# Lean Management in Crisis Response: Applications, Benefits, and Challenges

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## ABSTRACT

These days, problems like natural disasters and global pandemics are getting trickier to solve. So, methods for handling crises need to be flexible, effective, and able to be expanded. Lean Management was first used in manufacturing, but it has since spread to many other areas because it focuses on improving processes, cutting down on waste, and making things more valuable for everyone involved. This essay looks at how lean management ideas can be used in various emergency situations, such as medical emergencies, public health crises, and disaster reactions. Better collaboration, lower operational costs, more efficient workflow, and higher stakeholder happiness are some of the main benefits. But putting lean ideas into practice in times of emergency is very hard. Organisations often face pushback from change, need a lot of training, and have trouble adapting lean tools to crisis situations that are hard to predict. This review uses new research and real-life examples to show how tools like value stream mapping, pull systems, and Kaizen can help make crisis response systems work better. It also talks about ways to navigate around problems with implementation, such as how important strong leadership, working together across agencies, and an attitude of always getting better are. Future study should look into how new technologies, like Artificial Intelligence (AI) and the Internet of Things (IoT), can be combined with lean methods to allow data analysis and decision-making in real time. People could handle crises even more quickly and easily by creating hybrid models that blend lean and agile methods. Finally, this essay stresses how important lean management is for making organisations more resilient and improving the speed with which they respond. It provides useful information for organisations looking to improve their crisis management skills.

**Keywords:** Lean management; Crisis response; Operational efficiency; Disaster relief logistics; Emergency management.

## INTRODUCTION

Natural disasters, pandemics, and industrial accidents are all examples of crises that bring their own unique and often overwhelming problems. These include not having enough resources, operations that aren't working as well as they could, and the need to make quick, well-informed decisions. Traditional management methods often fail under such stress because they are too rigid and can't adapt well to situations that change quickly and aren't always clear (Khalid, 2024). In today's world, these kinds of crises happen more often and are worse than ever, so it's more important than ever to set up management systems that are both strong and flexible so that responses are quick and effective (Son et al., 2025).

Lean management, which is based on the ideas of cutting down on waste, adding value, and always getting better, has become a popular way to deal with these problems (Sasso et al., 2025). The Toyota Production System initially developed lean management in the manufacturing sector. Since then, it has evolved into a versatile approach applicable across various industries (Wahab et al., 2024).

Lean management has become a popular way to address these problems because it is based on the ideas of creating value, cutting down on waste, and always getting better (Sasso et al., 2025). Toyota was the first

company to use lean management in its production system. Wahab et al. (2024) assert that it has evolved into a versatile method applicable across various industries.

These issues can be highlighted by applying lean management, which holds the concept of continuous improvement, creating value and reducing waste (Sasso et al., 2025). The Toyota Production System has become the example for many industries which apply lean management for a variety of applications for their respective problems (Wahab et al., 2024). Lean management has become the solution for many problems due to its flexibility and time efficiency (Emami et al., 2024).

The best example of lean management in critical responses is during the COVID-19 pandemic. The way crisis response teams manage the healthcare resources, the logistics of vaccines and expanding hospital capacity proves to us that lean management is useful, not limited to the production floor (Bergami et al., 2024). Not only that, but earth disaster victims are also manageable in a timely and equitable manner by applying lean practices (Ülkü et al., 2024). These are some of the examples of how lean management resolves issues and problems during critical emergency response. The main objective of this study is to discuss and investigate in detail how lean management can improve and help the authorities and crisis response teams during crisis response. This study will investigate further the main concepts, real-world applications, benefits and issues of lean management in managing critical situations.

**Overview of Lean Management**

The Toyota Production System was the first lean management system, and it was used in manufacturing. Since then, it has become a flexible method that is now used in many areas, including healthcare, logistics, and crisis management. Lean is all about getting rid of things that don't help processes and making sure that resources are used for things that directly help reach the goals (Ferreira et al., 2024).

In this scenario, the business needs to think about what its consumers or clients need, not what it wants. When a crisis happens, bringing medical care promptly and effectively to places that have been impacted by a disaster could be the most important thing to do. Popoola et al. (2024) suggest that firms can get the most out of their resources and processes when they know how much something is worth. Another key feature of lean is kaizen, which means "always getting better.". This idea backs up a manner of doing things that always looks at and improves procedures. This makes the business more flexible and inventive.

