Humanitarian Logistics in Indiana Disaster Relief Operations

An Honors Thesis (HONR 499)

by

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Abstract

Natural disasters have disrupted all human societies for thousands of years. These catastrophes manifest in many forms, such as tornadoes, floods, and earthquakes in Indiana. The analysis of Humanitarian Logistics in Indiana Disaster Relief Operations will identify procedures that Indiana disaster relief agencies have used and the outcomes of these procedures. I will utilize resources such as the Indiana Department of Homeland Security (IDHS), Federal Emergency Management Agency (FEMA), and the Office of Community and Rural Affairs (OCRA). Interviews with local and state officials will provide clarity to understand how agencies dedicate their resources to overcome daunting challenges like natural disasters. In addition, I will research effective practices in the field of logistics. The purpose of this research paper is to analyze and present results that deal with the pre-planning, initial assessment, coordinated response, and recovery procedures to disasters in Indiana.
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Overview

In spite of the technological advancements in recent decades to forecast severe weather patterns, natural disasters pose a major threat to humans. The effects of these events can range from minor difficulties in daily life activities to the complete devastation of communities and surrounding environments. This fact is a constant reminder to communities, particularly officials and organizations who act as public servants, to prepare before such events occur.

The focus of the Honors Thesis research paper concerns the humanitarian logistics behind disaster relief operations in Indiana. An estimate from the Journal of Contingencies and Crisis Management cites logistical activities account for a conservative 40 percent of the total cost of an emergency response (McClintock 296). To be effective in managing disaster relief, humanitarian logistics must use resources efficiently when responding. This state faces challenges that are common within its geographic region; types of natural disasters include tornados, floods, and winter storms (Grant 1). Perhaps the most destructive threats to Indiana are tornados, which have caused human fatalities and massive destruction of public and private properties. It can be difficult to predict when and where tornados will occur and the extent of their devastation. A majority of the research paper focuses on the aspects of humanitarian logistics in Indiana responding to the event of a tornado. Humanitarian-oriented organizations in Indiana must regularly plan to mitigate the damage of natural disasters that occur each year.

Indiana's need for humanitarian logistics in disaster relief operations is a constant task. To respond to natural disasters, state and local organizations follow a framework of procedures. The diagram below shows an overview of disaster relief phases.

Figure 1

Source: Based on “National Disaster Recovery Framework” page 8

The first important step is the preparation prior to the disaster. After a natural disaster occurs, the initial response within the first hours is vital (Goodnight Personal Interview). Organizations must make an immediate analysis of the situation and scope of humanitarian logistics efforts. Agencies must simultaneously work together to execute urgent emergency management procedures (Graham Personal Interview). Short-term recovery actions then mitigate obstacles and provide resources to affected areas. The final stage of humanitarian operations entails long-term recovery actions. Although many often overlook this stage, the long-term recovery spans an extended amount of time to rebuild affected communities and prepare for future events.
Preparation
No amount of initial preparation can fully anticipate the scope of future natural disasters. However, extensive planning and instituting recovery procedures help alleviate additional problems that may accompany natural disasters. It is important to establish an emergency management organizational structure on a state and local level which tailors to specific needs.

Organizational Structure
The use of an organizational structure supports necessary, coordinated efforts and identifies which agencies are responsible for certain tasks. Although many groups have distinct goals and purposes, they should all collaborate to pool resources, time, and capabilities to better the community. Yet, all organizations should be aware of the other groups' involvement and responsibilities prior to the disaster relief operation to best utilize their combined efforts.

Additionally, a structured network of communication is vital to humanitarian operations. A centralized center to where information is directed allows one organization to manage information that will be dispersed to public relations, media outlets, and other involved agencies (Graham “November 2013 Tornado Activity” 1). The local contact network should share information with one another to maintain accurate and timely communication. Local officials can then appeal to county and state agencies when the situation demands further support (Van Wassenhove and Martinez 309). If state agencies lack the resources or ability to manage the disaster relief, they can appeal to the federal government for additional support. These steps create a hierarchy of communication to appeal for greater aid without unnecessarily expending national resources.

