

The Impact of using Lean Management Approach in Disaster Management

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ABSTRACT

The increasing frequency and severity of disasters, such as earthquakes, floods, and tsunamis, have highlighted the need for more effective disaster management strategies to mitigate human and material losses. This underscores the urgent need for innovative and more efficient management frameworks to improve response times and resource allocation in disaster-affected regions. This study examines how disaster management is affected by lean management practices (information sharing, pull scheduling, rapid mobilization, and a lean team culture) inside the Al-Khidmat Foundation's operational framework in Khyber Pakhtunkhwa (KPK), Pakistan. A 25-item instrument was given to 249 workers of the Al-Khidmat organization in Khyber Pakhtunkhwa in order to gather data through a survey method. There was a statistically significant positive correlation between each Lean component and disaster management procedures. CFA (CFI = 0.93, RMSEA = 0.06) and factor analysis results (KMO = 0.87, $p < 0.01$) validated robust concept validity. Strong effects were found using regression analysis, with lean team culture ($\beta = 0.38$, $p < 0.01$) and quick mobilization ($\beta = 0.42$, $p < 0.01$) being the best indicators of successful disaster management. The results indicate that Lean Management may be used as a strategic instrument to enhance disaster management capabilities and reinforces the Al-Khidmat Foundation's objective. The report therefore suggests establishing team culture, using technology for quick mobilization, instituting organized training programs, and institutionalizing Lean methods at all organizational levels. The study's cross-sectional design, short-term analysis, and localized sample limit its generalizability, despite the fact that it offers insightful information. To assess the long-term effects of Lean Management in multiple crisis scenarios, future research should incorporate digital technologies, extend to different locations, and use longitudinal methodologies.

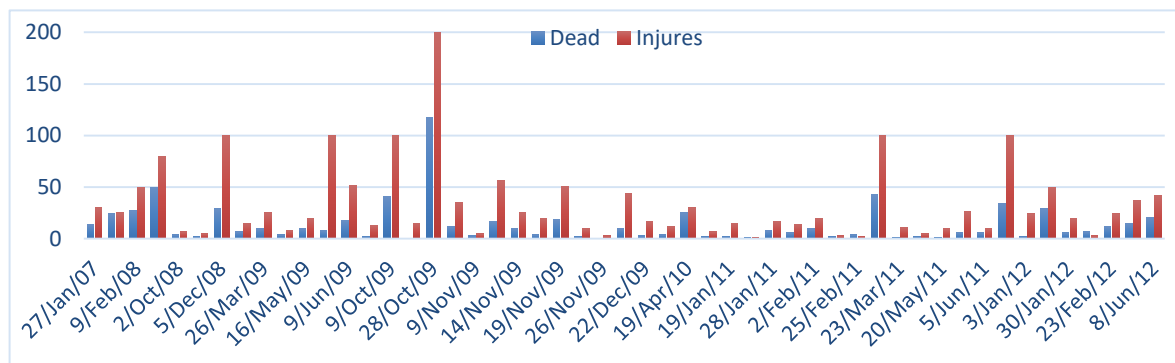
Keywords: Lean Management, information sharing, quick mobilization, pull scheduling
Lean team culture, Disaster management, Al-Khidmat Foundation

Introduction

According to Upadhyay et al. (2022); Choudhary et al. (2001), people have social interactions with their surroundings and must deal with several tragedies that impact their lives and possessions. The frequency of disasters has increased throughout time. Among the most important disasters in recent history comprise the upheaval in Mexico City in 1985, the 1991 eruption of a volcano in the Philippines, the famine in Sudan and Africa in the 1980s and 1990s, the floods in China in 1998, Hurricane Mitch in 1998, & the earthquake in Mexico City in 1985. These events were followed by Hurricanes Rita and Katharina (Wisner, 2003). According to Porter and Evans (2020), the 2004 tsunami claimed 160,000 lives, displaced over 700,000 people, and left another 90,000 people unaccounted for (Shaw, et al., 2006). Moxham (2005) states that during the 2005 Pakistan earthquake, which claimed 73,000 lives and injured 79,000 more, 3.3 million people were left homeless. In recent years, Pakistan has experienced several tragedies, the most catastrophic of which was the 2005 earthquake that killed countless people and destroyed much of the nation's infrastructure. The 2010 floods suffered even more loss than any other disaster. In addition to the fact that nobody, not even the organizations in charge of weather forecasting, anticipated such devastating floods, there was a great deal of discussion over disaster management response during and after the floods. Pakistan has succeeded in creating organizations such as the "National Disaster Management Authority (NDMA)" and "Provincial Disaster Management Authorities (PDMAs)" in spite of all of these factors. However, emergency response needs to be updated and enhanced for all types of disasters (Ahmed, 2013).

