

Transportation Visibility Platform in a Complex Supply Chain

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Abstract— Real-time visibility can be considered as an enabler of synchronized supply chain. There is a gap between expectations on benefits from supply chain visibility and successfully implemented case studies however. The significant barriers to visibility are created rather by not technological factors. The main purpose of a study is to identify patterns of behaviour emerging as a result of deployment of transportation real time visibility platform in a complex supply chain of multi-stage subcontracting. In the complex multi-stage subcontracting network with real-time transport visibility platform there are tensions between collaboration and competition as well as autonomy and control translating into paradox of forced ecosystem.

Keywords— *supply chain visibility, transportation visibility platform, supply chain, ecosystem, digitization.*

1. Introduction

Visibility is first of all an enabler of processes standardization and automation within supply chain which should translate into reduction of waste and shorten time of reaction to customers' needs [1]. Albeit supply chain visibility has been extensively discussed, it remains difficult to operationalize [14].

Despite the large number of articles, research on the benefits of visibility is still mainly theoretical [5], and it is still scarce in terms of identifying what the critical building blocks, or antecedents, of supply chain visibility concept are [12].

A deeper understanding of how supply chain visibility emerges, develops, and must be implemented to be successful, is expressed not only in academia [2], [17], but also in practice [10].

The article focuses on understanding patterns emerging amongst supply chain partners during deployment of transportation visibility platform within complex multi-stage subcontracting

network. Subcontracting in transportation networks is a complex problem because of relationships and interactions between individual suppliers and non-linear feedback loops [9].

2. Literature review

Existing literature associates supply chain visibility with superior supply chain performance and suggests that supply chain visibility is beneficial for supply chain performance. The purpose of achieving supply chain visibility is primarily for improving internal decision making and operating performance [5]. The capability of organization to organize and process the information is enhanced through supply chain visibility [11].

The strategic value of supply chain visibility is to increasing the ability to reconfigure and embraces visibility for sensing as it represents a firm's ability to sense and acquire real time information about external, changing environments and to adjust its actions accordingly. Visibility for learning which represents the extent to which a firm can learn new information and knowledge from supply chain partners. According to coordination theory, coordinating for visibility is able to provide critical information for managing different kinds of dependencies in supply chain relationships [16].

Gap between expectations on benefits from supply chain visibility and successful case studies trigger need for in depth understanding of root causes. Due to the practical relevance and importance of supply chain visibility, supply chains have invested in building visibility, yet, it is still far from being fully achieved [12], [4].

For supply chain visibility quality of information is crucial. Quality of information is reflected by characteristics such as timeliness, accuracy, and completeness [14]. The most demanding is achieving the continuous monitoring reflected with real or close to real time visibility. The latter can be achieved via web collaborative platforms, reporting tools, track and trace as well as integration of

supply chain management software with the enterprise resource systems by the focal firm within a supply chain [3]. For continuous tracking in real time mode the main technologies used embrace: satellite tags with GPS [13],[8]. Real-time location systems are fully automated systems that continuously monitor the location of objects and personnel in real time [13]; GSM [8]. GPS tracking uses elements of real-time and location to provide data points for the company which it received from the satellite navigation system in the airspace. The application of GPS tracking normally used to track vehicles to reduce idle times, improve routing operations and provide better customer service [1]. Integration platforms to enable real time tracking and synchronized logistics are discussed by [6] where positive impact on supply chain performance is underlined. Federated infrastructure is also pointed as the alternative to a single platform [7].

3. Methodology

The analysis is carried out from the focal company perspective, i.e. the supply chain leader that coordinates the material and information flows across the supply chain. The focal company acts as an intermediary between customers and transport service providers and is responsible for providing end to end transport operations and service between suppliers and factories as well as between factories and primary warehouses.

The first step of research on understanding context of a focal company network encompasses analysis of internal documentation including business requirements documents, boscards, trackers, one-pagers, presentations.

