

Lean management principles : Applications and case studies in operations

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Abstract

The research delves into the applications of lean management principles into the operational context. From the study, it has been obtained that, the efficiency and quality factor of organizations depends on the various possibilities in decision making process. This has emphasized the imperative approaches in terms of facilitating the terminologies. Employing the primary quantitative method, the study utilizes a survey method which has initiated a data collection method from 55 participants across different industries. The chosen tool for the analysis is SPSS that aligns with the various possibilities generating relevant results. The application of ANOVA, correlation and descriptive factors has acknowledged the nuance interpretation of the findings. The exploration of statistical sources has provided various

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insights into key variables while the correlation uncovers the relationship between various factors based on product service quality. The study employs with the possibilities that are present in lean management and its core applications in optimizing the organizational shortcomings.

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Keywords: Mathematical modeling, Ordinary differential equations, A duopoly economy.

1. Introduction

In a world increasingly developed and driven by customer satisfaction and efficiency, organizations are constantly seeking various ways to optimize management operations. Among the most influential management philosophies, lean management has emerged as one of the most powerful tools for achieving organizational goals. As stated by Al-Dweiri et al., lean emphasizes identifying and removing the non-value-adding activities, ensuring the quality and customer satisfaction that remains paramount [1]. Lean management was originally developed by the Toyota production system (TPS) in Japan which is known to be a systematic approach that focuses on eliminating wastage, thereby maximizing the values in all aspects of an organization's operations.

In the year 2022, the average share of projects delivered on time of management consultancies has reached approximately 83.6% due to lean management services (Statista, 2024). The subsequent years have witnessed variations in performance with 85.3% in 2016, 84.5% in 2017, 82.7% in 2018 and a subsequent increase at 86.1% in both 2019 and 2021, Statistica [2].

Lean management leads to the improvement of the quality of resources by focusing on the defects as well as focusing on improving them to enhance customer satisfaction [3]. As stated by Cannas et al. (2023), the coherence of the lean values has synthesized the operational elements [4]. Therefore, the implication of lean management has helped in stabilizing the accountancy level of the organization.

2. Contribution of Lean Management Principles

2.1 Adaptation of lean principles across different industrial sectors

With the diverse industrial sectors, lean methodology has applied various requirements to integrate a seamless experience into the production. As opined by Condé et al. (2023), automotive manufacturers have enhanced their operational performances [5].

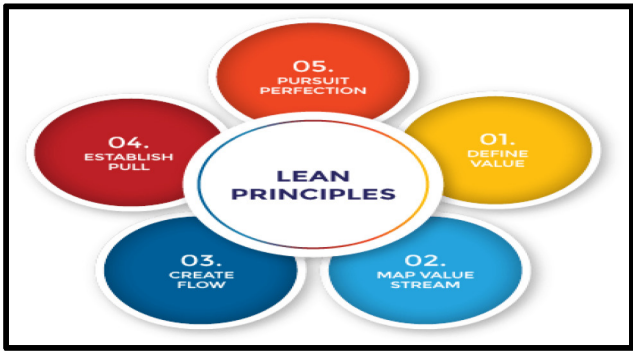


Figure 1

Lean principles across different industrial sectors

As stated by Gładysz et al. (2020) in Figure 1, through the implementation of the lean process the management can define the values and pursue perfection in project delivery times[5].

2.1 Effectiveness of lean principles in improving operational efficiencies

Lean methodologies have underscored the importance of employee involvement in culminating the standardized processes for pursuing relentless production.

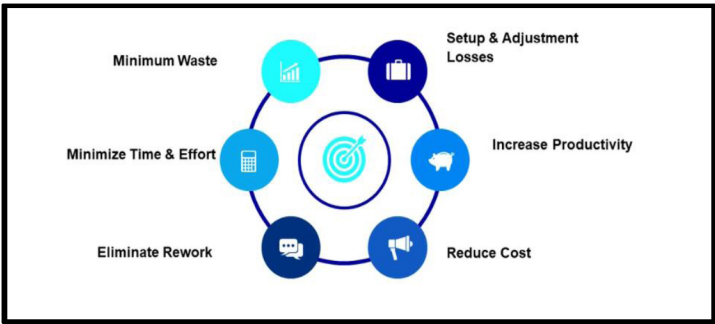


Figure 2

Effectiveness of lean principles in improving operational efficiencies

The Figure 2 demonstrates the various significant possibilities that are aligned with lean management services [6]. As opined by Kumar et al. (2024), Moreover, the idea of eliminating rework has addressed cost reduction thereby minimizing time and effort significantly.

