A Social Media Platform to Solve the Empty Return Trip Problem

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ABSTRACT
The waste of capacity on return trips in supply chains can be reduced if more business are connected to each other and know when the other companies have trucks riding routes (half) empty, and can reserve that space for their own products. This way both companies achieve cost savings. A possible solution would be to use a (custom-built) Social Network to make communication go smoother and faster. In this research a literature study on the empty return trip problem and its context has been executed, after which (functional) requirements for a suitable social media platform have been drafted based on the problem and its context.

Keywords
Supply Chain, Social Media, Social Networks, Requirements Engineering, Web platform, Capacity waste, Truck load planning, backhaul.

1. INTRODUCTION
A common problem in supply chains is the waste of capacity on return trips of trucks where they return empty after delivering their cargo [15], ideally their space on return trips is used for products from partners or competitors that need to be shipped in the other direction. There are systems designed to assist in this problem, freight exchange systems like VICS’ Empty Miles[5], logCoop’s transport module [18], backload4u [2], Timocom Truck & Cargo [28] and Teleroute [27]. A 2011 survey in the dutch logistics sector showed that 29% of respondents made use of such systems [8]. These Freight Exchanges deliver their content as a database of searchable and filterable entries[17], they do not advertise the best matches through intelligent algorithms, because of which logistics planners have to invest a lot of time into finding suitable matches. Another problem is that these platforms only offer an open market, while for example 80% of shipping orders in Fourth Party logistics service providers are only to be offered to a select group of trusted partners [23]. Freight Exchange fraud is a liability in these systems as there is a lack of contact between parties, and trustworthiness cannot be assessed [10]. These systems also tend to be closed and expensive platforms, not very ideal. While the success of return trip capacity sales depends on reaching a large audience of interested parties, and smaller SMEs need less expensive methods of data sharing [26]. This is where a social platform can play a role. If the threshold for an interested party can be held low, more businesses are able to subscribe to loading the original company’s trucks with their products, and thus help both sides save on transport costs.

2. PROBLEM STATEMENT
Logistics companies are not working together enough, to prevent trucks from returning empty. A study in Bangkok shows that 85.75% of trucks are empty on a return trip [21]. The company that could have transported a load on a return trip of another company now requires another truck to transport their load. This costs both companies more money than needed, and is inefficient. Another study ranks empty backhaul and low capacity utilization as some of the most named inefficiencies in logistics [14].

The companies in the logistics sector need to communicate more and better, and need a solution to help them herein. Pamatang et al. stress the importance of communication in logistics and supply chains and see social media as an effective medium for this [20]. Software requirements for a social media solution to the empty return trip problem need to be designed. This platform needs to be accessible and the threshold for participation must be kept low.

3. RESEARCH QUESTIONS
The main research question will be:
What are the functional requirements for a social media solution to the empty return trip problem?
To answer this question the following sub questions need to be asked:

1. What is the definition of the problem and what are the challenges surrounding the problem?

   Here we will define what exactly the problem is, what variations to the problems one can encounter, and possible pitfalls.

2. How can the context of the problem be described in the terms of Kietzman’s social network functionality building blocks?

   With this question the actors, the messages and the interactions a solution would need to contain are described based on the framework proposed by Kietzman et al. [16], providing a basis to work from for the following question.

3. What (functional) requirements are needed?

   The problem’s definition and context are translated into software requirements for a possible social media solution.
4. RESEARCH APPROACH

The first two sub questions are going to be answered through a literature study, on what the problem is and what its context is (the latter based on Kietzman’s building blocks [16]).

With these building blocks the context of the transportation problem can be described. The power behind social networks is in intelligently connecting the different users. For example not just displaying an alphabetical list of the companies who can be connected to you, but actively suggesting which companies are interesting for the user, based on prior co-operations and interactions. To be able to do things like this in a specific context like transport-planning in the logistics sector, you must systematically analyze the way its communicative environment is set up, to translate it towards design plans for a social platform.

A solution to the problem will be described as a set of (functional) requirements. These requirements are based purely on the problem itself and its (social) context, as suggested by Jarke et al.[13], and not on the specifics of a future implementation.

5. DEFINITION OF THE PROBLEM AND ITS CHALLENGES

Freight shippers have trucks coming back empty after delivering their goods, even though there are freightsthat could be transported on these return legs. Logistics planners don’t know whether other companies have these opportunities for their return trips, even though there is a will to collaborate between shippers [11]. There is a flaw in the coordination between these logistics planners [7], which could be solved by providing the communication means to reduce the threshold to propagate the information about planned shipments between these planners and increase the number of planners that are in contact with each other.

