UNDERSTANDING MATCHING SUPPLY AND DEMAND IN ONLINE SPOT MARKET FOR TRANSPORTATION SERVICES: REVISITING THE EXISTING LITERATURE

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ABSTRACT

The use of online platforms is developing with the growth of information and technology. Matching between the demand and the supply in the online spot market is one of the challenges, particularly in transportation services sourcing. The platform is required to make a decision, considering the specifications and requirements from providers and customers, to pair the supply and demand in a short time. This study explores the theory and application of the supply and demand matching for online spot market platforms. We elaborate more on the transportation services sourcing platforms. Some studies are collected and analyzed based on the categories including business model, mechanism, cycle setting, scheduling type, and expected outcomes. Some research directions are provided as results. This study provides the review of matching supply and demand studies in online transportation market. It also helps practitioners to classify and analyze the appropriate system to be applied for matching supply and demand in online transportation sourcing services.

Keywords: matching strategy, online platform, spot market, transportation service sourcing.

1. INTRODUCTION

With the advent growth of information and technology, the use of the online platforms is emerging, particularly for sourcing transportation services. Platforms such as uber, grab, gojek are the examples of online platforms which provides services for pairing riders and drivers. Online platforms, such as uship, uber freight, and kargo.tech provides services in pairing shippers and carriers for transporting bulky items. The problem in matching the supply and the demand arise as this business model develops (Wang et al., 2020).

Matching strategy is one of important aspects that need to be considered in pairing the demand and supply in the online platform. The online platforms, as the central element, has responsibility to bring together offers from providers and requests from consumers (Boysen et al., 2019). Within their system, the platform is required to develop a logic to match the request considering the specifications and requirements with the current available resources. The challenges in the transportation services are the uncertainties in the demand as well as the supply, the trade-offs of the user's benefit, imbalance pairs, and many more (Boysen et al., 2019; Wang et al., 2020).

The urgencies of spot sourcing are also become the challenge in shipper and carrier matching, as the trend of same-day delivery emerge (Zhou & Lin, 2018). Thus, study on matching strategies in pairing supply and demand for transportation sourcing are important.

This paper aims to explore the existing studies in matching supply and demand in online spot market, specifically for sourcing the transportation services. We specifically highlight the business process of online spot market, different types of matching theory, as well as the motives and expected outcome of matching studies in transportation services sourcing. This study helps practitioners and academicians to explore the suitable matching theory for their companies or their researches.

The rest of the paper is organized as follows. In Section 2, studies related to matching supply and demand in online spot market for sourcing transportation services is discussed. Section 3 provides the discussion on the results. Section 4 summarizes the study and provides research direction.

2. REVIEW ON MATCHING SUPPLY AND DEMAND IN SPOT MARKET FOR TRANSPORTATION SERVICES SOURCING

Matching supply and demand studies has been popular for decades. Researchers' interests in applying the theory in transportation services have been developed recently following the growth of the online platforms for transportation. Figure 1 comprises the criteria to categorizes the literature.

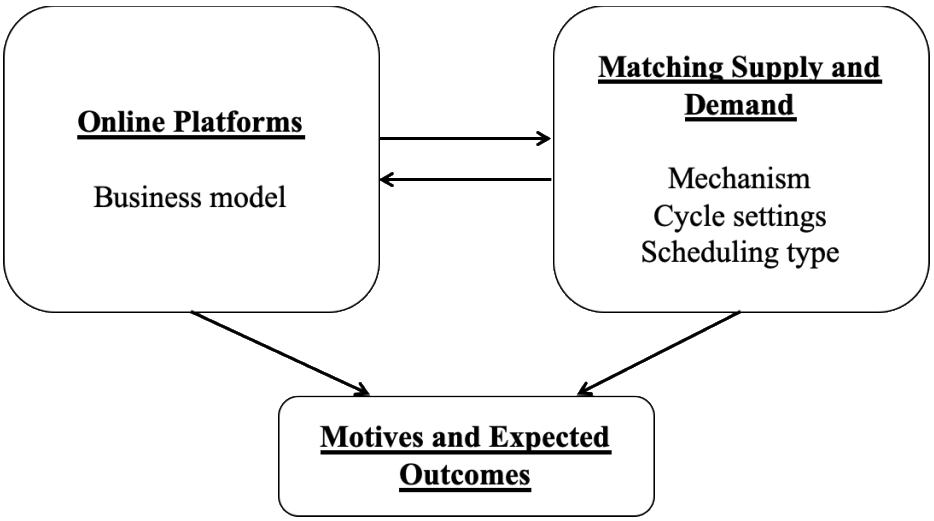

Figure 1. Categorization of the Literature

Here is the brief literature review that provides the online spot market in transportation services and the related studies on matching theory.

2.1 Business model of spot market online platforms

Armstrong & Associates (2016) mentioned the organizational settings for matching supply and demand in the spot market platforms. We mention two most popular settings based on their study, which are (a) Uber-like model, where the platform provides alerts for nearby customers task automation, as well as track and trace the progress. This model is applied in the Cargomatic and Transfix. (b) Loadboard model, where each of customers is provided by the list of suitable providers. The customer then chose one of the alternatives to match their own benefit. This model is found in

123Loadboard and DAT Trucker. The matching process is not required in this type of business, instead the platform needs to define as much as possible requirements to satisfy their customers.