Local and state agencies in Indiana should have an established set of emergency management policies in place for which actions to carry out in a natural disaster. These procedures link together local organizations that coordinate humanitarian operations. Resource sharing, combined efforts of different organizations, and the exchange of best practices all improve the efficiency of humanitarian logistics (Van Wassenhove and Martinez 313). Communication flows to warehouse and storage facilities which indicates what resources are needed.

Logistics Management
Agencies in Indiana should also include available hard assets and infrastructure as important resources in preparation. The administration and policy aspects of emergency preparation can only function effectively if organizations have access to necessary resources. Some of these assets range from buildings to power sources needed for efficient operations.

Sufficient warehouse and storage facilities are essential to manage the influx and flow of relief goods in emergencies. To be successful, humanitarian logistics need to balance efficiency and equity to meet dynamic supply and demand (Van Wassenhove and Martinez 308). Each warehouse facility should implement procedures that minimize wasted space to improve visibility while maximizing the available space with demanded goods. The Toyota Production System identifies common wastes of an organization, such as unnecessary inventory, unnecessary motion, waiting, and over usage of transportation (Mangan, et al. 64). These activities all hinder an organization from functioning efficiently as well as increasing inventory
holding costs and transportation expenses. Warehouses that focus on eliminating waste can add value to the humanitarian supply chain and increase performance.

Ideally one centralized warehouse would handle the supply and demand of relief goods; however, practitioners and actual experience in humanitarian logistics promote the arrangement of decentralized sites. Even though prepositioning goods is ideal, it may not be feasible for budgets (Van Wassenhove and Martinez 311). The scope of a natural disaster is often hard to predict, so specialists in the field of humanitarian logistics should focus on creating a system that is flexible to change. Humanitarian logistics challenges are complex and include high decentralization, uncertainty in supply and demand, and several organizations with various goals (Van Wassenhove and Martinez 308). These obstacles can coalesce, if unchecked, to bottleneck humanitarian logistics efforts. The transmission of knowledge between organizations with demand for these goods and warehouses is vital to ensure smooth operations.

Warehouses should implement the use of database management procedures to update what resources are available or need to be ordered. Computer database software efficiently manages inventory levels of each good within a warehouse. Humanitarian logistics may attempt to forecast demand of goods using quantitative risk analysis, such as a Monte Carlo simulation or deterministic risk analysis; however, it must be able to adapt to dynamic situations (Van Wassenhove and Martinez 311). These computer applications calculate the best-case, worst-case, and most-likely outcomes of future events. The data from the results can then apply to how effective warehousing will be in the event that a natural disaster occurs. Computer-aided mathematical modeling greatly benefits warehousing operations, but it is important to note that the results may vary from the actual outcome during a natural disaster (McClintock 298). As such, warehousing should focus on how to manage inventory already in storage.

The flow of goods in relief efforts, particularly the speed and lot size of loads, can determine the success of humanitarian logistics. Instituting a reorder point inventory control system is effective in managing inventory levels (Mangan et al. 196). When inventory of a specific good drops below the reorder point, the facility will issue an order to replenish its levels. It is important to note that safety stock, or a minimal amount of a good to hold “on-hand,” should be considered when choosing an inventory control system. If it is dangerous to carry little to no safety stock, especially in the case of valuable or not easily-accessible items, the reorder point inventory control system is best. These procedures buffer against the uncertainty of supply and demand in managing warehouses.

Asset Management

In addition to managing storage facilities, humanitarian logistics requires the use of hard assets. Examples may include vehicles, construction equipment, power sources, and other resources. Without the addition of these assets, effective planning and storage facilities cannot stem the effects of natural disasters.