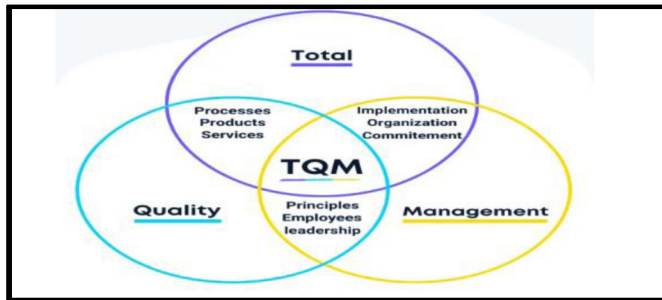


Figure 3

Relationship between lean management and product or service quality

2.2 Relationship between lean management and product or service quality

The exploration of lean management and its connections with product and service quality have brought as opined by Laroca et al. (2024). From the Figure 3, it can be demonstrated that the theoretical perspectives such as the Total Quality Management (TQM) and the Six Sigma framework have elucidated the connection between lean management and the quality resource factors [7].

As per the critical analysis by Leite et al. (2024), the synergy between lean and service-oriented theories has reinforced the notion of sustainability to withstand the quality of the product and services [8].

3. Methodology

The chosen methodology for this research is centered on a primary quantitative method, utilizing the survey method for data collection. According to Margherita & Braccini (2024), the methodology aligns with the research objectives by providing a holistic approach [9]. The survey method is employed to collect data from 55 participants representing various significant organizations. The collected data will be exercised by using the SPSS tool which has been proven as scientific and provides authentic results.

The analytical tools selected for this study include descriptive statistics, correlation analysis, ANOVA, reliability and validity, and regression analysis significantly. Additionally, regression analysis will be employed to identify the strength and direction of relationships between variables.

4. Inferences and analysis of the proposed model

From the Table 1, it can be derived that among the 55 participants, 50.9% are female, 29.1% are male and the rest 20% come under the preferred to not say group.

Table 1
Gender factor

	Frequency	Percent	Valid Percent	Cumulative Percent
Female	28	50.9	50.9	50.9
Male	16	29.1	29.1	80.0
Valid Prefer not to say	11	20.0	20.0	100.0
Total	55	100.0	100.0	

Table 2
Age factor

	Frequency	Percent	Valid Percent	Cumulative Percent
20 years to 30 years	17	30.9	30.9	30.9
31 years to 40 years	11	20.0	20.0	50.9
Valid 41 years to 50 years	22	40.0	40.0	90.9
51 years to 60 years	5	9.1	9.1	100.0
Total	55	100.0	100.0	

The Table 2 shows the age factor of the 55 participants which includes 30.9% under the age group from 20 years to 30 years and 20% between the age group of 31 years to 40 years significantly. Similarly, the majority of the participants belong to the age group from 41 years to 50 years whereas the least number of them are under the age group of 51 years to 60 years.

Table 3
Monthly income

	Frequency	Percent	Valid Percent	Cumulative Percent
Rs.30,000 to Rs.40,000	11	20.0	20.0	20.0
Valid Rs.40,000 to Rs.50,000	23	41.8	41.8	61.8
Rs.50,000 to Rs.60,000	21	38.2	38.2	100.0
Total	55	100.0	100.0	

The Table 3 illustrates the monthly income of the members who participated in the survey process. The pie chart shows that 41.82% of the participants have a greater income range as compared to the members who belong to the income range between Rs.30,000 to Rs.40,000 and Rs.50,000 to Rs.60,000 significantly.

Table 4
Descriptive statistics

	Descriptive Statistics						
	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
DV1	55	1	5	3.84	1.642	-.927	.322
DV2	55	1	5	4.53	1.168	-2.599	.322
IV1	55	3.00	10.00	7.9818	2.36088	-.749	.322
IV2	55	5.00	10.00	8.2364	1.94330	-.394	.322
IV3	55	2.00	10.00	7.2545	3.16356	-.771	.322
IV4	55	2.00	10.00	6.4000	3.10078	-.119	.322
Valid N (listwise)	55						

In the dataset with 55 participants, descriptive statistics shown in Table 4 reveal insights into the key variables. From dependent variables (DV1 and DV2), the mean scores are 3.84 and 4.53 respectively, indicating a central tendency. The variables IV1, IV2, IV3 and IV4 exhibit variations with means ranging from 6.40 to 8.24 significantly. Standard deviations reflect an asymmetry of distributions for more in-depth statistical analysis

