

# **Implementation of Lean Process and its Effects on Library Work-flow, Motivation, Behavior, and Staff Performance: a Case Study in one of the Libraries of a Research University in Malaysia**

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**Abstract.** Lean is a philosophy of work that defines means to improve and optimize the production system, focusing on identifying and eliminating all types of waste and reducing or minimizing variability between demand and supply. It was originally developed in an auxiliary organization, but the application can be made to an entire organization as long as the overall objective remains the same, which is to increase customer appreciation while reducing waste. The practice of Lean entails constant improvement at all levels of an organization. The research aims to analyse the effect of the Lean process on library work-flow, motivation, behavior, and staff performance in one of the libraries of a research university in Malaysia. This research employs a mixed-method approach. This study will assist the university library in evaluating the implementation of the Lean process and improving the work-flow in the relevant departments. Furthermore, this will allow the library to evaluate the performance of its staff after the implementation of the Lean process. This paper explored several issues and relationships that can be further explored in future studies.

**Keywords :** Lean Management, Academic Libraries, Lean Manufacturing, Lean Process, Waste

## 1 Introduction

Lean is a philosophy of work that defines means to improve and optimize the production system, focusing on identifying and eliminating all types of waste and reducing or minimizing variability between demand and supply (Shah & Ward, 2007). Lean concepts originated in the Toyota operating model of the 1930s. The term Lean was first introduced by Krafcik (1988). Lean manufacturing is considered by many authors as a technique to reduce waste, but in practice, Lean manufacturing maximizes the value of the product by minimizing waste (Sundar et al., 2014).

Much of the equipment and procedures were originally developed in an auxiliary organization, and the mindset can be applied to an entire company as long as the overall goal remains the same, which is to increase customer appreciation while eliminating waste. Lean management practices used in the assembly, circulation, and retail operations can be applied to the library environment. These systems have proven to be effective in an effective organization. It is invigorating to see library operations and methods through the eyes of someone who is not a library insider and who can bring a fresh perspective to addressing common problems.

There are many parallels between working in libraries and working in assembly, scheduling, or retail, which is why these Lean Management standards work so well. Lean management helps users identify the gap between current and desired execution measures and uses quantitative research and collaborative studies to close that gap. The developing ubiquity of Lean standards stems from the fact that they focus on improving every part of a work cycle and include all stages of an organization's order.

Lean assembling is a remarkable concept for management and business operations. Lean planning, a subset of Lean assembling, is about applying Lean ideas to the planning phase of a business. The central guiding principle of Lean planning is to schedule tasks in a way that increases customer appreciation while limiting waste. The Lean plan concentrates on product stream, high perceivability, and continuous improvement. A conventional plan will often try to benefit from large-scale tasks, while a Lean plan can achieve an adjusted work process by focusing on small workgroups. It should be noted that library work typically includes both large scope and limited scope activities. Large-scale activities in a large collection library involve storing and retrieving millions of items in a single space. Libraries have evolved in the past from the earlier notion of an "information warehouse" to a more customer-centric assessment of their cultural value. The standards of the Lean Plan, therefore, seem to form a preferred premise over traditional techniques for achieving library effectiveness.

The scope of this study focuses on the impact of Lean processes on workflow, motivation, and behavior in relation to library staff performance. This

study was conducted in one of the libraries of a research university in Malaysia. The study will assist the university library to evaluate the implementation of the Lean process and improve the work-flow in the relevant departments. It will also enable the library to analyse the performance of the staff after the implementation of the Lean process. Theoretically, this study will examine the impact on the library's work-flows, staff motivation, behavior, and performance. Due to the outbreak of the pandemic COVID-19, there were restrictions on the conduct of the study. Government policies to reduce working hours and to work from home hindered the research process.

## **2 Job Performance**

According to (Manzoor, 2011), organizations and companies must be successful and strive for continuous development. Staff or employees are one of the most important parts of any organization, so they should be inspired and persuaded to do their jobs. Most organizations do not realize that their human resources are the most important resources that can lead them to progress. No organization can progress unless its employees are satisfied with their work, motivated to achieve their goals, and encouraged to accomplish them. The most important factors affecting performance are adequate program funding, pioneers with motivational attitudes, skilled staff, a conducive authoritarian design, and a planning cycle that ensures effective asset allocation.

