem, Qureshi, & Afshan, 2018; Shukla, 2016). Regression analysis (Table 5) specifies the relationship with the dependent variable of all independent variables individually. TQM, Using 5S practices and QCO regressed against educational performance, and the variance accounted for, R2 (.610), R2 (.490), R2 (.352), respectively and these figures show that (61 %) of TQM, (49.0%) of Using 5S practices and (35.2%) of QCO can be increased performance of education in public sector universities in Malaysia.

Regression Analysis

F-test is statistically significant. Thus, the study results indicate that the model can explain a substantial amount of variance in the investor's investment decision.

Regression analysis was run to test the impact of overconfidence on investor's investment decisions to fulfill the primary objective of the research. Overconfidence is taken as an independent variable, whereas investor's investment decisions taken as the dependent variable. R-square value 0.189 shows that 18.9% variation in investor's investment decision can be explained through overconfidence.

Membership role for participation and outcome

A fuzzy set is regarded as a relationship (characteristic) utility that allocates to each entity a score of participation ranging (Turskis et al., 2019; Zadeh, 1965). Several types of participation utilities are presented. The group management procedures are essential to design and assess a set of diverse substitutes. While the furthermost important assignment is to discard those substitutes which do not come across lower limits of the essential criteria (Turskis et al., 2019; Zadeh, 1965).

Three fuzzy arrangements of membership role are functional at Ist and 2nd phases for both inputs purpose and output purpose in the fuzzy inference system. Thus at the Ist stage, the fuzzy distribution in expressions of dialectal variables comprises of 'Low,' 'Medium,' and 'High.' These included variables are the same in fuzzy figures on a range of figures from 1-5, as displayed in Table 2.

Table 4:
Regression analysis

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.538	.158		3.412	.001
	TQMmean	.336	.047	.347	7.134	.000
	Smean	.351	.044	.375	8.020	.000
	QCOmean	.170	.037	.194	4.571	.000

a. Dependent Variable: EPmean

Multiple linear regression analyses are employed to develop models relating to the three independent variables and one dependent variable. In the first model, the dependent variable is the educational performance. The model seems to be reliable (p-value for F<0.01 and adjusted R-square of 0.240. All three independent variables should be significant if P<0.05, where Table 5 shows that all the values have value 0.000. The outcome confirms that variables of TQM, Using 5S practices, and Quick change over jointly explain the variance (r2). Beta coefficient values designate the influence of the individual predictor in the model. The beta for TQM is 0.625. It shows that when one unit upsurge in TQM, the overall performance of lean operations will upsurge by 0.625. The significance establishes between Using 5S practices and educational performance and specifies beta value .524 that demonstrate the relationship among variables. The beta of Quick change over is .521 that indicates if one unit grows due to QCO with all followers, the whole performance of lean operations will grow by 0.524. Here found a significant relationship between these three variables of TQM, Using 5S practices and

Quick change over with lean operations; thus, it can be concluded that H1, H2, and H3 are accepted.

DISCUSSION

This study focuses on using relations between TQM, 5S modes, Quick change over, and educational performance in the situation of the public universities of Malaysia. The study outcomes illustrate that TQT has a positive influence on the variable educational performance using 5S modes and QCO's. These results are reliable with reliable pressure operation literature (Duque, 2014). This study shows that the process of implementation of public sector universities is also an important example, such as other developed countries (Shahbaz et al., 2019). It will have to benefit both of the individual, suppliers and buyers' organizations and other researchers. This paper discusses much importance and study. First, all three factors improve educational performance.

Academics can benefit the outcome of the current study to harvest awareness for future studies. Managers are capable of recognizing explicit educational performance that has an advanced perspective to upsurge the performance of public sector universities. Next, applying lean operations can help to boost educational performance. Managers of the supplier firm need to collaborate with the managers from the buyer firm in terms of making several operational decisions. Moreover, connecting managers across functional and organizational boundaries and providing them with relevant, accurate, and timely information reduces temporal and spatial distance enabling them to make better, more collaborative decisions. Recent technological advancements have dramatically increased companies' ability to connect.

In this study, we propose that TQM, Using 5S practices and QCO, are the related factors and propose that EP is the best significant. This study also offers an empirical elucidation that verifies the positive and significant relationship between lean approaches and educational performance within the context of public sector universities. Thus, executives seeing for ability and competence enhancements reflect established of lean operations that can support to magnify lean abilities and improve performance. There is an opportunity to enrich further studies by captivating diverse industries and growing the number of respondents.

The managerial contribution of this study establishes that careful attention should be applied once deciding lean approaches. Organizations that accomplish to attain this relationship take advantage of momentously by cultivating waste reduction, operating margins, agility, and time to market, and overall achievement of competitive advantages. This study establishes that these relationships are impossible to achieve in segregation.

CONCLUSION

There are various approaches, strategies, or frameworks proposed in the literature that can enhance the performance of the organizations. However, by applying lean in an organization is a key process to augment the educational efficiency. The objective of this study has achieved to help administrators in improving their performance by applying lean approaches. This study has considered three approaches to lean management total quality management (TQM), 5's practices and Quick change over. A questionnaire has been developed by adapted

items; data have been collected from public sector universities. Data has been analyzed through SPSS 23 and after the manual screening, missing values, outliers, correlation, multiple regression, have been calculated. It has been proved statistically in this study that all approaches have positive and significant effects on educational performance that are cost, quality, time, productivity and defective rate. Furthermore, this study is aligning with previous studies that have been revealed that lean practices have positive and significant effects on performance in many industries and demographics. Thus it has been found through lean practices performance can be increased in public sector universities. There are two managerial implications of this study; first, it will help managers to know the advantages of lean practices, if they are not applying or applying less degree, now they will be better able to apply these approaches. The second is to know which approach is better than others in managerial levels in public sector universities in Malaysia.

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