The problem that needs to be solved is when a logistics planner from company X has a truck shipment scheduled from point A to point B, doesn’t have any backhaul, and because of this has available cargo space on the return trip back from point B to point A, he needs to get in contact with a logistics planner from company Y that has a shipment that needs to go from point B to point A.

5.1 Transshipments

If the return leg of a freight run is from point B back to point A, and there is a point C in the vicinity of point B, where there is a load that needs to be transported from point C to point A, it could be more efficient to arrange intermediate transport from point C to point B, and have this shipment loaded for the aforementioned return trip between point B and point A, instead of arranging a separate freight run between point C and point A. Chou et al. have found [6] that having the flexibility of transshipment could lead to a 10-20% cost-saving.

**Figure 1: Transshipments with a return trip between B and A, and freight at C that needs to go to A**

It can get more complex if there is a point D in the vicinity of point A and the second freight goes between point C and point D (instead of point C and point A). In this case Intermediate shipments are needed between Point C and B and between point A and D, next to the already planned return trip between point B and A.

**Figure 2: Transshipments with a return trip between B and A, and freight at C that needs to go to D**

This can even be made more complex if there are multiple legs that can be used in sequence in getting from point B to point A. If these legs connect perfectly, and no intermediate transfers are needed, this could be feasible for use in the platform, but if the legs do not connect and intermediate transfers are needed this solution can get very complex very fast, and with enough complexity will even start to cost more than a new direct shipment between point B and point A, even when incurring empty return trip costs, and therefore falls outside the scope of this paper.

**Figure 3: Transshipments with sequential empty return trips.**

In case it isn’t possible to schedule intermediate transfers to perfectly connect to the used return trip storage of the goods is needed, and costs will be incurred. This needs to be taken into
consideration when calculating whether using return trips are feasible.

5.2 FTL & LTL

The basic dimension of long-distance truck shipments are so called ‘Full Truck Loads’ (FTL), where you use all the cargo space of a truck. If your shipment is small enough not to occupy the full space of the truck, which is called ‘Less than Truck Load’ (LTL), it might fit next to other cargo, and two companies can use the same truck to deliver their freight. When including LTL shipments, for the empty truck runs, the platform can achieve even more efficiency and more freight options are possible[23], which increases the usefulness and the possible utilization of the platform. When incorporating LTL shipments the dimensions of the cargo start to play a role: Does a new freight option fit into an already half loaded cargo space? Also weight distribution of cargo inside a container might cause problems[3].

5.3 Hypothetical Shipments

So far only cases have been mentioned where one shipment was already scheduled, and other companies could opt in to use the return trips of these shipments, with the original shipment set in stone even if the return trip will be empty. There might be cases where a shipment is only economically feasible if the return trip is filled by another company. Here a company needs to communicate their shipment plans with the side note that it will only be executed when one or multiple return trip partners are found.

5.4 Slot Auctions

When multiple shippers are interested in the same empty return trip, the platform supposedly could facilitate auctions wherein the shippers try to outbid one another to secure the slot for their shipment[1]. The platform is to be used on the other hand as a means of connecting and communication between logistics planners. When the platform also starts to venture into ‘legally binding’ agreements, the platforms boundaries are stretched, and thus slot auctions should not be included in the scope of the platform.

6. THE CONTEXT OF THE PROBLEM

To find out what the environment is that the social media platform needs to contain for communication between the logistics planners, the framework of social media building blocks by Kietzman et al.[16] is used. They describe different blocks with which one can find differences between social media sites, but it can also be used to describe the context for a social platform solution in a structured manner. The 7 building blocks are:

- Identity
- Conversations
- Sharing
- Presence
- Relationships
- Reputation
- Groups

6.1 Identity

“The extent to which users reveal themselves. What information do they disclose?”[16]

The targeted userbase of the platform is logistics planners within a common geographical area (Self-employed truck drivers can also be regarded as logistics planners). They probably already know most of their competitors and there is no need to hide their profile or part of their profile when using the platform. For efficient interaction they will instead wish to provide sufficient contact information.

Some may wish not to have other companies know what deals they have made and with whom that was, so as not to disclose sensitive business information[29]. They also may wish not to have widely known what freight they have planned, while still have other companies subscribe to their return trips, and only make their identity known to the partner-to-be in a later stage of the process[1].

6.2 Conversations

“The extent to which users communicate with each other.”[16]

Here we can define three ways the logistics planners interact for the purpose of filling otherwise empty return trips:

I. Propagating their plans for available return trips and for available freight to other logistics planners.

This is a conversation of one-to-many, where a logistics planner wishes to present his available cargo space or available freight to as many potential partners as possible, to maximize the chance to find a match. Because of this an information overload may occur for the logistics planner that searches for a match, if a large number of users present their available opportunities, and this heap of information is not filtered.