2.2 Matching mechanism

Studies, such as Furuhata et al. (2013) and Wang et al. (2020) mentioned two types of matching from economic perspective, which are (a) One-side matching, where the requests from customers are assigned directly to their own resources. The customers received the decisions, which are carried out by the operators, and decide whether to accept it or reject it. This arrangement has been applied in the sourcing of airport shuttle services. (b)Two-sided matching, where the providers update their capacities then the platforms will match them to the customer's requests. This setting is applied in the matching agencies which does not provide the resources, such as in ridesharing and taxi-sharing.

2.3 Cycle settings for matching demand and supply

The pairing process, according to Furuhata et al. (2013), can be done in two ways, which are using (a) One-shot cycle, where the incoming customers will be match directly to the available providers. The matching strategy is important in this setting, since predicting the long-term performance is difficult. (b) A rolling planning horizon, where the matching process is done periodically. This setting aims to collect as much as possible data and optimizes the matching results.

2.4 Scheduling and matching type for providers

Two types of scheduling, as mentioned by Alnaggar et al. (2019) are (a) Pure self-scheduling, which the providers actively update their availability by the time they are ready to receive assignments. This type of scheduling and matching process is used in UberEats and BuddyTruk. (b) Hybrid and centralized scheduling, where the providers are following the schedules or shifts created by platforms. Then, the providers will be assigned to the customers in the first come first serve mechanism. This scheduling process is applied in the Amazon Flex and Deliv. (c) En-route matching refers to the pairing process that are created when the providers are on their way of a pre-planned trip. This type is used in some ride-sharing studies.

2.5 Motives and Expected Outcomes of Matching Supply and Demand in Online Spot Market

Different scholars have widely discussed the motives and expected outcomes of matching supply and demand in the spot market. The motives identified from literatures are aggregated as follow. (a) Monetary outcomes, which includes reduce cost, increase profit, and increase revenue. While the (b) Non-monetary outcomes are maximizing number of pairs, mileage saving, service level, and minimizing travel time, waiting time, distance.

3. RESULTS AND KEY FINDINGS

This section provides the analysis of studies in matching supply and demand in online platform. This literature study focuses on analyzing the matching strategies and thus we limit our study for uber-like business model. Table 1 provides the classification of studies according to the categories as mentioned in the previous sections.

Table 1. Categorization of studies

Category	Sub-category	Studies
Matching type	One-side	Agatz et al. (2011), Baldacci et al. (2004), Chen et al. (2019), Hou et al. (2018)
	Two-sided	Allahviranloo & Baghestani (2019), Gdowska et al. (2018), Guo et al. (2019), Wang et al. (2018), Wang et al. (2020)
Cycle setting	One-shot	Guo et al. (2019)
	Rolling horizon	Agatz et al. (2011), Baldacci et al. (2004), Chen & Chankov (2018), Gdowska et al. (2018), Wang et al. (2018)
Scheduling type	Pure-self	Allahviranloo & Baghestani (2019), Gdowska et al. (2018), Guo et al. (2019)
	En-route	Chen & Chankov (2018), Chen et al. (2019), Liu & Qu (2016)
Expected outcomes	Monetary	Baldacci et al. (2004), Furuhata et al. (2013), Kavussanos et al. (2004), Pan (2019), Wu et al. (2020)
	Non-monetary	Alnaggar et al. (2019), Baldacci et al. (2004), Pan (2019), Stiglic et al. (2016), Stiglic et al. (2018), Wu et al. (2020)

4. NEW OPPORTUNITIES AND CHALLENGES

From the results, this section identifies some promising research topics that needs further attention for research in matching strategy. First, study on two-side matching can be extended in various ways. The two-side matching allows the users of the platform, either the providers or customers, reject the matching result (Wang et al., 2020). The consequences of the rejections are solely a longer waiting time because of the repeating searching process. There is no study that focus on analyzing the effect of the rejections or its consequences on the system's performances. For example, applying penalties for rejecting the matched pairs or giving the reward for users with few rejections.

Second, many studies use rolling horizon setting which requires many platforms and many customers at the same time. The rolling horizon only applicable when the platforms or the city has a lot of users. Researchers can extend the literature by developing strategies to accommodate the matching system that can be utilized in the limited users which represents the market for long-haul shipping or specialized transportation. Study such as evaluating the matching strategy using one-shot setting and projecting the result in the long-term manner is much needed.

Third, we found no study accommodate the centralized and hybrid scheduling model. The centralized means that the platform has a higher bargaining power over the providers. The study in this area can be developed into further. For instance, developing different type of compensations when the platform is failed to match the customers with the scheduled providers.

5. CONCLUSION

Matching strategies in online platforms is challenging topics, especially when dealing with the limited searching and decision time. Based on a review of the literature, this paper investigates the theory and application of the supply and demand matching in online platforms, particularly for transportation services spot market. The purpose of this study is to help researchers in understanding the problem in the online platform's matching strategy. Based on the comparison of literatures and

practices, this study identifies some interesting topics that deserves further attention for matching supply and demand in online platform. Researchers can extend the study in the two-side matching, one-shot cycle setting, and centralized or hybrid scheduling.

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