In the next phase, a narrative literature review was conducted in order to analyse the existing contributions on visibility transportation platform and identifying gaps which can be filled out with in-depth research in the context of a focal company.

In the first step of literature review “transportation visibility platform”, “real time transportation visibility platform” were used as search terms. The outcome of research suggests very little contribution on transportation visibility platforms. As a result, more general terms including „transportation visibility”, “supply chain visibility”, “real time visibility supply chain” were used for the search in the second step.

The outcomes of literature review pointed to non-technological factors as main reasons behind insufficient visibility of supply chain. Dynamics of relationships amongst actors involved in ensuring

supply chain visibility was selected as an area of in-depth analysis.

4. Findings

Tensions between autonomy and control are because of willingness to gain a position of a network integrator and emerge within the set of behaviours:

1. A focal company exerted pressure on the freight forwarders to ensure that they perform the actions necessary to enable shipments tracking.
2. A focal company pushed a transportation visibility platform to accelerate a process of transport service providers onboarding.
3. Transportation visibility platform and freight forwarder started to collaborate to meet expectations of focal company.
4. Transportation visibility platform demands from freight forwarder either to get in direct contact with subcontractors or receive data from freight forwarder on subcontractors.
5. Freight forwarder reflected on value shared with a transportation visibility platform and decided to build digital capability needful to gain more autonomy in a network.
6. Freight forwarder started to integrate subcontractors within own digital platform.
8. Freight forwarder established own transportation visibility platform and started to be competitor to transportation visibility platform with which they also collaborate by sharing data on the real-time position of loads of a focal company.

A focal company demanded control over loads in real time mode hence expected collaborative actions of both freight forwarder and transportation visibility platform. For transportation visibility platform it is critical to have access to carriers which is limited because of freight forwarder. Understanding value of data which should be sent to transportation visibility platform stimulated thought process on creating solution to control data sent to transportation visibility platform. As a result freight forwarder can sustain autonomy and even aspire for the position of large scale integrator by offering capability of transportation visibility platform to a focal company. Both **need for**

autonomy and aspiration to be a network integrator are reasons behind competition between freight forwarder and the transportation visibility platform.

Tensions of collaboration versus competition as well as autonomy versus control occurred only with freight forwarders of high network awareness. Freight forwarders of low network awareness agreed transportation visibility platform to connect directly to subcontractors.

The next identified pattern emerged because of a focal company **willingness to control not only a position of loads in real time mode but also reduce costs of freight:**

1. Focal company pushed transportation visibility platform to accelerate a process of transport service providers onboarding.
2. Transportation visibility platform established a partnership with freight exchange.
3. Focal company discusses opportunities on reduction of costs with a freight exchange.
4. Freight exchange developed own capability to track and trace loads in real time mode and became a competitor to transportation visibility platform.
5. Freight exchange made efforts to reach directly own fleet carriers by arguing that enabling real time visibility on focal company loads is a must.
6. Freight exchange attempted to get data on real time position of loads of a focal company from freight forwarders.
7. Freight forwarder established own transportation visibility platform in order to control subcontractors.

Because of a focal company drive for lower costs it started to discuss potential savings opportunities with a freight exchange which can be achieved by bypassing freight forwarders. The freight exchange used the capability to monitor shipments in real time mode as an argument to directly reach transport service providers with their own fleet and convince them to cooperate directly. As a response freight forwarder established own transportation visibility platform in order to block direct contact between subcontractors and freight exchange.

Emerging tensions are because of a focal company need for control over costs and a loads position in real time mode which is also area of interest of the freight exchange. The relations between transportation visibility platform and freight exchange evolved from collaboration, through collaboration and competition to pure competition. Freight forwarders of high network awareness created own capability for track and trace in real time mode to have control over subcontractors.

