IMPACT OF SATELLITE-BASED DISPATCH SYSTEMS FOR TAXI SERVICES IN THE URBAN AREAS: A LITERATURE REVIEW

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ABSTRACT

The current trend in urban transportation is the introduction of satellite-based dispatch systems for taxi services which consists of a real-time platform for mobile phone users to book taxi services with a simple tap. The service helps bridge the supply gap between taxi drivers and demand from users in the urban areas. The mobile application is popular simply because it reflects the essence of urban mobility; accessible, convenient and time-responsive. However, this trend is receiving backlash from taxi drivers all over the world even though customers favor this kind of services. Hence, this review is aiming in providing a clear understanding on the impact of technological advancement for taxi system. An extensive literature review on the impact of app-based taxi services for urban mobility will be done throughout this review by collecting and critically classifying on past researches in order to identify the gap between them. The review will facilitate an understanding of the extent of technological advancement in urban mobility as well as provide an extensive literature review for future research.

Keywords: Urban mobility, mobile application, public transportation, taxi system.

1. Introduction

Urban transportation consists of integrated public transportation system which supports the idea of sustainable movement of city dwellers to travel, not for the sake of movement but because they have a reason to be somewhere and this has been classified as derived demand (Mason & Deakin, 2001). Urban transportation system usually consists of a connection of a chain of city buses, trains, and taxi systems that offers a variety of transportations for users to choose without having to drive their own vehicle.

Inevitable growth in terms of size and population in the urban areas has led to the need of maintaining a constant flow of people and vehicles by reducing the use of individual means of transport modes and stimulate the use of public transportation modes (Veloso, Phithakkitnukoon, & Bento, 2011). At the same time, the growth of information technology has also been a benign effect towards the urban growth. Varieties of technological advancements in transportation industry such as the Global Positioning System (GPS) are having significant impacts on social and economic
activities, with major implications affecting transportation (Mason & Deakin, 2001).

Taxi services are able to pick-up the passengers right where they are standing and drop-off precisely at the desirable destination, without being bound to a pre-determined path (Veloso et al., 2011). This shows taxi services are flexible in terms of route operation and easy accessibility. Taxi fills a critical gap by providing transportation when driving or the unavailability of other public transit modes and thus, it both complements and substitutes public transit (Rayle et al., 2014). The growing concerns on the impact of technology have been discussed previously an article by Western and Ran (2009) which outlines Information technology (IT) and transportation applications as issues affecting transportation system. Recently, the introduction of satellite-based dispatch systems for taxi services, also known as electronic hailing system (e-hailing) or ride-sourcing has taken its toll by changing the conventional way of hailing a cab to a new system, which allows users to book a taxi by using smartphone application and internet connections.

2. Mechanism of Satellite-Based Dispatch System

The flow of satellite-based dispatch system on smartphone starts when a passenger requests a ride from private passenger vehicle driven by a (usually) non-commercially licensed driver through the mobile application, which then communicates the passenger’s location to drivers via Global Positioning Systems (GPS). These apps charge a distance-variable fare, approximately 80% of which goes to the driver, with the remaining to the ride-sourcing service (Rayle et al., 2014).

There are signs of significant changes in terms of ridership for conventional taxi services, especially in the urban areas. Compared to the previous times, people these days are very conscious about time as life in the cities requires them to be able to catch up with the fast-paced life. Hence, the satellite-based dispatch systems will offer unmet demand for fast, flexible and convenient mobility in the urban areas (Rayle et al., 2014).

Trip Purpose

An on-going discussion on the impact of satellite-based dispatch systems for taxi services by past researches keeps on mentioning whether the services react either as another medium of substitution for public transportation or just to complement the existing transport systems. Veloso et al., (2011) in their exploratory studies set drop-off locations and pick-up locations for taxi drivers as variables and found out that all these locations are equipped with some other public transportation modality such as train, plane, ferry and bus. They concluded that based on the result, taxi service is often used as a bridge between public transportation modalities.