Vehicles drastically improve the efficiency of disaster relief operations. Trucks of public agencies can deliver goods to points of distribution and haul other loads when necessary. Points of distribution act as centralized points where shipments of relief supplies are delivered and the public can receive goods from the site ("FEMA: IS-26 Guide to Points of Distribution" 4). This allows the right goods to flow to the right places at the right time to serve the right target market (e.g. affected natural disaster individuals). The point of distribution should be easily accessible
for residents to provide the most value in relief efforts. Construction equipment, like tractors and backhoes, clear debris to improve mobility of roads and access to points of distribution and homes in emergency situations (Goodnight Personal Interview). Emergency management vehicles of hospitals can travel quickly to treat individuals experiencing serious injuries. Firetrucks and police cars are also necessary to combat fires and maintain order in an affected area. Other vehicles can transport larger assets, such as generators for homes, to bring power to residential areas.

Planning should consider the implications of power outages during and after a natural disaster occurs. In such a case, public utilities companies should have established procedures for cutting off power to damaged areas or sending out work crews to fix power lines and other power sources (Goodnight Personal Interview). This reduces the threat of accidental injury to the well-being of individuals living in disaster-affected areas. Power generators are also important to provide energy for these individuals. Power outages pose concerns about refrigerated and frozen food, electrical machines for medical uses, streetlights, and other common tasks. A coordinated effort of multiple agencies sharing information and providing resources for the cause is the best strategy when planning asset management. Cities and respective local organizations in Indiana respond more effectively and quickly when adequate plans and preparation are in place prior to a natural disaster. However, the most daunting task for humanitarian logistics is implementing these procedures in the first few hours following a natural disaster.

Initial Response

As natural disasters unfold, the primary focus of humanitarian logistics should be to secure the safety of the community. Updated information should alert individuals in surrounding areas of the possible threat of a natural disaster. Depending on the type of disaster, information concerning the threat may appear suddenly or accumulate over time, such as a tornado or minor earthquake compared to a flood. In Indiana, a County Disaster Emergency Declaration for Travel Restriction grants local agencies the authority to institute a travel warning, which may restrict travel to only emergency personnel (Model 1). The purpose for this declaration is twofold: it reduces individuals’ exposure to the dangers of the disaster by directing them to seek shelter as well as reduces the amount of traffic on roads. In the case of humanitarian logistics, operations are most effective when circumstances that hinder the capacity of an organization’s processes, or “bottlenecks,” are removed. To gauge the needs of the community, first responders should create an initial assessment for the scope of the disaster’s damage.

Damage Assessment

As information floods in to social communication networks, humanitarian logistics must prioritize tasks and identify areas that require immediate attention. City or county emergency management organizations may send out representatives or receive information about critically-affected areas in the community. Areas with life-threatening injuries and hazardous conditions, such as fallen power lines, fires, and collapsed houses, become the primary focus for relief efforts. Emergency management workers also work with law enforcement officers to gain better understanding of the situation.

Police and county officers patrol roads and relay information about initial conditions back to city dispatchers. Knowledge of the conditions of roads promotes visibility among the
organizations involved. Police should communicate which routes are or are not suitable for emergency personnel to use until public streets crews can remove obstacles.

Another obstacle is the disruption for public utilities companies. Power outages magnify the effects of a natural disaster, not to mention the damage to infrastructure used to transfer energy throughout the area (Goodnight Personal Interview). Public utilities companies must stay in constant communication with disaster relief organizations to manage the flow of energy and support local operations.

These local organizations need to constantly communicate with one another to increase real-time information sharing. Although a centralized communication center can disperse public relations updates to residents and media sources, this center will not be capable of handling all communication between organizations. Leaders should employ whatever modes of communication are most reliable and efficient in the event that power is unavailable, such as using cellular phones, handheld radios, or written communication.

Local groups coordinate tasks and goals for relief efforts. If the situation requires further assistance, officials activate emergency management systems outlined in the previous section. The hierarchy of communication, local to state to federal, allows resources to be managed best by those involved unless the situation calls for outside aid. First responders can then maneuver more effectively to protect the community.