To make the system responsive and adaptable, small improvements should be implemented continuously every day, as this is part of Lean practices (Katz-Navon et al. 2024). Two main tools of LEAN are value- stream mapping and pull systems, which help the process flow of any system. The concept of value-stream mapping is looking at the whole system as one big map. From there, any obstacles which block the flow of the process can be easily identified, and teams will try to solve the problems by reducing the waste. However, pull systems tackle the problem from different perspectives by matching the production and service delivery with actual demand. It will help to prevent waste of production and underutilised resources. These two tools are best applied when limited resources are available and, at the same time, fast decisions should be made (de Freitas et al., 2024).

These two tools cannot be executed without the help of workers. Top management should motivate their subordinates to work in a team and cultivate trust and accountability sharing. Subordinates will willingly provide any important inputs to solve any problems, and at the same time, they will feel good about themselves. In crisis situations, this principle also includes protecting the health and safety of frontline workers and encouraging good cooperation between different groups (Hashimy et al., 2023).

Lean management is important for making organisations more resilient and sustainable in the long term, not just for improving operations. By embedding the values of efficiency, flexibility, and stakeholder- centred thinking into daily operations, lean equips organisations to respond effectively to current challenges while preparing for future uncertainties. More than just a short-term solution, lean nurtures a culture of learning and continuous development—ensuring that organisations remain relevant and adaptable in an ever-evolving landscape (Bolton et al., 2023).

## Lean Management Principles

The common problems that are normally faced by any organisation can be solved using lean management, especially by reducing waste, smoothing workflows, and optimising each available task. One of the first places these ideas were utilised in manufacturing was the Toyota Production System. Since then, they have been employed in many other areas, including healthcare, logistics, and responding to catastrophes. Lean principles help businesses work better and stay flexible when their needs change, as long as they are used correctly.

Lean principles help businesses work better and stay flexible when their needs change, as long as they are used correctly. For example, in disaster relief, value could mean helping communities in need quickly and fairly. When organisations align their processes with the outcomes that stakeholders have set, they can use their resources more effectively and achieve important goals (Qiao et al., 2024).

In crisis management, value stream mapping is particularly useful in optimising supply chains or improving communication flows. By looking at the process of distributing vaccines as a big picture, any delays and problems can be easily identified and resolved (A. Singh et al., 2024). It also applied in maintaining the smooth flow of essential supplies such as food and water to the affected area by minimising the wastage and delays. (Wright et al., 2024). Pull systems focus on responding to actual demand rather than relying on forecasts. This helps prevent overproduction, stockpiling, or the misallocation of resources—problems that frequently arise during emergencies. For example, a pull system for medical supply distribution ensures that items are sent only when needed, reducing waste and improving impact (S. P. Singh et al., 2024).

Kaizen helps teams stay flexible, which is important when they must act swiftly in an emergency. Kaizen teams can quickly alter direction and continue doing well when new difficulties come up (Butler et al., 2024). Respect for people emphasises empowering employees, encouraging collaboration, and valuing contributions from all levels of the organisation. Involving staff in decision-making fosters innovation and strengthens ownership. (Ravi et al., 2023).

The main priority of LEAN management is to improve quality and at the same time reduce error. This can be achieved by standardising the process and applying effective quality control. In healthcare emergencies, for instance, hospitals that adopt lean quality measures often report fewer errors and better patient care, even under pressure (Mostafa & El-Atawi, 2024).

Lean thinking helps organisations stay strong over time by dealing with any arising problems, and it also pushes them to develop processes that are efficient, adaptable, and focused on the interests of all stakeholders. Integrating these principles into daily operations will help the organisation to become sustainable and capable of evolving and acquiring knowledge over time (Hundal et al., 2021).

## Application of Lean Management in Crisis Response

In crisis response, lean management helps organisations to manage crises, such as limited resources, fast-changing situations, and prompt responses, for example, Emergency Medical Services (EMS). During the COVID-19 pandemic, lean tools were used to organise ambulances and optimise the arrival of emergency services. EMS crews referred to real-time data to send help to the region which needed the most help. Cvetković et al. (2024) showed that this strategy saved lives by managing available resources.

Lean management helps people in need during a crisis. For instance, using value stream mapping to map the logistics network during a natural disaster by showing many places where help was not getting through. Lean techniques helped streamline these processes, improved coordination among agencies, and significantly reduced response times—demonstrating the flexibility of lean tools in complex logistical scenarios (Raj et al., 2024).

Public health systems have also reaped the benefits of lean practices. During the pandemic, numbers of patients can be helped, vaccines were given out as quickly as possible, and the quality of the service can be maintained. Pull tactics made sure that PPE and other vital things are given to the exact person, including immunisations. At the same time, Kaizen made the plan for a team manageable, which kept healthcare services focused on the most critical areas (Talero-Sarmiento et al., 2024).