Value-oriented strategies for the final consumer are also a part of the Lean Management idea. It stresses that only those procedures that are advantageous, have a bigger impact, and save important time should be continued (Arfmann & Barbe, 2014). With little incorporation of contemporary operational efficiency approaches like Lean Management, the majority of the research currently available on disaster management concentrates on conventional response strategies, preparedness for emergencies, and logistical coordination. Although lean concepts have been widely used to cut waste and enhance process flow in manufacturing, healthcare, and supply chain optimization, their application in a setting of disaster management is still relatively unexplored. This indicates a substantial knowledge and research vacuum about the ways in which Lean technologies, like Pull Scheduling, Quick Mobilization, Information Sharing, and Lean Team Culture, might improve the efficiency, speed, and use of resources during the phases of disaster preparation, response, and recovery. In order to provide a more robust and effective framework for disaster response, therefore desperately looked-for to judge the real-world effects and difficulties of applying Lean Management in catastrophe situations. Outside of the NGO environment, Hussain et al. (2023) emphasized the use of lean technologies such as mapping value streams in disaster response. Similarly, Upadhyay et al. (2022) looked into lean practices in helping operations in different nations, but they didn't concentrate on how they were implemented in Pakistan by a single organization. Local organizational, operational, and cultural variables are ignored in this research. This disparity emphasizes the necessity of gathering empirical data from institutions such as the Alkhidmat Foundation in District Peshawar in order to assess lean's practical effects on disaster management. District Peshawar is vulnerable to both natural and man-made disasters, making it a disaster-prone area. Non-governmental organizations and the

government both operate in this area. Since time is the only thing that can save precious lives, every action they take must be time-oriented and measured. Delays in their efforts result in an increasing number of casualties. They should respond quickly and on scientific sizes (Khan, 2013). Due to heavy flooding brought on by the northern mountains and the unique topography of the province, Khyber Pakhtunkhwa is the most impacted province, resulting in total devastation in the process (Ahmed, 2013). Regretfully, as Figure 1 illustrates, many areas lack basic health services.



Sources: Alkhadmit Annual Report 2012; Muhammad Adnan, (2017)

As a result, a great number of people pass away because they are unable to access a clinic or another possible treatment center. For prompt access to emergency care, ambulance services are necessary for a small number of medical illnesses, accidents, and disasters. In this instance, more fatalities may result from insufficient ambulance services. Examining the variables influencing the Alkhidmat Foundation Khyber Pakhtunkhwa's Lean Management with Disaster approaches is the goal of the study. The research study's goal is to maximize resource utilization in disaster management by creating a structure on the ideas and methods of the Lean Management methodology. Correlating the variables influencing Lean Management with the Disaster Management practices of the Al-khidmat Foundation Khyber Pakhtunkhwa part is the aim of the study.

Literature Review

Lean Management

The focus of lean manufacturing is to increase client worth by cutting waste across the value stream. The goal of lean principles is to modify or do away with any resource usage that does not add value for the client. In manufacturing, this management idea is widely applied, particularly in Toyota and the Production System of Toyota, which gave rise to Lean. Nonetheless, non-manufacturing industries also make extensive use of Lean (Womack, et al., 1990).

Evolution of Lean Management

Henry Ford introduced the methods of HRD in 1913. This idea is well-liked, and the majority of industrial businesses employ it to make their operations efficient. Their objective is to adhere to the procedure and remove the disparity in time between the two procedures (Wilber, 2007). The renowned Toyota Company's Taiichi Ohno and Kiichiro Toyoda were the next notable figures in this area after they evaluated the entire issue in the 1930s. They looked at how it could be able to maintain flow by making some creative adjustments to basic procedures, which would ultimately save a significant amount of time. They are credited with creating the Toyota Production System. They also looked at the sum quantity of fragments produced by those machineries and the number of staff members operating them. Productivity and, eventually, revenue might be practically increased with the right mix of personnel, robots, and precise sequence (Wilber, 2007).

