Enhancing Vehicle Utilization via a Mobile Application within the Courier Industry in New Zealand

A thesis presented in partial fulfillment of the requirement for the degree of
Master of Supply Chain Management

At Massey University, College of Sciences,
School of Engineering and Advanced Technology, Manawatu,
New Zealand

Dongwen Luo

2015

ABSTRACT

In the New Zealand transport sector, the Owner-Operator is an indispensable part of Logistics industry. Most couriers and road freight companies Owner-Operators as independent contractors for delivery service. Hence, the vehicle utilization of Owner-Operators might directly influence the profitability and service quality of couriers companies as well as their personal incomes. With respect to the inefficient vehicle utilization, it normally represents as underutilized capacities of part-load shipments, empty movements or idle time.

In conducting the qualitative research, the researcher has interviewed thirty respondents who consist of Owner-Operators and Operations team staff. According to the relevant qualitative data, the research found that the inefficient activities, such as empty run, unpaired shipments and part load shipments are principally caused by unsteady delivery frequency, lack of business acquisition opportunities and small time window. These causes provide mobile technology with a significant potential to enhance the vehicle efficiency. A Logistical Mobile Application, which is installed in a smart phone or portable electronic devices, offers a cost-effective and real-time information exchange platform between customers and service providers.

From the perspectives of respondents, Owner-Operators believe that the mobile app is a new trend of integrating the functions of scanner, GPS and pager. Furthermore, around ninety percent of them perceive that it is a useful tool for improving the vehicle utilization and incomes. However, although the respondents have relatively positive attitudes on this new technology and business model, there are some constraints of its practical effect, due to the boundary and policy of the companies, as well as the population density of New Zealand.

KEYWORDS： Mobile Commerce, Mobile App, Owner-Operators, Vehicle Utilization, Logistics Management

ACKNOWLEDGEMENTS

I am hugely grateful to Prof. Paul Childerhouse, whose meticulous guidance, expertise, rigorous scholarship, patient and understanding made this research thesis possible. I was delighted to work with him for the whole year's study. He is not only an excellent supervisor, but also a great mentor. Thanks so much for his gracious and generous suggestions, experience, and instructions which are precious to me, regardless of study or life.

I would also like to thank my other supervisor, Mr. Walter Glass. For the duration of data collection and analysis, his profound knowledge and insightful advice inspired me a lot. Without his wide connections in logistics industry, I could not have collected the data successfully. I am thoroughly indebted to his generous introduction of two important people in the courier market who have shared with me some essential information.

Thanks to all the respondents for spending their precious time on the interviews and participating in my study. Their sophisticated experience provides the research with a host of informative materials.

I am thankful to my lovely classmates Ms. Lisa and Ms. Pimpin who encouraged me continuously and gave me considerable help.

I sincerely express my gratitude to the Massey University for offering the postgraduate fund to conduct the research.

My special thanks to my family for their kind understanding and full support throughout the whole study.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

1.1 RESEARCH TOPIC

This research aims to explore the causes of influencing the vehicle utilization within Owner-Operators in New Zealand, and mobile commerce is treated as an approach to alleviate the relevant inefficient activities. Hence, the comprehensive academic literature review will be conducted, and it will help to support and develop a conceptual model in order to provide a high level understanding of the theoretical concept. The qualitative research strategy will be applied to collect and analyze the qualitative data. Eventually, the outcome of the research will be issued.

In this chapter, the general overview of the research will be explicated. Research objectives and importance explains the purpose of the research. Study boundaries and research method will be introduced concisely, and study limitation is elaborated as well.

1.2 RESEARCH OBJECTIVES/QUESTIONS

According to the explanation of Supply Chain Operations Reference (SCOR), supply chain performance can be measured in six distinct management processes: “Plan, Source, Make, Deliver, Return, and Enable” (L. Puigjaner, A. Espuña, 2005). Vehicle Utilization enhancement is also an approach of ameliorating supply chain performance. The objective of this study is to identify the causes and effects of poor vehicle capacity usage, and investigates the feasibility of enhancing the fleet efficiency by means of integrating mobile commerce capabilities into the New Zealand Owner-Operators couriers’ sector. Depending on their focus the specific research questions are addressed as follows:

Q1. What is the level of Vehicle Utilization?
Q2. What are the main causes of the Inefficient Vehicle Utilization within Owner-Operators in New Zealand context?
Q3. What are the potentials of mobile commerce to improve the Vehicle Utilization within Owner-Operators in New Zealand context?

