NCIT
The National Center for Intermodal Transportation

.
.

THE ROLE OF INTERMODAL TRANSPORTATION IN HUMANITARIAN SUPPLY CHAINS

FINAL REPORT

JULY 2009

.
.
.
.

PRINCIPAL INVESTIGATORS:

Lesley Strawderman

Burak Eksioglu

.

TABLE OF CONTENTS

Objective 4 Investigate whether organization type or processes impact decision

1.0 Abstract

After a nature or human made disaster, effective and efficient disaster relief support is needed. People affected by disasters should be moved away from affected areas and staff and disaster relief supplies need to be moved to destinations in time. The movement of personnel and supplies is completed by disaster relief supply chains, which directly affect the performance of humanitarian aid. Utilizing appropriate transportation modes in the relief chain is critical to effective supply

how intermodal transportation might impact the disaster response and recovery operations through the use of focus groups, surveys, and interviews with disaster relief agencies.

3.0 Literature Review

After a nature or human made disaster, effective and efficient disaster relief support is needed. People affected by disasters should be

Besides efforts to measure the performance of humanitarian supply chains, several studies have made recommendations to improve the structure of humanitarian supply chains. Özdamar (2004) provided an optimized schedule for pickup and delivery of relief vehicles and optimized quantities for emergency supply chains. Balcik (2008a) develop a maximal coverage model of a relief network and the amount and locations of distribution center, considering different coverage requirement, inventory capacity limits, and budgetary constraints. Balcik (2008b) proposed a model of delivery schedules for vehicles and equitably allocates resources minimizing transportation costs and maximizing benefits to aid recipients.

These studies (Davidson, 2006; Beamon, 2008; Balcik, 2008a) have identified a number of similarities between commercial supply chains and disaster relief chains, such as speed as an essential factor and supply flow via both long haul and short haul shipments (Beamon, 2004). Due to the similarities between the two types of chains, the factors that affect commercial supply chains might also impact humanitarian supply chains. The specific characteristics of humanitarian supply chains have also been highlighted. According to Balcik (2008a), first, the strategic goal of relief chain is to

through disaster relief chains and disclose the factors that most disaster relief agencies consider when choosing transportation modes.

.

.

.

Table 1. Summary of evaluation criteria

evaluation

.

frequently mentioned and other modes are rarely used when transporting

supplies (people), amount of supplies (people) and availability of roads. However, it is unclear which one is more important and which is less, therefore, H8, H12, H13 were set to identify the most important factors in transporting supplies, people and evacuating people. To better differentiate the importance of different factors, a question of overall factors ranks was designed. H9 is to prove whether importance of factors can change if the decision makers use various transportation modes.

H8: Cost is the factor that is considered most

information from

Table 2. Data Analysis Categories

were designed as multiple answers since some of the answers are not exclusive from each other, for example, an agency can be both religious and non profit and conduct both international and national operations.

6.1.2 Procedures

The second phase of the study is to develop an online survey according to the interview results from the first phase. For example, five potential factors that many affect decisions about transportation modes were obtained in interviews, and based on these factors questions about their weights in decision making have been made in the online survey. In total there are 42 questions in the survey and some of them are the same because of the logics of questions, as shown in Appendix 2. The survey includes 6 parts: introduction, background information, the use of transportation modes in transporting

| | | 1 | 4.38 (4.38, 0.96, 24) | 1.61(1.61, 1.19, 13) | 1.77 (1.77, 1.36, 13) | 2.11(2.11, 1.13, 18) |
| | | 2 | 4.4 | | | |

The transportation modes and their frequency scores are listed in Table 3 including Van/Bus/Car (self owned), Van/Bus/Car (organization owned), Van/Bus/Car (rental or commercial), Vehicle (all),Rail, Ship, Air. Among these transportation modes, organization owned vehicles have the highest score of 3.75, and ship is the least used one with a lowest score of 1.33. The second highest score is self owned vehicles and that means self owned vehicle is the second mostly used transportation mode for evacuation.

6.2.2　Objective 2: Quantify the amount of intermodalism used in disaster relief.

H4: Intermodal transportation is not common in

Two questions were related to this hypothesis. One is the area a disaster relief agency is covering: international, national, regional or local. The categories were coded as follows: International organization (4), national (3), regional (2), and local (1). Each organization can get more than one score in the rating. The score of an organization is the maximum one among the multiple scores it has got. For example, if an organization is conducting both international and national relief operations, its score is 4. Average area score 3.11 (3.11, 0.99, 129). Another question is about the times of transportation modes changes, from 0 to 3. ANOVA was conducted to test the hypothesis. Independent variable is organization covering area score and dependent variable is the number of changes F= 6.13, p=0.001. Therefore, the area that an organization covers has a significant impact on the number of change of transportation modes. The original hypothesis is correct. Regression is also done to see the relationship between the two variables. The regression equation is number of stops = 0.27 + 0.29*size. For the coefficient of size, p<0.001, and R square is 10.0%. This is a significant model while not a good fit model. Yet we can still conclude that the number of stops is positively correlated to the area an organization is covering.