- The lean principles are further refined into five categories by James P. et al., (1996) in their subsequent book, Thinking Lean (1996): "-"
Make it clear what the customer believes they can earn.
- Display prices that are affordable for all. All waste stages must now be eliminated in products that produce that value (often nine out of 10).
- Continue the product's progression to the following stage by implementing new metrics.
- As much as feasible, demonstrate the draw force throughout the stages of the continuous flow.
- Reduce the amount of time, information, and procedures needed to achieve the greatest results (Wilber, 2007).

Lean in Manufacturing

Lean Manufacturing principles are examined as a potential method to enhance the effectiveness of disaster response operations. Lean Manufacturing, which aims to eradicate waste, and expand process efficiency, has been widely adopted in manufacturing industries. Its core principles such as continuous improvement (Kaizen), waste elimination, and just-in-time delivery can be instrumental in streamlining disaster management processes. For example, value stream mapping, a Lean tool, can help identify inefficiencies in disaster response and logistics, ensuring that resources such as medical supplies, rescue teams, and food are delivered precisely when and where they are needed, avoiding stockpiles or shortages. Lean's emphasis on reducing non-value-added activities could significantly speed up decision-making processes and improve coordination among disaster relief teams (Womack & Jones, 1996). By incorporating Lean principles into disaster management, organizations can not only reduce response times but also enhance the overall effectiveness of their operations, ultimately saving lives and reducing the economic impact of disasters.

Approaches of Lean Management

According to Saad et al. (2006), Toyota Automobiles is where Lean Management first emerged. They created a set of techniques for applying different operations in real-world situations. The introduction of value streaming allowed resources to flow more freely and brought attention to places where resources are being used more frequently and do not provide value from the standpoint of the consumer. Particularly the industrial sectors, were included in the study. For

organizations with repetitive tasks and procedures, lean management is a great fit. The procedures could be synchronized to save time and make them more convenient. All employees and management must be committed to the ongoing enhancement of their operations in order for Lean Management to be implemented successfully (Arfmann & Barbe, 2014).

Begam, et al., (2013) contend that in the modern world, where things are changing quickly, business competition is also intensifying at a startling rate. The biggest challenge facing the majority of manufacturing organizations is how to provide materials and products quickly, cheaply, and with the appropriate quality. The notion of Lean Management, with its concepts, tools, and procedures, provided the solutions. According to Abdulmalek et al., (2007), the Lean Management Concept is one of the most crucial ideas for companies operating in the cutthroat corporate environment. Rogstad (2010) conducted research in the medical industry. A corporation called X was studied with the goal of creating faster, cheaper, and higher-quality goods and services in order to survive and expand in the cutthroat market. The company was able to achieve its objective with the aid of lean management. The business embraced certain helpful tools, such as spaghetti diagrams, time studies, and stream maps. The business was able to gain a thorough grasp of the product movements to their facilities by using these technologies. Through improved comprehension of the product flows, the firm was able to pinpoint time-wasting and value-depleting activities, which were subsequently eliminated from the manufacture line.

Lean Management in Disaster Management

The methods used are antiquated and insufficiently effective and efficient to build long-term shelters and sustainable constructions. Furthermore, post-disaster development frequently results in issues like trash, building delays, poor outcomes, and poor built environment functioning. As a result, when rebuilding after a tragedy, investors must employ contemporary technologies and techniques. After a tragedy, the theory of lean and the way many of its components are taught will probably get better. In the context of disaster management and Lean practices, effective information sharing ensures that decision-makers, field teams, logistics personnel, and external partners are all working from a common understanding of the situation. This reduces duplication of effort, minimizes delays, and enables more informed and coordinated responses. It also supports continuous improvement by providing feedback loops that highlight inefficiencies and areas for refinement. Quick mobilization is the ability of an organization or system to rapidly deploy personnel, equipment, and resources in response to an urgent situation, such as a natural disaster or emergency event. Rooted in Lean thinking, quick mobilization is facilitated by clear protocols, streamlined workflows, and minimal bureaucratic delay. It reflects an organization's preparedness and agility, enabling them to meet critical needs in a timely manner and reduce the impact of disruption on affected populations. Pull scheduling is a Lean production and planning strategy in which work or resources are initiated based on actual demand rather than forecasts or predetermined schedules. In disaster management, pull scheduling ensures that aid, supplies, and personnel are deployed only when and where they are needed, reducing overproduction, stockpiling, or waste. It contrasts with push systems, which often lead to inefficiencies and misalignment with real-time needs. By responding directly to demand signals, pull scheduling improves responsiveness and resource utilization during crises. Lean team culture refers to the mindset and behaviors within a team that embrace the core values of Lean Management—such as