1.3 SCOPE AND BOUNDARIES OF RESEARCH

Fleet management efficiency or vehicle capacity management is one subset of Logistics Management. According to the Council of Supply Chain Management Professionals (CSCMP), Logistics Management manages the efficiency of material flow (forward and reverse), goods storage, information and service between suppliers and end consumers for the sake of fulfilling customers' requirements (Waters, D., 2007). This shows that logistics management involves transportation, inventory and information management. The proposed research will concentrate on the vehicle capacities in transportation management, through the integration with information technology for promoting its efficiency. Regarding the transportation management, many studies, (Bretzke & Barkawi, 2013), (Harrison, Hoek, & Skipworth, 2014), (Waters, D., 2007), (Simchi-Levi, Bramel, & Chen, 2014), are focus on route planning and network configuration by process-based or organization-based theory. The prerequisite of above mentioned theory, there must have a relatively big network, adequate business volume and several routings in appropriate time window. However, with respect to some of the Owner-Operators, they are only providing the point-to-point service, so most of them are just running the single transport leg, which results in inefficient operations (McKinnon, 2015). Hence, according to their daily operations and circumstance of customer relationship, this research will figure out the elements of low performance, and try to plug in the mobile technology as a new approach to optimize the information flow for the sake of vehicle utilization.

1.4 IMPORTANCE OF RESEARCH

In New Zealand context, where has insufficient intermodal system throughout the country, road freight efficiency seems to be more significant to the economic development. Consequently, this research will consider how the mobile commerce might improve the road haulage efficiency within Owner-Operators in New Zealand. Moreover, against the platform of real-time information exchange, it enables Owner-Operators to enlarge their network for acquiring new business and increasing incomes. Meanwhile, it is conceivable that 3PLs could arrange the vehicle scheduling more rationally because of mastering valid information from customers.

According to Ministry for Environment Technical Report (MFE, 2009), between 1992 and 2007, in New Zealand, the proportion of road freight volumes had risen faster than GDP growth, and the upward trend are predicted to keep increasing over the next 30 years by 70-75% (NZBC, 2011). Apart from that, compared with other freight mode (rail, costal shipping and air), regardless of tonnes lifted or tonnes-kms, road freight occupied the highest proportion and remained the dominance in 2008 (NZBC, 2011). This shows that, in the foreseeable future, road freight will continually be the most primary transport means in New Zealand. Undoubtedly, road freight efficiency plays a pivotal role in GDP growth.

Furthermore, by the statistics of commercial vehicle operations in New Zealand (TERNZ, 2010), it is shown in table 1.1. Among total 4986 Road Freight companies, there are 4206 companies hiring fewer than 5 employees, that means 84.3 percent of road freight companies are Small and Medium sized Logistics Enterprises. Besides, 2584 (account for 51.8 percent) road freight companies have no employee, which probably means that they are Owner-Operators. Therefore, to increase the vehicle utilization within Owner-Operators is highly essential to holistic transport efficiency.

Industry Category	Numbers of Employees							
	0	1 to 5	6 to 9	10 to 19	20 to 49	50 to 99	100+	Total
Road Freight	2584	1622	273	278	146	49	34	4986
Road Passenger	3206	389	64	52	37	17	18	3783
All Road Transport	5790	2011	337	330	183	66	52	8769

Table 1.1 Distributions of Road Freight Companies by Employee Numbers
(Source: An Overview of Commercial Vehicle Operations in New Zealand 2010, Transport Engineering Research New Zealand Limited)

From the perspective of Alan Harrison (Harrison et al., 2014), “Logistics is the task of coordinating material flow and information flow across the supply chain to meet end-customer needs”. Any logistics activities like vehicle utilization, its efficiency enhancement cannot be completely divorced from the information flow. In addition, IT science is immersed in supply chain management (Russell, Hoag, 2004), and with the wide spread use of e-commerce, it is indispensable in supply chain by electronically

linking and synthesizing its activities (Bhatt, Emdad, 2001); (Kalakota, Robinson, & Kalakota, 2001). Therefore, with the development of mobile technology, it might promote the Owner-Operators better use their internal and external resources.