II. Finding out if certain shipments are flexible enough for a detour or a change in time schedule.

A logistics planner might not find an exact match in an empty return trip to his shipment, but might find a trip that is a close match. He can then contact the company that provides the return trip asking if it is possible to have the truck take a detour or change its schedule to accommodate the shipment without intermediate transport or storage of the shipment. If it’s a FTL shipment or there are no other parties interested in the empty return trip this is a one-to-one conversation. If it is regarding a LTL shipment and there are other parties already in contact about the return trip the conversation is many-to-many.

III. Working out the (financial) details of an agreement for filling an empty return trip.

This is a (private) one-to-one conversation between the empty return trip provider, and the company that wishes to use the cargo space. This conversation might be handed off from the logistics planners to the financial departments of the companies.
6.3 Sharing
“The extent to which users exchange, distribute and receive content.”[16]

The logistics planners would share their plans in the form of a description of the empty return trip they provide or the description of the shipment they wish to have transported. These descriptions need to be brought to the attention of the planners that might be interested in these plans, and be shown in a clear and perhaps graphical manner.

6.4 Presence
“The extent to which users know if others are available.”[16]

Displaying the availability of the logistics planners themselves is not necessary, as the return trip plans and the freight plans are the main subjects in the platform, not the users behind them. Displaying the availability of the logistics planners themselves could be an option in direct (chat)-conversation inside the platform, when having to handle time-sensitive exchanges.

If a company has competitors that it wishes not to cooperate with, they might not want to have their plans for empty return trips or plans for cargo shipments known, and have the presence of the plans hidden from these competitors.

6.5 Relationships
“The extent to which users relate to each other.”[16]

The base relationship the logistics planners have to each other is loose, they present their plans and wait for a response from another planner. This relationship changes when they have found a transportation match and start to privately converse on the details of the arrangements, with the end result being a legally binding contract for the transport of the goods (outside the platform).

Within larger companies there might be multiple logistics planners that have the need to cooperate, and do not have the need to keep information hidden between them, they have a special relationship which the platform could facilitate by giving these planners access to each other’s shipment plans and the conversations they have with outside logistics planners.

6.6 Reputation
“The extent to which users know the social standing of others and content.”[16]

Having users of the platform rate the service of the others companies publicly, could increase the quality of the offered content[24], but it could also deter companies from using the platform decreasing the quantity of offered content[19]. As this platform is about connecting logistics planners with each other, having a public rating system falls outside the scope of this platform. What could give an indication of the reputation is recording and displaying the amount of ‘transactions’ a company has made through the platform, it gives a preliminary indication but is fuzzy enough not to deter companies fearing damaged reputations.

6.7 Groups
“The extent to which users are ordered or form communities.”[16]

Two types of groupings can be discerned amongst logistics planners: Companies, where multiple logistics planners work together in a company as described under ‘paragraph 6.5 relationships’. This does not necessarily have to be the same company, as short term intensive cooperation’s like Virtual Enterprises [22] might also need the close interaction between logistics planners normally seen between planners in the same company. Alliances, where multiple companies work together, these cooperation’s can range from intensive to loose[4], and might wish to only share their transport plans within the circle of members[23], or give them preference before having the wider public participate. Especially alliances that have an high level of information sharing work well from a cost-efficiency point of view[14].

7. THE NEEDED FUNCTIONAL REQUIREMENTS

In the following segment functional software requirements for the social media platform will be defined based on the results from the previous two research questions. These requirements will focus on the functionalities that are specific to this platform. Standard web development practices and requirements will not be included.

7.1 Users:
Logistics planners will have to be able to register as users, and fill out their profiles. As this platform is primarily focused on the communication between logistics planners, particular attention has to be given to the contact info like mail-addresses, phone-numbers and visiting-addresses. Communication can also be stimulated by personalizing the profile, as building social ties between different users can influence the perception of trustworthiness[12] and lead to increasing information-exchange with more relevance[7]. This can be done by using the planners own name and picture[24].

R1: The user has to be able to register and fill out their profile.
R2: The profile needs to contain as much contact info as possible, such as: mail-address, phone-number and visiting-address.
R3: Users should be stimulated to use their own name and upload a profile picture.

7.2 Groups:
To accommodate certain forms of cooperation within the platform, special arrangements should be made for grouping logistics planners into companies and grouping companies into alliances.

R4: Users should be able to create a company.
R5: A company should have a profile page, including a company-description, contact-information and a logo.
R6: A company should have one or more employees.
R7: Some or all employees can be admins of a company.
R8: In the settings for a company there should be a choice whether to share all information, plans and conversations between employees.
R9: Companies should be able to be grouped into alliances.
7.3 Empty Return Trips & Shipments:
Presenting descriptions of planned empty return trips and planned shipments to other users is the most important means by which the users are brought together. This information should be easy to find, quick to take in and intelligently filtered. To facilitate trips that can only proceed if the return trip can be filled with cargo, hypothetical shipments, the return trip offerings can contain information about its conditions.