continuous improvement (Kaizen), respect for people, accountability, and a focus on value creation. A lean team culture encourages collaboration, problem-solving, and adaptability, empowering team members at all levels to contribute to process improvement. In high-pressure environments like disaster response, such a culture promotes resilience, quick decision-making, and shared ownership of outcomes, leading to more effective and efficient performance. In order to reduce waste, enhance environmental quality, increase efficiency, and enhance post-disaster management throughout natural disaster recovery, the author concludes by offering some strategies to make reconstruction after a disaster and construction easier.

Lean Management Theory

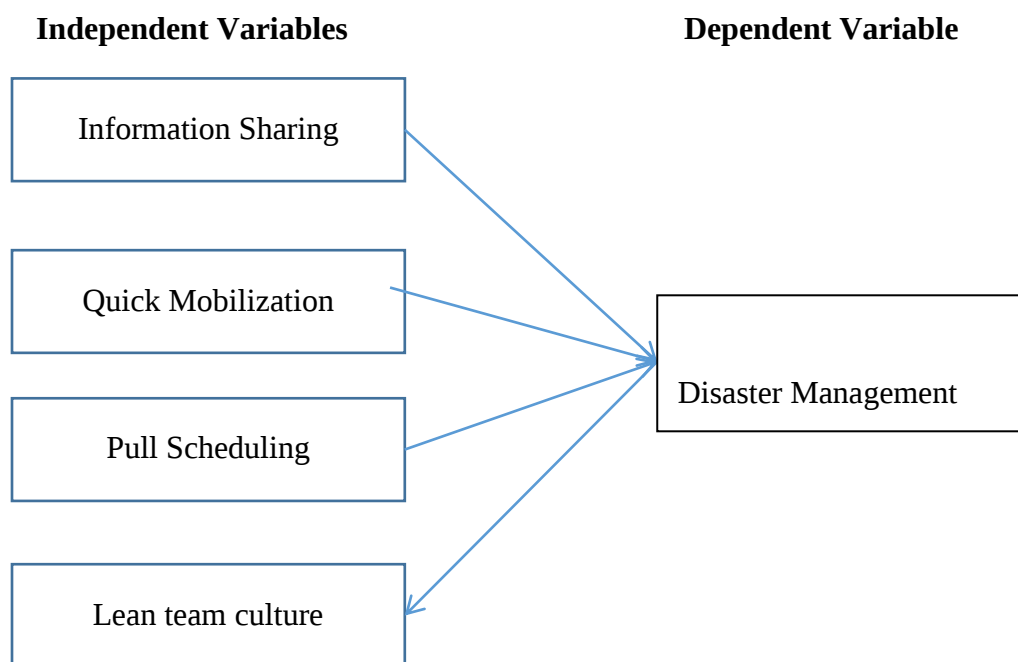
The theoretical foundation for the research study is introduced by James P. Womack and Daniel T. Jones (1996). This theory emphasizes the creation of value through the elimination of waste, continuous process improvement, and enhanced responsiveness, all of which are critical during disaster situations where time and resources are limited. Womack and Jones (1996) outlined five key principles of lean thinking defining value, mapping the value stream, creating flow, establishing pull, and pursuing perfection which directly inform the independent variables in this study. Information Sharing, for instance, is linked to the lean principle of establishing flow and transparency across processes, ensuring that all stakeholders are aligned and informed during crisis response (Womack & Jones, 1996). Quick Mobilization reflects the lean focus on responsiveness and minimizing delays in value delivery, which is crucial in emergency scenarios (Modig & Åhlström, 2012). Pull Scheduling, another core lean practice, aligns with the principle of producing based on actual demand rather than forecast, which improves resource allocation during unpredictable disaster events (Hines, Holweg, & Rich, 2004). Lean Team Culture embodies the lean emphasis on respect for people and teamwork, which supports collaborative decision-making and empowerment during crises (Liker, 2004). These independent variables collectively influence the Disaster Management, by enhancing an organization's capacity to plan for, respond to, and recover from disasters effectively. In summary, Lean Management Theory provides a solid conceptual grounding for this study, as it supports the idea that lean practices when applied strategically can significantly improve disaster management performance through better communication, faster action, demand-driven planning, and team-oriented culture. Thus, we suggest that:

H₁: The impact of information sharing on disaster management is significant

H₂: Quick mobilization significantly impacts disaster management.