Table 5
Correlation coefficient

		Correlations					
		DV1	DV2	IV1	IV2	IV3	IV4
DV1	Pearson Correlation	1	.654**	-.445**	.343*	.343*	.159
	Sig. (2-tailed)		.000	.001	.010	.010	.247
	N	55	55	55	55	55	55
DV2	Pearson Correlation	.654**	1	-.272*	-.178	.284*	.391**
	Sig. (2-tailed)	.000		.045	.193	.036	.003
	N	55	55	55	55	55	55
IV1	Pearson Correlation	-.445**	-.272*	1	.300*	-.371**	.254
	Sig. (2-tailed)	.001	.045		.026	.005	.061
	N	55	55	55	55	55	55
IV2	Pearson Correlation	.343*	-.178	.300*	1	-.139	-.382**
	Sig. (2-tailed)	.010	.193	.026		.310	.004
	N	55	55	55	55	55	55
IV3	Pearson Correlation	.343*	.284*	-.371**	-.139	1	.310*
	Sig. (2-tailed)	.010	.036	.005	.310		.021
	N	55	55	55	55	55	55
IV4	Pearson Correlation	.159	.391**	.254	-.382**	.310*	1
	Sig. (2-tailed)	.247	.003	.061	.004	.021	
	N	55	55	55	55	55	55

The correlation coefficient analyses the variables that have scored significant relationships in lean management depicted in Table 5. Dependent variables have exhibited a positive correlation of 0.65 which indicates a strong association. IV1 and IV3 display a negative correlation with DV1, while IV2, IV4 and IV3 have varied relationships with DV2. Notably, IV4 have demonstrated a strong positive correlation of 0.391 with DV2. The findings suggest the complex interdependencies between the variables in terms of operational outcomes.

The regression model with the predictability of the variables IV4, IV1, IV3 and IV2 demonstrating high explanatory power with the R values 0.912 and 0.831 respectively in Figure 4. Moreover, IV1 and IV2 exhibit substantial standardized coefficients which are -0.978 and 0.923 respectively indicating a significant impact on DV1. Similarly the regression model predicting DV2 with IV4, IV1, IV3 and IV2 with $F = 6.074$ with $p\text{-value} < 0.001$. The interception with IV2 has more significant effects that suggest a statistical significance in the substantial portion of the DV2's variations

Model Summary ^a					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.912 ^a	.831	.818	.701	2.258

a. Predictors: (Constant), IV4, IV1, IV3, IV2
b. Dependent Variable: DV1

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	120.959	4	30.240	61.541	.000 ^b
	Residual	24.569	50	.491		
	Total	145.527	54			

a. Dependent Variable: DV1
b. Predictors: (Constant), IV4, IV1, IV3, IV2

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.647	.617		1.048	.300
	IV1	-.680	.055	-.978	-12.324	.000
	IV2	.780	.061	.923	12.749	.000
	IV3	-.073	.038	-.140	-1.934	.059
	IV4	.425	.042	.803	10.039	.000

Figure 4
Analysis of DV1

4. Discussion

Lean management has induced various possibilities that revolve around the factorial sectors of management concerning the varied valuable insights that exist in organizations. The high explanatory power of the regression model has predicted that DV1 aligns with the studies, emphasizing the positive impacts on the lean practices that enforce operational outcomes. As opined by Naeemah & Wong (2023), the significant coefficients of IV1 and IV2 support literature that highlights lean implementation for enhanced efficiencies [11].

However, from the regression analysis, it has been established that the effectiveness of specific and operational outcomes has sufficiently pronounced the effects of IV2 and IV3 underscoring the multifaceted nature of quantity outcomes within lean contexts. Organizations benefit by tailoring the lean management factors which are demonstrated in the form of Six Sigma principles based on the significant operational aspects they aim to improve.

The marginal effects of IV3 on DV1 have a modest influence on IV2 and DV2 which raises the significant valuations across different operational prospects that show relative courses in the organizational context. Therefore, it can be established that the discourses in the organizational sectors can be minimized by adapting the theoretical opportunities based on diverse settings.

5. Conclusion

The study advances the understanding of lean management with its core values and applications in organizational settings. The statistical approaches have induced a positive correlation uncovering the insightful factors into the operational outcomes. The practical implications have suggested the growth in production rate that promotes the further course of actions into the contextual relevance. These findings hold practical significance hold a practical urge to caution a limited influence of IV3 into contextual relevance. The adaption of the lean principle along with the effectiveness of organizational congruencies has evoked significant terms and planning.

These findings hold a relevant course of action that emphasizes the needs and possibilities that provide organizational avenues a better place for optimization. From the above discussion, it can be stated that lean management evokes brighter sources that not only benefit the

organizational forums but also resonate with the working patterns of the employees significantly. The unexpected results provide a better understanding of the dynamics of lean management. Therefore, it can be concluded that, lean management have optimized certain values and opportunities which has both qualitative and quantitative advantages.

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