As a result of an exceptionally unpredictable business climate and exceptionally fierce competition, companies are forced to create specific standards by improving their presentation to respond to such a wide range of requests. Human capital is becoming the most critical component to the achievement of an organization's goals at the individual, corporate or governmental level. Good employee performance reflects the ability to make a positive contribution through their work, thus achieving the organization's goals. At the same time, the success of an organization depends on the performance of its employees. Several studies on the importance of how employee engagement drives growth have been conducted (Sorenson, 2013, Bhuvanaiah & Raya, 2014).

## **3. Work-flow**

Lean thinking depends, in part, on errors creeping into a work process over the long term because the first cycle is unsteady and outdated practices are inadvertently retained. To address these issues, Lean Thinking analyses the exercises of the work process and the sequence with which those exercises are associated. After determining the value of the cycle next phase is to explore and plan the practices that create it. Planning the cycle fulfills a few needs. First, it familiarizes the leader with the intricacies of the cycle. Second, it is used to

improve both the work-flow and its linkage. As being described by Lian & Van Landeghem,(2002) “The concept of flow is to make parts ideally one piece at a time from raw materials to finished goods and to move them one by one to the next workstation with no waiting time in between”.

A cycle guide should enable the head of the business to place the additional uses of the cover within the framework of the general work process (Tuai, 2006). The planning cycle typically consists of three key elements. The first cycle involves the creation of a guide as a function of discussions with line staff. The following cycle seals the guide for changes and enhancements. The final cycle ensures that the guide contains an accurate overview of the work cycle.

#### **4 Motivation**

Motivation is determined by the passion or drives to achieve something, as well as the capacity to satisfy a few needs. Employers can motivate their employees by expanding the scope of the work and making it more intriguing, keeping them engaged, as well as by improving their performance in the workplace. The achievement in achieving progressive targets and goals is probably one of the most crucial facets of their success. Motivation to work plays a central role in the presence of workers since they formulate the fundamental explanation of working for the duration of regular day-to-day existence. A high level of motivation is an essential constituent of business exercises, whereby high motivation is correlated with work satisfaction, a sense of accomplishment, and a profound attachment to the company, which affects performance and profit. “Motivating employees towards high performance is very much influenced by the prevalence of the culture in the organization” (Garg & Rastogi, 2006). A Lean management approach would be a very effective way to motivate all employees in an efficient manner. As been described by (Oláh et al., 2017) “In a real Lean organization, employees strive to perform their work perfectly, they constantly look for development opportunities they are not afraid to reveal their ideas to the public. The organization and work environment should support and motivate workers in this endeavor and they should acknowledge and develop them by providing constant feedback”. People are stimulated by numerous things, sometimes in different ways and under various conditions. Motivation stems from three sources: reason or significance; social connections; and situational rewards and discipline.

#### **5 Behaviorism**

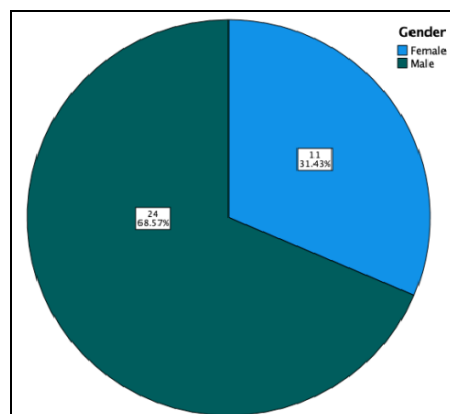
An individual's behavior within an organization refers to how he behaves or reacts at work. In general, it is a combination of reactions caused by internal and external factors. “The organization depends on the commitment of the

individual, and the individual depends on the tools that are implemented in the organization” (Loku & Gogiqi, 2016). As stated by Riyanto, (2017) “The behavior of workers in the organization can be explained by the locus of control, which states that the results obtained by a person controlled by the self are called the internal locus of control while the success obtained by external factors is called an external locus of control”. People respond differently depending on different conditions and express different emotions, such as happiness, rudeness, love, anger, etc. Organizational performance is strongly influenced by the behavior of individuals. Riyanto, (2017) also demonstrated, individuals who have an internal locus of control typically have better performance and psychological stability. Positive employee behavior leads to increased productivity. On the other hand, negative behavior will cause damage and lead to heavy losses for the company. Van Assen (2018) explains that Lean management is not only determined by the technical practices used, but also by the so-called soft practices, such as employee and management behavior and actions.