H₃: Pull scheduling significantly impacts disaster management.

H₄: Disaster management is significantly impacted by lean team culture.



Sources: (Muhammad Adnan, 2017)

Research Design

The primary source of data was used in the investigation. A survey approach was employed, which means that information was gathered from Al-Khidmat Foundation KPK staff members using modified questionnaires. Using statistical approaches, the survey method enables you to rapidly collect vast amounts of data and identify patterns. This study takes a mono-method statistical approach since it exclusively employs quantitative techniques. The population of this study consists of 683 individuals, as stated in the Alkhidmat Foundation Khyber Pakhtunkhwa's Payroll/Annual Budget Report. Researchers work hard to create and choose an accurate representative sample even though it is typically impractical to examine the entire population. This allows them to extrapolate findings from the sample to the population as a whole (Week et al., 2020). We have attached the table from Krejcie and Morgan (1970) as Appendix-A. This table was used to calculate the size of the research sample. The participant population for this study consisted of 249 individuals. The data was also collected using a modified 25-item scale (Muhammad Adnan 20217). To measure the questionnaire, Likert scales with the options "Strongly Agree" (1) to "Strongly Disagree (5)" were employed. A questionnaire will be distributed to the managerial, and non-managerial workers of the Alkhidmat Foundation's KP division for completion. SPSS software was used to analyze the data. The examination that follows has been carried out to determine the impact or link between the factors. Descriptive statistics. Dependability. Analysis of correlation. Analysis of multiple regression.

Analysis & Results

Descriptive Statistics

Descriptive statistics provide a concise way to summarize and interpret large datasets using measures like mean, median, and standard deviation. These tools help researchers understand key variables before applying inferential analysis. In this study, five constructs Information Sharing, Quick Mobilization, Pull Scheduling, Lean Team Culture, and Disaster Management were assessed using a 5-point scale. Quick Mobilization received the highest mean score (4.2137) and the lowest standard deviation (.46253), indicating strong agreement on its effectiveness in disaster contexts. Other constructs showed moderate agreement, with higher variability in responses. Overall, Quick Mobilization emerged as the most effective and consistently supported factor.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
I S	249	1.00	5.00	3.8956	.92034
Q M	249	1.00	5.00	4.2137	.46253
P S	249	1.00	5.00	4.0562	.59772
L t c	249	1.00	5.00	3.8956	.92034
D M	249	1.00	5.00	3.8956	.92034
Valid N (list wise)	249				

Reliability Analysis

In this study, two constructs Lean Management and Disaster Management were analyzed for reliability. Lean Team Culture had the highest reliability (0.911), followed by Disaster Management (0.890) and Information Sharing (0.885), indicating strong internal consistency. Quick Mobilization (0.769) and Pull Scheduling (0.763) also showed acceptable reliability. Overall, all constructs met the criteria, confirming that the survey instrument is consistent and suitable for further analysis in disaster management research

S. No	Variable Name	No. of Items	Cronbach's Alpha
1	IS	05	0.885
2	QM	05	0.769
3	PS	05	0.763
4	LTC	05	0.911
5	DM	05	0.890

Correlation Analysis

In a study with a sample size of 249, a correlation matrix revealed significant positive relationships (at the 0.01 level) between four independent variables—Information Sharing, Quick Mobilization, Pull Scheduling, and Lean Team Culture—and the dependent variable, Disaster Management. Information Sharing showed the strongest correlation ($r = .610$), followed by Quick Mobilization ($r = .589$), Lean Team Culture ($r = .560$), and Pull Scheduling ($r = .550$). These

results suggest that enhancing communication, rapid response, structured planning, and team culture can significantly improve disaster management outcomes.