An analysis has been done in understanding the role of a taxi trip which has been done (Rayle et al., 2014) by using two measures: proximity to transit stops and relative transit travel time. Measurements for estimation travel time by public transit and by driving are geocoded by Google Directions API. The result shows estimated total travel times were consistently greater for transit than ride-sourcing, although a few trips would have been faster by transit. The trips would not have been easily made by public transit, indicating a possibly complementary relationship with transit.

A research on understanding urban mobility for taxi done in Lisbon showed that almost 30% of trip purposes was for education facilities such as kindergarten, high school and university while the other 24% was for services such as bank errands. Another 20% was for recreation purposes: bar or restaurants trips (Veloso et al., 2011). The same research also suggested that taxi trips in Lisbon are mainly distributed in areas with a higher population density or commercial, the main cluster is
centered in the city center and downtown.

Mason and Deakin (2001) in their research stated that even though it was a common belief that telecommunication advancements could substitute physical travel in the early 1970s, their findings, however, showed that telecommunication activities and physical transportation movements complement each other rather than substitute in the aggregate.

**Productivity**

The introduction of satellite-based dispatch systems in this era not only is beneficial to the service providers but also affects the productivity of drivers with enhancement of waiting time, improvement of system accuracy and system efficiency. Information technology allows transportation systems to be “smart”, whereby complex and vast amount of data can be sensed and managed in a comprehensive or iterative manner (Mason & Deakin, 2001).

Satellite-based Dispatch Systems for taxi services enable company to substantially utilize savings in terms of time management and manpower as well as improvement in productivity. Theoretically, less time spent on route meant more time with customers, hence, the quality of customer service was enhanced (Liao, 2001). The enhancements that satellite-based dispatch systems bring enable higher handling capacity compared to the previously phone-based system as it allows more reservation to be processed with the same level of manpower within a particular period of time.

Computational capabilities these days have improved incrementally with provisions of technological diversity in taxi services; practically help service providers and drivers to fully utilize taxis without having to wonder around to find the next customers. Many taxi drivers experienced productivity increments as they are now able to take more reservations while reducing their daily operating costs by cutting down on empty cruising (Liao, 2001). This research has taken place in Singapore where taxi plays a role in bridging the gap between buses and rail transport in the republic.

In order to improve productivity and profit rate, it is advisable for a taxi driver to wait for passengers in locations related with the main public transportation terminals such as airport, train stations, ferry dock or main bus stops, and it is not necessary for them to travel great distances to the next pick-up locations (Veloso et al., 2011).

3. **Current Situation in Selected Cities**

**Legal Issues**

The rapid expansion of advancement of technological instruments in taxi systems began to outpace the current policy in countries it operates. Critics were quick to judge e-hailing services as unfairly flouting the existing regulations, competing with public transit, increasing congestion at peak times, misleading consumers through opaque pricing practices and endangering public safety (Rayle et al., 2014). Debacles on legal issues for e-hailing services are on-going as the expansion of the services keeps on growing.

Government and regulators are struggling to find solutions for e-hailing services as the current taxi providers and drivers feel threaten and complain that they have lost their market share and customers due to the fact that competition from e-hailing providers is hard to compete with. E-hailing offers services that conventional taxi drivers could not provide for ages; satisfying demands for fast, flexible and convenient mobility in the urban areas (Rayle et al., 2014).

The taxi industry, typically a regulated market with the control over pricing and market share, falls...
under the governments’ responsibilities and the blooming of e-hailing services in this market is deemed as an interruption towards the existing systems. The similarity between e-hailing and conventional taxis has caused a great deal of policy confusion and tension around “fairness” in regulatory treatment for both services (Rayle et al., 2014).

When e-hailing was first started off in New York in 2012, Uber was the first e-hailing company to start its’ own pilot program with a nod from New York Taxi and Limousine Commission (TLC). At that time, the existing taxi drivers were feeling the heat of competition when people are changing their preference to e-hailing, with the assistance of blooming smartphones sales and accessible internet connections. On the other hand, users find it very promising and worthy and that was the reason why people are opting for it as an alternative.