## 6 Research Methodology

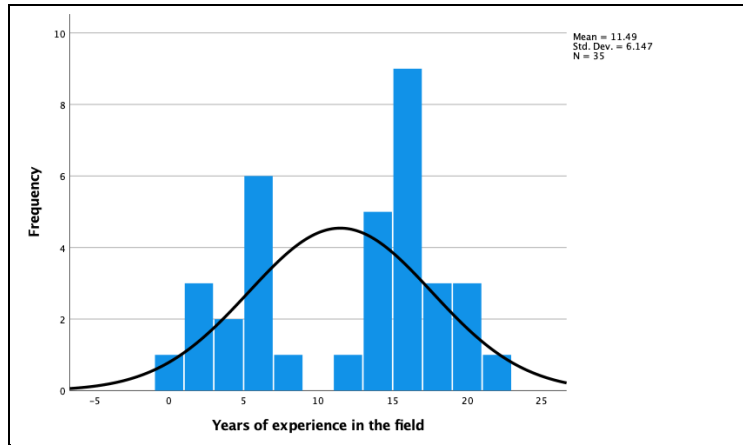
This research employs a mixed-method approach. Exploration will be largely dependent on the quantitative and qualitative data acquired in subsequent discoveries. Regarding validity and legitimacy, quantitative strategies are easier to evaluate by utilizing particular software, Statistical Package for Social Science. A total of 35 respondents are required to complete these studies.

### *Demographic Analysis*



**Figure 1**

Figure 1 shows the percentage distribution of the respondent's gender. (68.6%) respondents are male and 11 (31.4%) respondents are female.



**Figure 2**

Figure 2 shows the years of experience in the field of respondents following a normal distribution with a mean of 11.49 years and a standard deviation of 6.147 years.

***Understanding the Lean Concept***

In terms of understanding the concept of Lean, as shown in Table 1, 6 (17.15%) respondents voted strongly agree and agree, 5 (14.3%) respondents voted neutral and disagree, and 13 (37.1%) respondents voted strongly disagree. The respondents voted Lean process affects library work-flow significantly with a mean of 1.03 and a standard deviation of 1.014. Specifically, 17 (48.6%) respondents voted Yes and 18 (51.4%) respondents voted Not Sure. Meanwhile, the mean and standard deviation of item Lean process affects staff behavior in a work environment and improves performance are 1.43 and .884 respectively. In specific, 9 (25.7%) respondents voted Yes, 2 (5.7%) respondents voted No, and 24 (68.6%) respondents vote Not Sure. In terms of the Lean process moderates the relationship between work-flow and performance, 13 (37.1%) respondents voted Yes, and 22 (62.9%) respondents voted Not Sure. Meanwhile, 11 (31.4%) respondents voted Yes, 1 (2.9%) respondent voted No, and 23 (65.7%) respondents voted Not Sure for the item Lean process affects staff motivation and improves performance.

Item	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean (SD)
You understand the concept of "Lean"	6 (17.1)	6 (17.1)	5 (14.3)	5 (14.3)	13 (37.1)	3.37 (1.555)
	Yes		No		Not sure	
Lean process moderates the relationship between workflow and performance	13 (37.1)		0 (.0)		22 (62.9)	1.26 (.980)
Lean process affecting library workflow significantly	17 (48.6)		0 (.0)		18 (51.4)	1.03 (1.014)
Improved library workflow affects staff performance dramatically	16 (45.7)		1 (2.9)		18 (51.4)	1.06 (.998)
Lean process affects staff motivation and improves performance	11 (31.4)		1 (2.9)		23 (65.7)	1.34 (.938)
Lean process affects staff behavior in a work environment and improves performance	9 (25.7)		2 (5.7)		24 (68.6)	1.43 (.884)

**Table 1**

## 7 Hypothesis Testing

Cross-Tabulation with Chi-Square, T-test, ANOVA multiple linear regression, and qualitative observation are the method used to test the hypothesis. The T-Test is a statistical technique used to test whether the mean difference between two groups is statistically significant. T-tests are three types i.e., one-sample t-test, independent samples t-test, and paired-samples t-test (Mishra et al., 2019). "0" T-values are produced by the t-test if the sample data is exactly equal to the null hypothesis. An increasing t-value indicates that the sample data are increasingly divergent from the null hypothesis. The analysis of variance (ANOVA) divides the observed aggregate variability within a data set into two parts: systematic factors and random factors. ANOVA offers the possibility to compare more than two groups simultaneously to determine whether they share a relationship. In a regression study, the ANOVA test is used to determine the impact of independent variables on the dependent variable (Kenton, 2021). In ANOVA, the variance within each group is compared to the variance of the mean within each group. These two ratios form the F statistic of an F distribution with (number of groups minus 1) as the numerator degrees of freedom and (number of observations minus number of groups) as the denominator degrees of freedom. Crosstabulation is a statistical technique used to display a breakdown of the data by these two variables. The Pearson chi-square test essentially tells us whether the results of a crosstabulation are statistically significant.