H13: Organizations that preposition supplies are more likely to utilize intermodal transportation.

A question was about whether a relief organization preposition supplies before a disaster. This question was associated with number of transportation mode changes to see whether staging supplies will affect the use of intermodal transportation. The independent variable is whether or not an organization prepositions supplies and the dependent variable is number of changes. ANOVA was conducted, demonstrating that prepositioning of supplies does have an impact on transportation modes changes, with F=3.12, p=0.080. The regression equation is mode changes = 0.250 + 0.423 preposition with p=0.080 for the coefficient and R square is 2.4%. Therefore, we cannot conclude this is a good fit model or a strongly <0003Tj/TT41Tf.2240TD.0008Tc(about)Tj/TT31h1Tf8TJ/TT31Tf4.31150TD<0003Tj/T420Tf.2240TDh@foithe

The reason that organizations prefer to use trucks to transport supplies most frequently could be due to the fact that transportation by trucks is of low cost in medium distances. Additionally, trucks are more well known to most people. Availability of trucks can also lead to the high frequency of use since commercial transportation companies use mostly trucks. The reason that this phenomenon needs to be examined is that some of the transportation modes used currently might not be the most cost efficient mode or the most effective mode. There exists a strong need to educate the organizations' transportation decision makers to expand modes used to ensure efficient transport network.

Objective 2

Most organizations only stop once during each trip, and with mostly only one mode change. Among the change of transportation modes, changes between truck types are most common, much more frequently than other combinations. This also means that it is necessary to study how the organizations choose type of trucks to examine whether their decision process is reasonable.

There is a relationship showing that more stops are correlated with more mode changes. The reason can be that for supplies trucks are most used, so usually only trucks are involved in most changes. Not many changes were made overall because not many stops occurred or transportation modes were used (see objective 1). It is important to learn that not many changes because of the same reason in objective 1 that current use of modes may not be the most efficient ones. Also, if we aim to model transportation networks to inform the design and development of improved networks, it is critical to have an accurate depiction of current mode use.

Objective 3

Distance is considered most often in mode selection in the transportation of supplies, however, all factors (travel distance, cost, type of supplies, and availability of roads) were considered of equal importance (by rating and by ranking). The possible reason that distance is the mostly considered factor is that distance has a great impact on price, time, and other factors. Organizations firstly need to consider distance to determine the related price, delivery time, and other outcomes. Distance makes some modes more/less feasible in certain conditions. For example, it makes more sense to use trucks instead of air if the distance is fairly short.

It is important to know the factors that the organizations consider mostly since it is the key to understand decision making process and why modes are chosen. Therefore, if we want to encourage intermodalism among the organizations, we should address all of the factors in their choice of transportation modes, with an emphasis on distance.

Objective 4

Usually the organizations with larger coverage area will make more stops in the transportation process. Also, prepositioning impacts the number of mode changes, though the relationship between

transportation modes. Objective 4 is

10. Jones, W. B. (2000). *Developing*

APPENDIX 1

Interview Questions

Cargo Transportation

1. What types of supplies do you deliver

APPENDIX 2

Survey Questions

1. Would you like to proceed with the survey?
2. In what areas does your organization provide relief? Please select all that apply.
3. What kind of organization would you classify your organization to be? Please select all that apply.
4. When delivering supplies, how often does your organization use each of the following modes?
5. For each transportation mode, which of the following factors impact your decision to use (or not to use) that mode? Please select all that apply.
6. In transferring supplies from one mode to another, which modes are typically included?
7. Where do the changes of transportation modes occur?
8. Why do your supplies change transportation modes?
9. When delivering supplies, how often does your organization use each of the following modes?
10. For each transportation mode, which of the following factors impact your decision to use (or not to use) that mode? Please select all that apply.
11. Please describe which transportation modes are used between each stop.
12. Why do these changes of transportation modes occur?
13. When delivering supplies, how often does your organization use each of the following modes?
14. For each transportation mode, which of the following factors impact your decision to use (or not to use) that mode? Please select all that apply.
15. Consider the delivery of supplies in which you used trucks. How often does your organization use each of the following types of trucks?
16. When transporting supplies, how often is the truck loaded to full capacity before delivery?
17. During an entire trip, do the supplies ever get transferred from one type of truck to another (e.g. semi truck to box truck)?
18. Since you transfer supplies between different types   types 17b0   A
                                                                                      the

31. Feel free to make any other comments about your transportation process here.
32. Once the data collection is completed, researchers will compile a summary of the responses. Would you like to receive a copy of this summary report via email?
33. After the survey is closed, we will