Lean management makes it much easier to fix crucial systems when things go wrong. Using Kaizen, setting priorities, and other lean methods, response teams have been able to send out repair workers more quickly, reduce downtime, and speed up the restoration process. This made sure that important services could be restored quickly (Farnsworth et al., 2024).

Schools and universities applied lean principles to overcome problems with digital access so that content and materials can be sent easily and both teachers and students utilise online platforms seamlessly. The schools were able to adapt to the new norm easily by making small changes over time, which made it possible for the students and teachers (Jayamohan & Bhasi, 2024).

Also, lean management is very important for getting people from different groups to work together when things go wrong. In an emergency, many groups may need to cooperate, such as non-profits, commercial businesses, or government agencies. Kumar et al. (2024) say that organisations may work together more efficiently to attain their goals if they all utilise the same lean methods. This means they don't have to do the same task twice. This means that what they do has a bigger impact.

**Benefits of Lean Management in Crisis Response**

Lean management helps crisis response operations work better by finding and resolving problems and making better use of resources. Lean helps people make decisions faster and with more information by simplifying processes and getting rid of unnecessary tasks. Additionally, it ensures optimal utilisation of resources. For instance, during the COVID-19 pandemic, hospitals used lean strategies to keep track of important medical supplies and make the most of their beds. This made patients wait less time and improved the quality of care overall (Mostafa & El-Atawi, 2024).

Also, lean management makes it easier for people from different groups to work together and talk to each other. It makes it easier for all the groups involved in crisis response to work together by focusing on standard processes and clear lines of communication. There are a lot of tools that may help you uncover faults in a process and make sure that everyone is on the same page so that there is no confusion and everyone does the same thing (Citybabu & Yamini, 2024).

Lean is also good because it cuts costs. Lean helps firms work better by getting rid of chores that don't help them. This gives you more money to spend on the changes that matter most. This is extremely crucial when there aren't many resources available, as after a tragedy when people are still trying to get back on their feet. Lean approaches, according to Javaid et al. (2024), assist in cutting down on waste in supply chains and make sure that aid gets to the right people.

Another way that lean management keeps stakeholders happy is by giving them what they want when it matters. In this manner, support will always arrive at the correct time and in the appropriate places. Responders on the front lines feel strong because it gives them power and helps them make decisions. This dual focus on meeting needs and involving people leads to better results and more satisfaction (Xiaoxin et al., 2024).

Lean approaches also promote being adaptable and flexible, which are vital for handling emergencies because they can arise at any time. The Japanese word "kaizen" means "continuous improvement". It allows companies to adjust their plans, transfer personnel around, and change their supply lines as needed. (Tortorella et al., 2024).

For instance, in healthcare emergencies, providers that used lean-based quality systems made fewer mistakes when caring for patients and giving out medications. This made service delivery safer and more consistent (Calçado et al., 2024).

**Challenges in Implementing Lean Management in Crisis Response**

Applying LEAN management in crisis response is particularly challenging, especially when it comes to altering established norms. Before organisations reach their full potential, they need to deal with a few important

problems. One of the primary problems is that people are resistant to change in their culture. Many businesses work in traditional hierarchies, which might make Lean's collaborative and iterative approach seem like a problem.

It's possible that workers don't know much about lean principles or question whether they work in high- stress situations. This happens because most of the team members don't appreciate and know the value of LEAN practice. To solve this, the LEAN culture should be cultivated and implemented in the organisation so that employees are motivated to make improvements in their tasks (Johansson et al., 2024).

Besides, LEAN is best used for those who are trained as experts in using LEAN tools. But crises usually happen without much warning, which doesn't give people much time to get trained, especially in the field of crisis response and public health, where LEAN practices are not normal for them. Organisations should invest in ongoing training and preparedness initiatives to equip teams before crises strike (Khalaf, 2024).

LEAN practices are difficult to apply in the area where the environment is unpredictable since they were developed for stable, repeatable manufacturing processes. In such settings, data may be incomplete, workflows unpredictable, and outcomes uncertain. Therefore, organisations must adapt and innovate— modifying traditional lean practices to suit the urgency and complexity of real-world emergencies (Lawrence & Mupa, 2024).

Lean management is very challenging to apply during a disaster because there aren't enough resources, like money, people, and objects, especially when the existing resources have been used up for procuring new technologies, training, or procedures. Kazancoglu et al. (2024) suggest that it is up to the judgement of managers to establish a balance between satisfying the requirements of the present and making sure that lean principles are maintained for long-term efficiency.

During a crisis, different groups, including government agencies, non-governmental organisations, and business sector partners, need to work together. These groups don't always agree on how to do things or talk to each other, which might make it challenging to develop one lean solution. For cross-sector collaboration to work, it's essential to set up common standards, ways to talk to each other, and goals (Ghobakhloo et al., 2024).