***H1. Implementing Lean Process Affects Staff Performance Dramatically***

Cross-Tabulation below, Figure 3 shows the Lean process and pre-performance. According to the Cross-Tabulation below, 6 (17.1%) respondents voted for strongly disagree and good on the pre-performance and Lean process. Meanwhile, 5 (14.3%) respondents voted for disagreeing and good on the pre-performance and Lean process respectively. There is 1 (2.9%) respondent voted strongly agree, agree, neutral and disagree, and neutral on the pre-performance and Lean process.

		LeanProcess					Total	
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree		
Performance	Excellent	Count	2	2	0	0	2	6
		% of Total	5.7%	5.7%	0.0%	0.0%	5.7%	17.1%
	Good	Count	2	3	4	3	6	18
		% of Total	5.7%	8.6%	11.4%	8.6%	17.1%	51.4%
	Neutral	Count	1	1	1	1	5	9
		% of Total	2.9%	2.9%	2.9%	2.9%	14.3%	25.7%
	Bad	Count	1	0	0	1	0	2
		% of Total	2.9%	0.0%	0.0%	2.9%	0.0%	5.7%
Total		Count	6	6	5	5	13	35
		% of Total	17.1%	17.1%	14.3%	14.3%	37.1%	100.0%

**Figure 3**

Figure 4 shows Chi-Square results for Lean process and pre-performance. The level of asymptotic significance for the test (sig=.455). There is no significant effect as sig is indicated to be greater than a = 0.05. There is no significant relationship between the two variables.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10.640 <sup>a</sup>	12	.560
Likelihood Ratio	12.077	12	.440
Linear-by-Linear Association	.559	1	.455
N of Valid Cases	35		

a. 19 cells (95.0%) have expected count less than 5. The minimum expected count is .29.

**Figure 4**

Cross-Tabulation in Figure 5 below shows the Lean process and post-performance. According to the Cross-Tabulation below, 8 (22.9%) respondents voted for strongly disagree and excellent on the post-performance and Lean process. Meanwhile, 4 (11.4%) respondents voted for disagreeing and good on the post-performance and Lean process respectively. There is 1 (2.9%)



respondent who voted strongly agree, agree, neutral, disagree and strongly disagree, and neutral on the post-performance and Lean process.

			LeanProcess				Total	
			Strongly Agree	Agree	Neutral	Disagree		Strongly Disagree
Performance	Excellent	Count	3	2	4	4	8	21
		% of Total	8.6%	5.7%	11.4%	11.4%	22.9%	60.0%
	Good	Count	1	3	0	0	4	8
		% of Total	2.9%	8.6%	0.0%	0.0%	11.4%	22.9%
	Neutral	Count	1	1	1	1	1	5
		% of Total	2.9%	2.9%	2.9%	2.9%	2.9%	14.3%
	Bad	Count	1	0	0	0	0	1
		% of Total	2.9%	0.0%	0.0%	0.0%	0.0%	2.9%
Total		Count	6	6	5	5	13	35
		% of Total	17.1%	17.1%	14.3%	14.3%	37.1%	100.0%

**Figure 5**

Figure 6 shows the Chi-Square result for Lean process and post-performance. The level of asymptotic significance for the test (sig=.160). There is no significant effect as sig is indicated to be greater than  $\alpha = 0.05$ . There is no significant relationship between the two variables.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11.664 <sup>a</sup>	12	.473
Likelihood Ratio	12.257	12	.425
Linear-by-Linear Association	1.978	1	.160
N of Valid Cases	35		

a. 19 cells (95.0%) have expected count less than 5. The minimum expected count is .14.

**Figure 6**

The significance level for pre and post-performance indicates that there is no significant relation between Lean process and performance. There is no evidence to accept the hypothesis as true, so the hypothesis is rejected.

***H2. Lean Process Affecting Library Work-flow Significantly***

Due to the limitations of research, observation and scrutiny were conducted only upon two departments, namely the Collection Development Division and the Information Access Division. These two departments were chosen due to their interconnected tasks and work-flows.