In an attempt to understand the trend in taxi systems, TLC somehow only approved a one-year program, with restrictions. E-hails will only be able to summon cabs from a half mile away in the heart of Manhattan and a mile and half elsewhere, to minimize the number of frustrated street hailers who have to watch empty cabs driven by them on the way to e-hail pickups. In addition, to prevent drivers from privileging e-hails over street hails, drivers cannot charge more for e-hails than the taxi meter fare (Bloomberg Business, 2012).

Rayle et al., (2014) have outlined on the existing and proposed public policies on e-hailing or ride-sourcing until 2014 for a few countries and states. After on-going debacles on the issues, local governments and regulatory bodies in California, Colorado, Chicago, Nashville, North Carolina, Pennsylvania and Seattle passed the proposed legislation and policies for these kinds of services to be operated with due respect to the existing taxi drivers. Hence, it is a win-win situation for both parties.
Table 1 Existing Policies on E-hailing in Selected Cities and Malaysia

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<th>Approved Legislation in Selected Cities</th>
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<td><strong>California</strong>: The California Public Utilities Commission (CPUC) requires Transportation Network Companies (TNCs) to conduct criminal background checks of all drivers, have a driver training program, maintain a “zero-tolerance” policy on drugs and alcohol, and maintain at least 41 million per incident insurance coverage, $5,000 medical payment coverage, $50,000 comprehensive and collision coverage, and $1 million uninsured/underinsured motorist coverage per incident.</td>
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<td><strong>Nashville</strong>: Municipal ordinance passed amending local codes pertaining to vehicles for hire</td>
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<td><strong>North Carolina</strong>: The General Assembly passed a law prohibiting the regulation of “digital dispatching” services by local governments.</td>
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<td><strong>Seattle</strong>: The city council passed an ordinance requiring commercial insurance coverage for ride-sourcing companies whenever a driver is “available” to drive.</td>
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<th>Pending Legislation</th>
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<td><strong>Illinois</strong>: HB 4075 (The Ridesharing Arrangements and Consumer Protection Act) requires that drivers working more than 18 hours a week obtain special licenses and vehicle registration; ridesharing cars be less than four years old; and that vehicle dispatchers insure drivers who do not have insurance. HB 5331 decreases the required insurance coverage to $350,000 to mirror the insurance requirement of Chicago taxis.</td>
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<td><strong>Minneapolis</strong>: The city council is considering regulations for ride-sourcing companies that would address a wide array of issues including insurance and inspections.</td>
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Pending Legislation in Malaysia

Since e-hailing was introduced in Malaysia in 2014, it became a trend in the taxi industry and many users are satisfied and happy with the services provided by UBER. However, Suruhanjaya Pengangkutan Awam Darat (SPAD) in its media statement informed that in order to operate in Malaysia, these providers must be in accordance with the law. These are three key factors why e-hailing providers are still not being recognized as legal in Malaysia:

1. The usage of private vehicles as well as vehicles registered for Hire & Drive and limousine services are prohibited for public transportation purposes according to the Land Public Transport Act 2010.
2. UBER drivers do not have a Public Services Vehicle (PSV) driving license will be classified as an offence under the Road Transport Act 1987.
3. Vehicles used are not covered with commercial vehicle insurance and do not go through semi-annual checks with Puspakom.

SPAD has tried to reach out to UBER and other e-hailing providers to set an agreement which will benefit both parties but until now such attempts are being ignored. Hence, the legalization of this kind of services is still pending.

Source: Rayle, Shaheen, Chan, Dai and Cervero (2014), Modified with facts by Suruhanjaya Pengangkutan Awam Darat (SPAD), 2014.

4. Discussion

Accessibility in urban transportation is the key to encourage more people to switch from driving private vehicle to use public transportation to move. Thus, with the ease of using smartphone application for taxi booking systems, it will help to elevate the rate of occupancy for public transportation. The initial purpose for the existence of the taxi system is to serve the need of moving from one place to another without having to depend on pre-determined routes, and it has successfully served the demands for transportation for many years. This taxi system in large cities such as New York, London and Singapore is clear evidence that effective taxi systems are possible to be done; actually, the implementation of the GPS-based taxi system has improved the taxi operators’ way in handling their businesses.