It's easy to see how well things are going in production right away. But when things go wrong, the benefits of lean may take longer to show up and be difficult to discern. For example, it could take weeks or even months to find out how successful a relief operation that is based on lean works is. (Kareem et al., 2025).

It can be challenging to adopt lean when people don't cooperate and work together between teams and agencies. LEAN requires teams to work together. However, many organisations have separate departments that don't work together very often. These silos can delay communication and resource coordination during a crisis. To verify that lean practices work, these barriers must be broken down by setting shared goals, communicating in real time, and making the whole system visible (Allam et al., 2024).

**Future Directions for Lean Management in Crisis Response**

It's a good thing that the Internet of Things (IoT) and Artificial Intelligence (AI) can function together, especially to improve Lean Management in crisis response. For example, IoT sensors are very useful to monitor the stock of help reliefs and send them to the impacted regions. Result forecasting, work procedure improvement and resource sharing can be optimised using AI-powered systems. Gajić et al. (2024) suggest that these technologies can help emergency response teams to apply lean approaches faster, more accurately, and in a way that works best for them when things go wrong.

Another significant strategy is to combine lean concepts with other frameworks, such as agile and resilience-based ones. Lean is about getting rid of waste and making things work better. On the other side, agility means being able to change and act rapidly. Using these strategies together can help you build a better plan that works for both accuracy and flexibility in your operations. When things change quickly, like during a public health

emergency or when you need to get commodities to people who need them after a disaster (Yadav & Yadav, 2024), this is the ideal approach.

In the future, it will also be vital to learn how to manage a crisis in a lean way. Everyone should have the lean tools and know-how they need to improve things. This entails preparing teams to be ready for genuine emergencies by using scenarios, simulations, and continual professional development (Subramanian & Suresh, 2024).

The future of lean management also depends on enhanced collaboration across sectors and borders. Since crises frequently span multiple regions and involve diverse actors—from governments to NGOs and private sector entities—collaborative efforts are essential. Developing international standards for lean practices in crisis settings, along with platforms for sharing lessons learnt and best practices, can strengthen coordination and improve global preparedness (Son et al., 2025).

Sustainability is becoming an important part of how lean crisis response works. Plans should be effective and eco-friendly. For example, using ideas from the circular economy in supply chain management, like reusing and recycling materials, can help reduce waste during large humanitarian operations. Companies that make sustainability a part of their lean frameworks will not only do a better job, but they will also have a bigger impact on the environment (Chen et al., 2024).

Lastly, ongoing research and new ideas will be crucial for improving lean practices and moving them forward in times of crisis. Future research should examine the application of lean principles in emerging crises, encompassing cyber threats, climate-related disasters, and impending pandemics. Longitudinal evaluations of lean's impact on crisis response outcomes will offer important lessons for the improvement of tools and methodologies. Academia, industries, and governmental institutions should work together to promote innovation and ensure that lean methodologies are relevant and applicable to future challenges (Bechtsis et al., 2022).

## CONCLUSIONS

Lean management is absolutely a breakthrough in crisis response, especially in handling modern crises. There are many advantages of using LEAN in crisis response; for example, it helps in making work more efficient, reducing waste and improving the crisis management response towards the communities. Due to its more flexible nature, it can be adapted to any crisis environment.

Lean management is excellent because it makes processes more efficient and uses limited resources well. There are a lot of real-world examples that show how lean practices help crisis response, health administration, and earth disaster logistics by improving coordination, reducing delays, and prioritising responses. Besides, LEAN helps optimise the usage of resources based on the priority of important tasks, which improves the effectiveness of operations and satisfaction.

Unfortunately, the application of LEAN cannot go on smoothly without any challenges, especially in an unknown and unpredictable environment. LEAN is best used on the production floor or in predictable situations; however, challenges may arise, including objections from communities, untrained personnel, and difficulties in applying LEAN in these environments. Communication and coordination problems between agencies are common when there is a lack of strong leadership to steer the teams to stick to LEAN methodologies. Moreover, the team must receive adequate training to ensure the efficient application of the practices.

With the help of IoT and AI, there are many possibilities that LEAN management can be improved to be very flexible for use in crisis response. There might be new techniques which can be incorporated with LEAN to make the effort seamless to achieve corporate goals and bigger social and environmental aims.

Lean management is a useful tool for making crisis response systems stronger because it is flexible, can grow, and always tries to get better. To maximise its benefits, companies must embrace innovation, remove obstacles, and invest in their people and processes. This way, lean management can go from being a quick fix to a long-term solution that helps communities be more prepared for whatever the future holds.

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