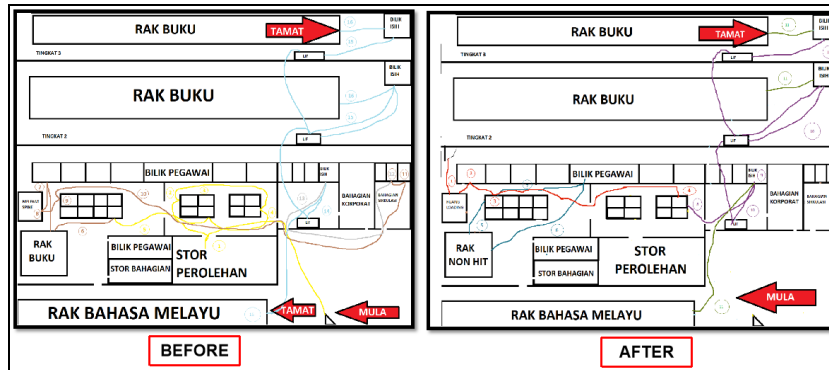


Figure 7

This observation is used to identify the work-flow in the department. A spaghetti diagram is then developed to show this flow. A spaghetti diagram shows the actual state of the flow being practised. A library can then use tree diagrams to identify waste or unproductive work-flows once the problematic flow has been identified. Figure 7 shows the comparison of the spaghetti diagram before and after Kaizen. Figure 8 illustrates the process of identifying waste using the tree diagram method. From here, Kaizen can be implemented. Kaizen is a technique that uses the concept of improvement to eliminate weaknesses. Figure 9 shows how the Kaizen sheet was implemented.

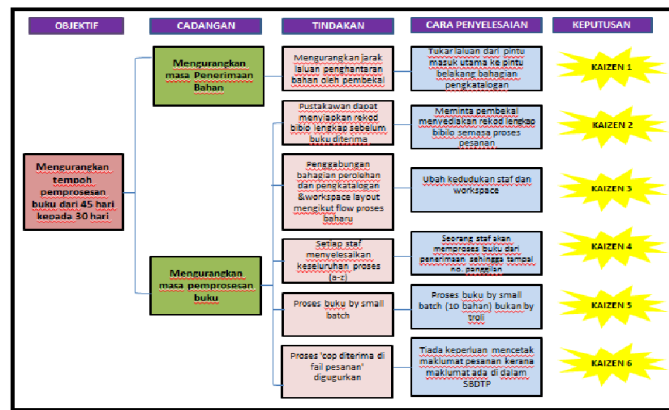


Figure 8

KAIZEN THEME	REASON FOR SELECTING KAIZEN THEME	KAIZEN BY:
Mengurangkan masa penerimaan bahan	Jarak yang jauh untuk pembekal menghantar buku	Shahrize
BEFORE KAIZEN		AFTER KAIZEN
PROBLEM CONTENT		EXPECTED EFFECTS
<ul style="list-style-type: none"> <li>Mengambil masa dan jarak yang jauh untuk pembekal menghantar bahan</li> </ul>		<ul style="list-style-type: none"> <li>Mengurangkan TRANSPORTATION</li> </ul>
SPECIFIC & CONCRETE KAIZEN CONTENTS		AMOUNT OF MONEY CONVERSION
<ul style="list-style-type: none"> <li>Mencari laluan pembekal daripada melalui pintu utama perpustakaan ke pintu alternatif di Bahagian Perolehan (create an organized workspace)</li> </ul>		<ul style="list-style-type: none"> <li>RM1,000.00 (membina ramp untuk memendakkan laluan penghantaran buku)</li> </ul>

Figure 9

As a result of the techniques used, 7 out of 21 work-flow steps were identified and eliminated, resulting in a 33.3% reduction. Based on the observations made, the library was able to reduce work processes and improve efficiency. The results support the hypothesis Lean process affects library work-flow significantly. This hypothesis is considered true and accepted.

### H3. Lean Process Moderates The Relationship Between Work-flow And Performance

Multiple linear regression was used to do the moderator analysis. According to the following ANOVA, Figure 10, the multiple linear regression model is significant.

ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18.697	2	9.348	18.640	<.001 <sup>b</sup>
	Residual	33.603	67	.502		
	Total	52.300	69			
2	Regression	18.722	3	6.241	12.266	<.001 <sup>c</sup>
	Residual	33.578	66	.509		
	Total	52.300	69			

a. Dependent Variable: Performance  
b. Predictors: (Constant), Workflow, LeanProcess  
c. Predictors: (Constant), Workflow, LeanProcess, LeanProcessXworkflow

Figure 10

Coefficients <sup>a</sup>						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.477	.325		1.469	.146
	LeanProcess	.015	.056	.026	.267	.791
	Workflow	.661	.109	.601	6.077	<.001
2	(Constant)	.364	.609		.598	.552
	LeanProcess	.047	.158	.084	.300	.765
	Workflow	.714	.264	.649	2.706	.009
	LeanProcessXworkflow	-.015	.070	-.073	-.220	.827

a. Dependent Variable: Performance

**Figure 11**

Meanwhile, based on Figure 11, the Lean process is not the moderator of the relationship between work-flow process and performance since both Lean process and work-flow are not significant factors that contribute to the performance. There is no evidence to accept the hypothesis as true, so the hypothesis is rejected.

***H4. Lean Process Affects Staff Motivation And Improves Performance***

T-test was used to compare the staff motivation in pre and post-group for the Lean process. According to the following Figure 12, there is no statistically significant staff motivation for both groups ( $t = .965$ ,  $\text{Sig.} = 0.338$ ).

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Motivation	Equal variances assumed	.444	.508	.965	68	.338	.16327	.16923	-.17443	.50096
	Equal variances not assumed			.965	66.624	.338	.16327	.16923	-.17456	.50109

**Figure 12**

The findings show that there is no significant effect between staff motivation both pre and post with the Lean process. There is no evidence to accept the hypothesis as true, so the hypothesis is rejected.

***H5. Lean Process Affects Staff Behavior In a Work Environment And Improves Performance***

T-test was used to compare the staff behavior in pre and post-group for the Lean process. According to the following Figure 13, shows that it is statistically significant staff behavior for both groups ( $t = 2.480$ ,  $\text{Sig.} = .016$ ).

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Behavior	Equal variances assumed	.048	.828	2.480	68	.016	.21558	.08693	.04211	.38906
	Equal variances not assumed			2.480	67.954	.016	.21558	.08693	.04211	.38906

**Figure 13**

The findings show that there is a significant effect between staff behavior both pre and post-with the Lean process. The hypothesis is supported and verified as true.

## 8 Discussion on Finding

The research aims to analyse the effect of the Lean process on library work-flow, motivation, behavior, and staff performance in one of the libraries of a research university in Malaysia. A mixed research method has been applied to study the effects. Cross-Tabulation with Chi-Square, Multiple linear regression, T-test is the method used to test the hypothesis. A total of 35 respondents has participated in this study.

The significance level for pre ( $\text{sig}=.455$ ) and post ( $\text{sig}=.160$ )-performance indicates that there is no significant relation between Lean process and performance. There is no evidence to accept the hypothesis as true, so the hypothesis is rejected.

The observation revealed a reduction of 33.3% resulted from the elimination of 7 steps from 21 work-flow steps. After analyzing the observations, the library was able to optimize its work-flow processes and reduce costs. The findings support the hypothesis Lean process affects library work-flow significantly. This hypothesis is considered true and accepted.

Based on the findings using ANOVA and Coefficients shown in Figure 10 and Figure 11, the Lean process is not the moderator of the relationship between work-flow process and performance, the hypothesis is rejected since both Lean process and work-flow are not significant factors contributing to the performance.

T-test was used to compare the staff pre and post-motivation and there is no statistically significant staff motivation for both groups ( $t = .965$ ,  $\text{Sig.} = 0.338$ ). The hypothesis is considered rejected.

T-test was used to compare staff pre and post behavior shows that it is statistically significant for staff behavior for both groups ( $t = 2.480$ ,  $\text{Sig.} = .016$ ). The hypothesis is supported and verified as true.

## **9 Conclusion and Recommendation**

In general, Lean is a process of constant improvement practiced at every level of the organization. The primary purpose of Lean management is to identify and reduce factors that sit idly, such as time and money. Lean is based on the possibility of Kaizen - or persistent improvement. Ensuring that all representatives contribute to the continuous improvement of the work process ensures the organization's success at whatever point issues arise. Lean management is a theory that eliminates waste in every cycle by making small and gradual improvements. It focuses on quality improvement and decreases surrenders, as well as improving overall assembly adaptability. The findings obtained from this study may be helpful to future researchers in further exploring the issue using the concepts and results developed in this study. This paper explored several issues and relationships that can be further explored in future studies. Future research could investigate a better sampling method to gather data.

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