1.5 RESEARCH METHOD OVERVIEW

The qualitative research methodology has been applied on this study. As this research approach is broadly interpretive, data will be gathered from selected Owner-Operators in New Zealand by the interviews and questionnaires. After the data is collected, the causes of inefficient vehicle utilization will be analyzed and conceptual model might be modified.

1.6 POTENTIAL CONTRIBUTION TO KNOWLEDGE

The proposed study, from a practical perspective, considers that mobile app may raise the vehicle efficiency for Owner-Operators in New Zealand. From a theoretical perspective, it tends to build a new theory of conceptual frameworks that how the synthesized instant information flow via mobile app affects the causes of poor usage of vehicle capacities. Because the Owner-Operators are also the users of traffic infrastructure, if the theory spreads on improving their efficiency broadly, it might be not only beneficial to Owner-Operators, but also to public transport management. Not surprisingly, vehicle capacity enhancement also has the potential of mitigating the environmental degradation and traffic congestion (Button & Hensher, 2003).

1.7 LIMITATIONS OF THE STUDY

The research concentrates on vehicle capacity improvement, and the capacity means time and space utilization. Notwithstanding, for some special cargos, such as temperature controlled food-stuff, hazardous chemical goods, hanging garments and pallets pack cargos (hard to stack), etc., it is almost impossible to increase space utilization just by management skills. In addition, with respect to long distance road freight (cross cities and countries), efficiency improvement needs holistic network cooperation rather than merely reliance on mobile commerce. Consequently, depending on the characteristics of Owner-Operators in New Zealand, the values of this research

tends to be achieved better in B2B/B2C market with small parcel shipments. To some extent, this technology is relatively young and only popularized in several metropolitan areas due to the high population density. Time and resource constraints do not permit the further testing in depth of its practical effect, but broadly construct a predictable picture through qualitative research that reflects most Owner-Operators in New Zealand.

1.8 FLOW AND CONTENTS OF REMAINING CHAPTERS

Chapter 1 has briefly introduced the study topic, research objectives, and study area, importance of research, research method overview, and limitations. The following parts have been organized as follows. Although the mobile application is a new technology to enhance the vehicle utilization efficiency, there are still some constraints, which the research boundaries and limitations will explain.

In Chapter 2, the comprehensive academic literature will be reviewed and the conceptual model has been built up accordingly for the sake of the intact logical structure. Subsequently, the research methodology will be analyzed in Chapter 3. In that chapter, epistemological perspective will be determined by the researcher and qualitative method will be conducted for the future study. In addition, a formal survey will be dispatched as an approach of collecting data, after that the collected data is going to be utilized for constructing a generalizable picture.

In order to demonstrate a much clearer picture of how the mobile app applies on logistics industry, in Chapter 4, the researcher takes an instance of a mobile app which has been launched in the USA. It is the app to integrate the idle vehicle capacities by the business model of crowd sourcing, primarily in Taxi industry. On the basis of the main features of this app, the researcher attempts to plug those functions in couriers market.

After data collection, all the data will be filed and integrated. Accordingly, the data will be analyzed in Chapter 5. Through the face to face interviews and questionnaires, daily operations of thirty valid respondents will be analyzed for inducting the cause and effect of inefficient vehicle utilization. In addition, through the introduction of logistical mobile application, their perspectives and attitudes will be collected and analyzed in this

chapter.

To round up the research findings with literature, discussion will be elaborated in Chapter 6. The conceptual model has been refined in terms of the actual scenario combination. In the meantime, recommendation, critique, and further research are discussed as well, notably for the prospective effect and threat in the future logistics market. Eventually, the conclusion of the research will be stated in the last chapter.

2.LITERATURE REVIEW

This chapter elaborates a review of theoretical literature about the vehicle utilization and develops a theoretical framework for improving the capacity.