In fact, a research done in Singapore (Liao, 2001) has outlined that taxi that operates with GPS can solve the problems of i) mismatch in the demand for supply of taxi services, ii) imbalance of job segregation based on location proximity of a task, iii) noise interruption for radio-paging systems and iv) long waiting period before confirmation of a taxi can be given.

These problems have been overcome with the implementation of e-hailing in which the system analyzes it and comes out with the idea of optimizing demand and supply by using algorithm and real-time response system, which telecasts the live update of available taxi in the nearest location as well as the estimation time of pick-up time by the taxi. Hence, GPS-based taxis not only solve the long-overdue problems in the taxi industry but also help operator to optimize the movement of taxi fleet in general.

On the other hand, an on-going debacle on the existence of taxi fleet services in urban transportation suggested that these services are complementary, instead of playing role as
substitution for public transportation. Rayle et al., (2014) have proven that taxi services in general serve demand for short-distance trips, regardless of taxi type (whether radio-paging system or GPS-based). Users usually tend to make taxi bookings mainly for social and leisure trips; with almost 80 percent of respondents made less than 1km trip. This shows that taxi services are complementary especially in the urban areas, as the travel distance in the city center is shorter and connected to other modes of public transportation.

In contrast, productivity is another dimension of the impact of satellite-based dispatch systems for taxi industry in the urban areas. It helps to enhance the management of taxi fleet towards an effective approach whereby taxi drivers will no longer be seen wondering around the town looking for customers as the system will help to allocate the demand for taxi services. This will help service providers to minimize the operating cost and fully utilize available resources. According to Liao (2001), this improvement will also cultivate a better working environment to service providers and taxi drivers; a reduction in time required for order taking, processing, and dispatching process resulting in considerable improvement of taxi services.

Users will also benefit from these services as they can save time and make proper journey planning as e-hailing will provide them with detail of booking as well as estimated arrival time. In this millennium era, time is very precious; therefore, this responsive service really helps city dwellers to cope with their on-the-go lifestyle.

However, the biggest obstacle e-hailing services is facing right now is legal threats. Some countries in the world are banning the services, claiming it to be affecting the established protected market formed by the regulators. As for now, e-hailing has operated in more than forty countries across the world and more than half of them are against the services. For instance, India and South Korea have already banned e-hailing and its providers as the services have been receiving a backlash from the local taxi drivers who claim that their earnings have dropped since the introduction of this alternative to their offerings. In addition, there have been several cases involving sexual assaults for e-hail drivers in India and that is the reason why the government has banned the services.

However, the acceptance of governments for e-hailing in developed countries such as United States and Europe has been very welcoming. Even though at the very first stage of implementation, e-hailing did receive a no-no from the local government and users, now e-hailing has become the phenomenon in urban transportation as the city dwellers found that e-hailing offers so many advantages, thus the government has gone through so many stages of discussion to finally legalize the services. For example, e-hailing services such as UBER have been accepted by the New York Taxi & Limousine Commission (TLC) after a pilot test has been done in the late 2013 and the city dwellers in New York have fallen in love with e-hailing ever since.

From users’ perspectives, e-hailing services really help them to get accessible services, on-time supply and conveniently shorter waiting times for a taxi to arrive. The previous radio-paging taxi services have been struggling to solve the long-overdue problems in the taxi industry, which is the gap between demand and supply; especially during peak hours and public holidays. The situation will get worse during the rainy weather since taxi services will decline in terms of supply. E-hailing will also help in managing demands with algorithm and real-time display systems as it elevates the possibility to allocate and segregate taxi fleet accordingly.
5. Conclusion

According to The World Bank in their Malaysia Economic Monitor, June 2015, transformation for urban transport is needed in order to achieve quality of life among the urban dwellers so as to avoid negative impact of urbanization and to provide adequate social amenities among the urban areas. The satellite-based dispatch system for taxi services in the urban areas is the answer to a question that has been asked about for so long as it not only helps elevate the accessibilities between users and taxi drivers, but also fixes the gap in taxi fleet management to make it more systematic and cost-effective. The impact of satellite-based dispatch systems for taxi fleet in urban areas is beneficial especially for users and taxi drivers. Thus, a proper understanding on this subject is needed for exploration for future research.

References


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