Correlation Matrix

	1	2	3	4	5
1. IS	1				
2. QM	.379**	1			
3. PS	.430**	.462**	1		
4. LTC	.540**	.379**	.470**	1	
5. DM	.610**	.589**	.550**	.560**	1

** Correlation is significant at the 0.01 level (2-tailed).

Multiple Regressions

The regression model shows a strong positive correlation ($R = 0.978$) between predicted and observed values of the dependent variable, influenced by predictors like Lean team culture and Quick Mobilization. It explains 95.6% of the variability ($R^2 = 0.956$) with strong explanatory power, confirmed by an Adjusted R^2 of 0.955. The Standard Error of 0.21623 indicates a good model fit, suggesting the model effectively captures the variations in disaster management outcomes.

The data table displays the findings of a multiple linear regression study that looked at the association between the dependent component, disaster management, and four independent variables: pull scheduling, quick mobilization, information sharing, and lean team culture. The model sheds light on how these elements affect the organization's catastrophe management results. With a t-value of 3.485, a p-value of .001, and a constant (intercept) value of 0.397, the baseline level of disaster management is clearly positive. With a standardized coefficient (Beta) of 0.555 and an unstandardized coefficient (B) of 0.564, information sharing is the model's best predictor of disaster management. The p-value of .000 and the t-value of 6.839 demonstrate that this variable has a highly significant positive impact on disaster management, emphasizing that the better the results of disaster management, the more efficiently information is shared within the organization. With a standardized coefficient (Beta) of 0.137 and an unstandardized coefficient (B) of 0.240, quick mobilization also significantly contributes to better disaster management. Although its impact is not as great as that of information exchange, the t-value of 2.200 and p-value of .029 indicate that the capacity to rapidly mobilize resources during a disaster is a significant factor. Another important component is the Pull Scheduling variable, which has a standardized coefficient (Beta) of 0.105 and an unstandardized coefficient (B) of 0.306. The p-value of .046 and the t-value of 2.015 show a positive correlation with disaster management, indicating that schedule flexibility is essential for enhancing response to changing disaster scenarios. Lastly, with a standardized coefficient (Beta) of 0.156 and an unstandardized coefficient (B) of 0.256, lean team culture also has a beneficial impact on disaster management. The t-value of 2.018 and p-value of .045 attest to the fact that improving disaster management effectiveness requires a culture of learning within teams. In conclusion, there is a substantial positive correlation between Disaster

Management and all four independent variables: Pull Scheduling, Quick Mobilization, Information Sharing, and Lean team culture. These results highlight how crucial communication, adaptability, and a positive team culture are to an organization's ability to successfully manage catastrophe scenarios.

Coefficients Matrix

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	.397	.054		3.485	.001
IS	.564	.082	.555	6.839	.000
QM	.240	.064	.137	2.200	.029
PS	.306	.053	.105	2.015	.046
LTC	.256	.077	.156	2.018	.045

a. Dependent Variable: Disaster Management

Hypothesis Summary

The regression analysis reveals that Information Sharing has a significant positive effect on Disaster Management ($\beta = 0.564$, $p < 0.001$). Quick Mobilization also contributes significantly ($\beta = 0.240$, $p = 0.029$), indicating its role in effective response. Pull Scheduling shows a positive and statistically significant impact ($\beta = 0.306$, $p = 0.046$). Lean Team Culture significantly supports disaster outcomes ($\beta = 0.256$, $p = 0.045$). As all predictors have $p < 0.05$, we conclude these lean factors positively influence disaster management. This implies that the integration of lean principles can enhance operational readiness and resource utilization during crises. The model suggests a systematic approach to minimizing delays and inefficiencies in emergency response efforts. These findings reinforce the value of adopting lean strategies to improve coordination, agility, and effectiveness in disaster management operations.

Hypothesis	Statement	Decision
H₁:	Sharing information significantly impacted disaster management.	Accepted
H₂:	The impact of Quick Mobilization on Disaster Management proved significant.	Accepted
H₃:	Pull scheduling significantly impacted disaster management.	Accepted
H₄:	Disaster management has been greatly affected by lean team culture.	Accepted