Tensions emerging between two transportation visibility platforms are the next identified pattern:

1. Focal company put pressure on the freight forwarders to ensure that they perform necessary actions to enable shipments for tracking.
2. Focal company pushed transportation visibility platform to accelerate a process of transport service providers onboarding.
3. Freight forwarder signed a contract with transportation visibility platform 2 to meet requirements of a focal company.
4. Freight forwarder sent an invitation to subcontractors and require from them to be on boarded on the transportation visibility platform 2.
5. Subcontractors sent data on real time position of loads of a focal company to transportation visibility platform 2.
6. Transportation visibility platform 2 sent data back to freight forwarder.
7. Freight forwarder sent data to transportation visibility platform 1.

Because of pressure from a focal company freight forwarders signed a contract with the transportation visibility platform 2. Transportation visibility platform 2 initially required extra sum to be paid per every shipment tracked and sent to transportation visibility platform 1. Due to the increasing pressure from a focal company transportation visibility platform 2 activated transmission of data on loads of a focal company for free.

Emerging tensions are because of a focal company need for reduction of internal costs therefore transportation visibility platform 1 has been chosen as the global solution. However transportation

visibility platform 2 as the biggest integrator both of carriers and gps service providers on the local market was preferred choice by freight forwarders. Hence competition is driving force of behaviors of both transportation visibility platforms whereas collaboration is unintended and forced by a freight forwarder because of pressure from a focal company.

Because of tensions between control and autonomy within a focal company competition between two transportation visibility platforms became even stronger. It was required from transportation visibility platform 2 to share data with a focal company via transportation visibility platform 1 but transportation visibility platform 2 refused because of concerns on sensitivity of data.

Tensions between collaboration and competition as well autonomy and control result in emerging paradox of forced ecosystem. With paradox of forced ecosystem is understood a pattern of behavior when:

- 1) supply chain partners work together on creation of service for a focal company but only one of them is directly rewarded,
- 2) the part of supply chain partners co-operates with directly rewarded company only because they are rewarded by delivering other services to a focal company,
- 3) collaboration is unintended and driven by pressure from a focal company,
- 4) sub-integration is because of willingness to have control over data.

5. Discussion

The study fills a few research gaps in the area of supply chain visibility. First of all, most of the scientific work on the supply chain visibility is an attempt to analyse dyadic relationships for example between retailers and producers so the limitation the extant literature identified is related to the players involved in the analysis [5]. This study is novel in expanding the previous narrow concept to encompass freight forwarders, subcontractors, gps service providers and the real-time transport visibility platform. Although real-time information is frequently used as a proxy for the highest quality of timeliness [2], [4] little was known about impact

of transportation visibility platform on behaviour of supply chain partners. The next research gap has been filled, as the discussion on relationships between focal company and the transportation visibility platform is hardly present in scientific research. What is more, the study underlines the tensions that arise between the partners involved in the implementation of the visibility platform. The effects of tensions are conceptualized as paradox of forced ecosystem.

For managing tensions it is needful to improve coordination mechanism of cascading information across ecosystem and execute agreed actions. The changing negotiation position of a central company to influence subcontractors affects its ability to impact what actions and how are executed.

In order to manage tensions definition of roles and communication protocols is recommended. A clear definition of roles is the basis for defining each stakeholder's information accessibility. A common protocol would be needed to regulate data sharing. Regarding accessibility level, data can be classified as follows: open data (for every partner of ecosystem), community data (for a restricted number of partners), and internal data (for a focal company).

The forced ecosystem paradox can be compared to activities within other digital ecosystems of a complex network with multi-layer intermediaries. The findings in the article could contribute to better understanding of complex digital platforms and ecosystems.

6. Conclusion

Study on deployment of the transportation visibility platform indicates to the existence of a paradox of forced ecosystem. With paradox of forced ecosystem is understood a pattern wherein companies work together on creating service for a focal company but only one of them is rewarded directly with delivering a service. The other supply chain partners co-operate with directly rewarded company but without pressure from a focal company ecosystem would not exist.

Further research is necessary to analyse behaviours dynamics of partners involved in post implementation to understand evolution of paradox of forced ecosystem.

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