Coordinated Response

The usual first responders for many natural disasters are public workers, such as police, firefighters, and emergency medical personnel. After tornadoes struck Kokomo, Indiana, in November 2013, public officials and chiefs of the police and fire departments met together to coordinate their response (Goodnight Personal Interview). This grounds all of the organizations involved to have a common understanding. Operations should involve an “agile” approach, one in which activities are flexible enough to handle uncertainty in demand of goods and logistical constraints. Once first responders mobilize and activate the emergency response, local agencies coordinate simultaneous procedures to aid the affected community.

Execute Simultaneous Response

Police continue to enforce rules as well as direct vehicle and pedestrian traffic near affected areas. A natural response for many pedestrians involved is to crowd affected areas and survey the damage or attempt to help those in need. Police presence alleviates the potential congestion around affected areas to allow other first responders ease of access. Their goal is to maintain order and peace following a disaster. Police officers also assist firefighters and emergency medical personnel in providing relief to injured individuals.

Emergency Medical Technicians (EMTs) are essential in initial response efforts. Ambulances offer mobility for EMTs to respond to emergency calls and provide urgent care. If the extent of physical injuries requires further attention, EMTs can transport the affected individual to the nearest hospital using available routes. Local hospitals bear an enormous responsibility during serious natural disasters to care for injured individuals. Hospital staff may work overtime to accommodate the demand for medical personnel.
Accurate, Real-Time Communication

Community organizations, such as United Way, The Salvation Army, American Red Cross, and other groups, manage incoming relief donations and volunteers. These organizations have different aims, but all serve the same goal: to use their competencies for assisting in the relief efforts following natural disasters. Phone calls, e-mails, and physical goods and people swell in the early hours during and following a natural disaster. Depending on the number of members present, the amount of incoming communication may overload the staff and create a bottleneck in the communication network.

Communication groups should track the number of calls and individual visits, the nature of the inquiry, and either provide accurate information or document and follow-up later with the correct information (Graham Personal Interview). An influx of donations may create a bottleneck if left unchecked. In some cases, community groups have to temporarily refuse physical good donations and volunteers because of a donation surplus. When these groups are in need of volunteers, the group administrators must delegate throughout the organization what goals to accomplish as well as the necessary resources to acquire.

Humanitarian supply chains often encounter high personnel rotation, limited skills of volunteers, limited reliable information, and poor local infrastructure, which complicate the efficiency of recovery organizations in reaching goals (Van Wassenhove and Martinez 308). These challenges threaten the effectiveness of relief efforts in providing adequate care. Community groups should maintain real-time communication with other organizations and individuals about their needs and provide accurate information about what resources or services they currently provide. Meanwhile, while first responders are clearing hazards and injured people from the affected areas, they are simultaneously designating and preparing points of distribution to deliver relief goods.

Designate Points of Distribution

When creating a point of distribution, humanitarian logistics personnel must consider a number of different factors to effectively meet needs. The site should be capable of handling the substantial amount of relief goods soon to arrive. Open, vacant areas near affected neighborhoods or parking lots are commonly converted into short-term points of distribution (Goodnight Personal Interview). Infrastructure and vehicles need to support the transport of goods stored in warehouses to these sites for points of distribution to work effectively. In the event that large groups of people arrive, the point of distribution needs to have designated leadership intact and supervising the operations. Sites need to train emergency workers and managers the appropriate procedures to act in accordance with local laws (“FEMA: IS-26 Guide to Points of Distribution” 8). These workers help control the flow of goods to those who need aid. Some positions include managers, traffic controllers, community relations staff, fork lift operators, pallet jack operators, loading teams, site security officers (11-13). A varying degree of complexity can factor into the selection of individuals for particular positions at points of distribution. Yet, each role serves a unique function to help the site’s operations flow smoothly.

Humanitarian organizations such as The Salvation Army, American Red Cross, soup kitchens, homeless shelters, and other groups, often act as points of distribution that provide additional functions. These groups are already established and do not require disassembly after the recovery ends. Communications in the form of public relations can inform nearby residents
and external organizations of the resources available and other vital information. As these groups relay information from organization to organization, the next phase of short-term recovery occurs.