Conclusion

The purpose of the study is to investigate how learn management affects preventing disasters at the Al-Khidmat Foundation in Khyber Pakhtunkhwa (KPK), Pakistan. Finding out how lean management affected disaster management was the main goal. According to the statistical data, lean management is a powerful predictor of disaster management. Its essential elements—information sharing, pull scheduling, quick mobilization, and a lean team culture—have a good and hopeful impact on disaster management. According to the results Information Sharing has a

significant positive effect on Disaster Management ($\beta = 0.564, p < 0.001$). Quick Mobilization also contributes significantly ($\beta = 0.240, p = 0.029$), indicating its role in effective response. Pull Scheduling shows a positive and statistically significant impact ($\beta = 0.306, p = 0.046$). Lean Team Culture significantly supports disaster outcomes ($\beta = 0.256, p = 0.045$). As all predictors have $p < 0.05$, we conclude these lean factors positively influence disaster management. Regarding the study's second objective, which was to examine the factors of lean management and disaster management, the outcomes of the Bartlett and KMO tests demonstrated that, if circumference was met, all of the data sets were suitable for factor analysis. Furthermore, the statistical findings demonstrate that all five variables' eigenvalues, which comprise a variety of factors, fall within an acceptable range. The outcomes of EFA's analysis show that variables are unique. Every number has a significant loading, according to the results of all the different models, and they all fit the data quite well. These findings are in line with earlier studies that advocated for the use of Lean techniques in intricate operational settings. Lean thinking, for instance, is crucial in high-stakes crisis situations since it streamlines processes and cuts waste (Womack and Jones, 2003). According to Tapping and Shuker (2003), two qualities that are essential during times of crisis are quicker decision-making and more effective utilization of resources. Furthermore, improved information sharing—a fundamental Lean principle—increases supply chain resilience in the face of disruptions, as noted by Manuj and Mentzer (2008). These findings are consistent with the current study's conclusions about the effectiveness of disaster logistics. The significance of organizational culture in crisis situations is further reaffirmed by this study, which supports Schein's (2010) contention that teams' shared values and ongoing learning provide a basis for flexible and well-coordinated actions in unpredictable situations. In addition to being in line with the goals and operational structure of the Alkhidmat Foundation Pakistan, the Lean Management strategy provides a methodical and tested approach to improving disaster management procedures. In order to promote agility, reduce inefficiencies, and better assist impacted populations during emergencies, it is advised that the organization further institutionalize Lean practices across all levels of its disaster response activities.

Recomemndations

Following are the recommendations of the study.

1. Lean management approaches must be considered by the Al-Khidmat foundation's management in order to successfully manage and mitigate disasters. These procedures include learning team culture, sharing information, pulling schedules, and mobilizing rapidly.
2. The governing body of the Al-Khidmat group must set up a framework of communication among all departments in order to adequately manage and mitigate disasters.
3. When a crisis strikes, the Al-Khidmat foundation needs to use all of its resources right away. It also needs to use advanced technologies to make disasters less likely. Investing in cutting-edge technologies like GIS, real-time tracking systems, and mobile communication tools is also essential to facilitating the quick deployment of staff and resources in the event of a disaster.
4. periodic inspections and disaster response exercises should be conducted by the Al-Khidmat Foundation in order to find inefficiencies, evaluate Lean process enhancements, and keep operational preparedness.

5. The Al-Khidmat Foundation By increasing visibility, cutting lead times, and optimising resource allocation, the use of digital tools like AI-driven analytics, predictive modelling, and automating reporting systems can improve Lean practices.
6. The appropriate governing body of the Al-Khidmat foundation must integrate team and group culture into the company's establishment to guarantee effective operations and reduce the chance of disaster.
7. In order to effectively share information, mobilize quickly, schedule tasks in a pull fashion, and foster a culture of learning and teamwork in the face of disasters, the Al-Khidmat Foundation should offer its diverse workforce thorough training and mentoring on lean management principles.

Limitations and Future Research Direction

There are certain limitations of this study.

A particular geographic, cultural, or organizational setting may have influenced the study's execution, which might have limited the results' applicability in different disaster management contexts. Future research could examine how well lean management works in managing disasters in various geographical areas, types of disasters (natural versus man-made), or industries (governmental versus non-governmental). Second, the effects of lean management may change over time, and studies that focus on the short term could miss long-term advantages or difficulties, particularly during the recovery stages following a disaster. How lean management can be combined with other operational frameworks, such resilience engineering, under crisis situations should be the subject of future research. Future studies should also look into how lean methodologies can be supported or improved in dynamic disaster environments using digital tools, artificial intelligence, and real-time data analytics. Thirdly, because of its small sample size, which was chosen using a cross-sectional basis, this study may have biased outcomes and decreased factual generalizability. To test the current theory, it will be advantageous to carry out more longitudinal studies with large samples from numerous other organizations in Pakistan.

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