Peetijd and Bangvivat say that the information needed to arrange effective return trip utilization is simple data like origin point, destination point, type of truck, cargo space constraints and the time windows[21].

R12: Users should be able to make offerings of empty return trips, containing information about the place of origin, the place of delivery, intermediate waypoints if necessary, truck type, cargo space constraints and the time window.

R13: Users should be able to make offerings of shipments that need to be transported on return trips, containing information about the place of origin and the place of delivery.

R14: if applicable the user should be able to attach terms and condition and pre-set prices to these offerings.

R15: The return trip offerings should have fields for the conditions under which a hypothetical shipment can proceed. These offerings might not have an assigned date or time for departure.

7.4 FTL & LTL:
FTL shipments are easy to implement, but LTL shipments can become complex because of multiple shipments in the same trip and the cargo sizes.

R16: Offerings for empty return trips should have the option to accept FTL only, LTL only or either.

R17: The platform needs to be able to calculate whether multiple LTL shipments fit in the available cargo space.

R18: Available cargo space on a trip needs to be recalculated if a trip gets LTL-cargo scheduled.

7.5 Journey Descriptions:
For the (software) description of these trips the description by Dürr and Giannopoulos [9] can be used where a journey is the travel between an origin and the final destination and consists of n trips (travelling between waypoints) and n+1 visits (The time used for the loading, transferring or offloading of the cargo). The properties of these trips and visits are loosely based on the description by Dürr and Giannopoulos as they designed it for a real-time system and this platform has different needs. Visits are also needed for waiting time when heavy vehicles are only allowed inside some cities during strict time windows[25].

Figure 4: Software description of trips

7.6 Matching Algorithms:
To match return trip offerings to shipment offerings the platforms needs to calculate the costs of the trips when the shipments are combined, and what the costs would be if the shipment is transported directly with an empty return trip. For some specific routes alternative costing is needed because of tolls and congestion charges[25].

R24: Users should be able to input the average costs of visits, the average initial costs of trips and the average costs per kilometer of trips.

R25: These averages should be used by the platform in calculating what return trip and shipment matches reduce (most) costs over a direct transport of the shipment with an empty return trip.

R26: When the user wishes to calculate the price of a proposed shipment journey more precisely, he should be able to adjust the costs of each individual trip and visit.

7.7 Transshipments:
When suggesting possible shipment journey options, return trips where the point of departure and point of delivery do not align with the points of the shipment can also be taken into consideration, when multiple return trips are sequentially used to transport the shipment, and/or when intermediate transport is used to transport the shipment from origin to the begin point of the return trip.

R27: The platform should be able to calculate the costs of multiple return trips in sequence.
R28: Users should be able to input separate average prices for intermediate transport.

R29: The platform should be able to calculate the costs of shipment journeys with intermediate transport.

7.8 Conversations:
Communication is an important pillar of the platform, and the platform needs a means of communicating between users which provides easy and quick (chat-) conversations, even though the important communications in a later stadium of the process should be through conventional means of communication, as contact on a personal level between the users stimulates the trustworthiness and reliability of the network[12].

R30: Users should be able to send each other chat-messages.

R31: These messages should be able to be publicly (to be read by everyone) attached to users, companies, alliances, return trip offerings, shipment offerings, trips and visits.

R32: The admins or owners of an entity should be able to disable the publicly attaching of messages.

R33: These messages should be able to be privately attached to the same entities (only to be read by the users inside that entity or the owner of that entity).

R34: The admins or owners of an entity should be able to remove attached messages.

R35: Conversations should be made possible where two or more users, companies and/or alliances can interact with each other.

8. CONCLUSIONS
This paper examined the problem of empty return trips for truck logistics planners and the challenges surrounding the problem. It described the social environment in which the proposed social platform would have to operate. Afterwards it combined the results of the problem definition and its context into a set of functional software requirements. These functional software requirements can be used as a set of global guidelines by which the proposed social platform is to be designed. These requirements deal specifically with the functionality such a platform should have, standard web development requirements are not included.

9. FUTURE WORK
Further study can be done on the applicability of these guidelines by having the requirements validity examined through a survey among logistics planners. Also a prototype can be made based on these requirements and be used in feedback sessions with experts to assess its validity.

Another possible area that could be researched is in designing optimal algorithms for finding and presenting possible matches between empty return trips and shipments. One could also look at how the proposed platform could be extended beyond the scope of empty return trips and assist in brokering the whole chain of freight shipments, and possibly include intermodal transportation. Also work could be done researching possible business models for the proposed platform.

10. REFERENCES