Short-Term Recovery
Although the early, coordinated response of humanitarian logistics shares similar features with short-term recovery, operations in the latter phase possess more information. This knowledge guides the organizations involved by sharing their resources and personnel to support relief efforts. Simultaneous actions are still occurring, but the focus is now on repairing and restoring the community.

Mitigate Transportation Obstacles
One question that is often unasked by the public involves how the debris will be stored and disposed. Most public waste companies will not be capable of removing debris in the same manner as they remove weekly trash. When the city of Kokomo experienced tornados in 2013, vacant parking lots and open areas became temporary sites for debris collection (Goodnight Personal Interview). This allowed the recovery process to prioritize what was important and postponed clean-up until the situation was clear. Howard County estimated the cost of debris removal to be around $412,500 (Burgess 2). As street crews remove debris from buildings and roads using vehicles from local or nearby emergency management organizations, the flow of goods becomes more effective in delivering aid.

Manage Distribution Activities
Reducing transportation obstacles directly influences the effectiveness of points of distribution. A point of distribution has three main areas: a supply line, a loading line, and a vehicle line (“FEMA: IS-26 Guide to Points of Distribution” 17). Each area designates how the flow of goods should travel to prevent bottlenecks. The supply line determines where trucks may unload shipments; the goods are stacked in the loading line for organized distribution; residents drive their vehicles through the vehicle line to stop and receive relief goods (17). This promotes an efficient process that eliminates confusion from infiltrating how the points are organized. At points of distribution, incoming shipments in large quantities can break down into smaller lots to be distributed further (McClintock 301). A visual explaining the process is shown below.
Relief goods should follow a routine ordering system to prevent waste and bottlenecks. A First-In/First-Out (FIFO) approach is the ideal method to resupply points of distribution ("FEMA: IS-26 Guide to Points of Distribution" 31). Since most goods are scarce or difficult to access, using this method is most efficient for humanitarian logistics. Reordering supplies through nearby warehouses minimizes the distance and time spent transporting goods to points of distribution. These sites must maintain contact with warehousing and storage sites for accurate counts of demanded goods. Likewise, warehouses and storage facilities should follow a similar procedure to obtain goods from external sources. When points of distribution contact warehouses for goods, warehouses need to inform them about current shortages and advise contacting other storage facilities for requests.

Humanitarian groups contribute to the short-term recovery actions outside of temporary points of distribution. Even though natural disasters can severely affect communities within Indiana, there are times when these disasters cross state borders. In November 2013, a series of tornadoes passed through Illinois to Indiana and created a destructive path in both states. Over 500 American Red Cross volunteers delivered more than 1,600 relief items and served more than 32,000 meals and snacks in Illinois and Indiana ("Red Cross" 1). Efforts may become more complicated as “interstate” coordination mobilizes a broader pool of humanitarian agencies. However, these scenarios operate best when local humanitarian logistics manages the situation until the situation calls for higher intervention of state and federal resources. While the coordination and distribution of goods is ongoing, local groups collaborate to reconnect power within the community.

Reestablish Power Networks

Street crews and public utility companies reinstall or repair damaged power lines when the area is safe and secure to do so. At 4:30 p.m. on November 17, 2013, about 45,000 Duke Energy customers remained without power throughout Indiana (Burgess 2). Many homes and facilities
may be without electricity, so it is critical to connect these affected areas with power. Utility companies and local agencies should communicate about which areas are suitable for reconnecting power to reduce harm to residents (Goodnight Personal Interview). Renewed power provides residents with access to better communication and a way to preserve perishable food. Once the local organization connects electricity to isolated homes and buildings, the flow of information and communication increases significantly.

**Maintain Communication Procedures**

Communication groups distribute accurate, up-to-date information to volunteers to manage relief efforts. They also inform volunteers of the necessary details of participation, such as what tools to bring, which area to arrive, when to arrive, the extent of time needed from volunteers, and other facts. These organizations can send out requests from the community or surrounding areas for donations in the form of food and water supplies, generators, blankets, clothing, or money. The Kokomo Disaster Relief Fund collected approximately $119,688.32 in donations for relief during the 2013 tornadoes (Burgess 2). Donors can contribute to humanitarian logistics and ensure that relief organizations have essential equipment and goods to care for affected residents.

Depending on the available resources of humanitarian groups, some volunteers proactively seek out residents to provide aid. In the case of the Kokomo tornadoes in November 2013, The Salvation Army Emergency Disaster Services (EDS) canteen traveled through the city delivering drinks and food to residents as well as notifying them about temporary shelter areas (Hyde 2). The Salvation Army of Central Indiana provided support that year for a substantial number of natural disasters within the state. Its contributions served 1,214 people through disaster services (“2013 Annual Report” 7). As the situation becomes more stable, organizations begin to disassemble points of distribution and focus on improving the community through long-term recovery.

**Long-Term Recovery**

After the first weeks and months following a natural disaster, coordinated relief efforts turn to different goals. Humanitarian logistics focuses on long-term recovery rather than immediate, emergency-related situations. People begin to perform their normal routines again. Businesses and other organizations learn to adjust and attempt to operate as they did before the disaster. However, the recovery process lingers long after the last volunteer returns home. Two major concerns in the long-term recovery are financial relief for individuals affected by the disaster as well as projects to rebuild damaged infrastructure.

**Financial Relief**

An extensive amount of time is dedicated to assist residents who need disaster relief funds. People may need local, state, or federal financial aid to repair their homes or cover some loss from the disaster. In other instances, many businesses, schools, hospitals, religious establishments, and other groups may seek financial support. Each case varies from another and requires individual attention. Generally the financial assistance aspect does not involve the area of humanitarian logistics, but it is a critical step in the recovery process. However, the long-term goals to repair and renovate infrastructure demand logistics planning.
Rebuild Infrastructure

Affected towns and cities face the challenge of restructuring buildings, homes, and other infrastructure in the aftermath of a natural disaster. Building projects could range from small-scale, such as replanting a few trees in city parks or repainting buildings, to large-scale operations, including the construction of completely new buildings and homes. On March 2, 2012, tornadoes devastated homes and wildlife in southern Indiana. Over a year and a half, citizens in Indiana raised support for the communities of Marysville, Borden, Pekin, and Henryville, Indiana, by donating time and money to rebuild homes. A faith-based partnership, Volunteers Rebuilding Our Community (V-ROC), assisted homeowners who were either underinsured or did not have any home insurance (Hyde 2). Some of the accomplishments from The Salvation Army are shown below.

Figure 3

- 14 Homes Built
- 267 Properties Repaired
- $500,000 dollars raised during WAVE 3 Tel-a-thon
- 10,000-plus volunteers

Source: Hyde page 2

A common focus is not only to repair the current damage, but also to design the new structure better than how it was before the disaster (Goodnight Personal Interview). The effects of the event may never fully disappear, but humanitarian logistics seeks to repair present damage as communities move forward.

Conclusion

Therefore, the processes of preparation, initial response and immediate analysis of situation, coordinated response, short-term and long-term recovery actions present a great challenge to humanitarian logistics. The amount of academic research on this topic, especially in Indiana, is limited. Yet, the best evidence to examine involves best-practices from those working in the field. Each natural disaster is unique and possesses complex problems. Although it would be ideal to create formulas and mathematical equations to solve these issues, it is highly unrealistic to what actually occurs.

Future research in humanitarian logistics will identify new theories and best-practices that surpass the recommendations outlined in this Honors Thesis research paper. However, the information presented contains accounts and solutions from local agencies involved in
humanitarian logistics in Indiana. As students and academics seek to apply this knowledge outside the university setting, communities throughout Indiana will benefit from research on logistics behind disaster relief operations.
Works Cited


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