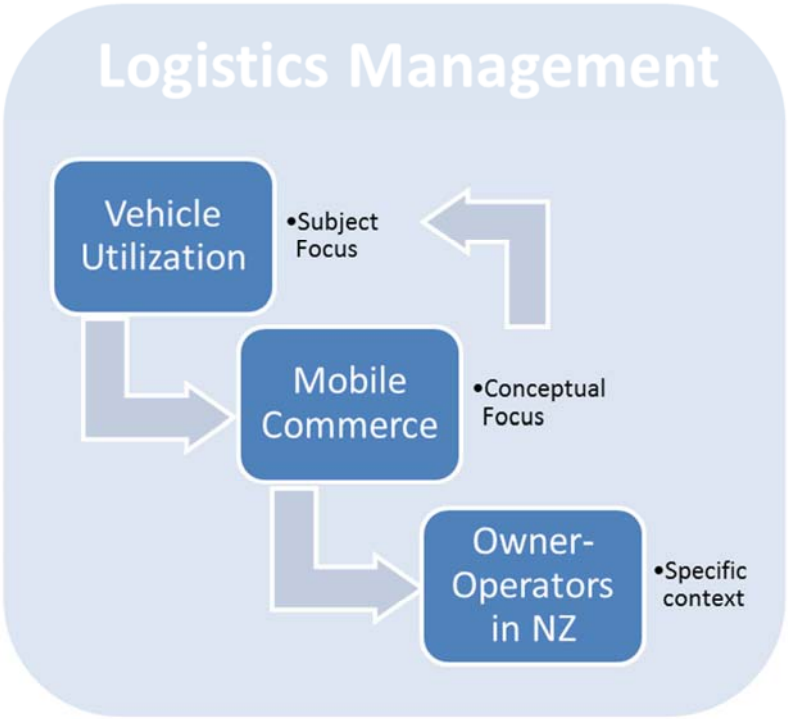


Figure 2.1 Logical Literature Structure

According to figure 2.1, it shows the logical structure in this section. At the beginning, it introduces the broad topic area which is Logistics Management. Then this review will highlight the key subject area of Vehicle Utilization, and the causes of low capacity usage will be explained as well. Subsequently, conceptual model of Mobile Commerce will be discussed to mitigate the effect of inefficient causes. As a tool for improving the capacity usage, relevant conceptual model will be constructed. Furthermore, the approach of enhancing vehicle utilization through m-commerce will be analyzed within the Owner-Operators in New Zealand. Eventually, the research gap and summary of essential factors of the literature is interpreted.

2.1 LOGISTICS MANAGEMENT

On the early stage, Logistics, stated by Ruppenthal in 1962 at Stanford University (Ruppenthal, K.M., 1963) is only the concept of physical movement. The significant feature of this incipient concept is that the materials should be available no matter when and where they were needed. With the development of technology, IT science has assisted the evolution of logistics, and information flow has become the crucial element in Logistics Management. Nowadays, the most generalized definition of modern Logistics Management is: “Logistics is that part of supply chain management that plans, implements, and controls the efficient, effective forward and reverses flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customers’ requirements.” (CSCMP, 2005)

This depicts that physical logistics activities, such as inventory, transportation, warehouse, even the customer service, could not be separated from information management. They are interdependent. Likewise, logistics performance is tightly bound with Information and Communication Technology (ICT).

2.2 VEHICLE UTILIZATION

Vehicle utilization, to some extent, is an indicator to show the level of vehicle used and its enhancement is also a measure of reducing environmental burden (McKinnon, Browne, & Whiteing, 2012). Including New Zealand, road freight is the dominant mode of transportation in most countries and this research focuses on road haulage management. In this section, the literature review is primarily regarding vehicle utilization rather than marine or air capacity usage.

In Europe, during the 1990s, some major research had analyzed the road freight rationalization from three varying tiers: ‘Modal split’ (split the whole freight to alternative modes); ‘Transport intensity’ (decrease transport intensity from governmental perspective); and ‘Vehicle utilization’ (reduce proportion of vehicle-kms to tonne-kms), which is shown in table 2.1. In table 2.1, almost all the research has considered the vehicle utilization as a significant option to increase the economic growth (McKinnon et al., 2012).

Author/Organization	Study Area	Date	Model Split	Transport Intensity	Vehicle Utilization
Hey et al EURES/Green peace	Europe	1992	*	*	*
Peeters/Werkgroep 2000	Netherland	1993	*		*
DIW/ifeu/IVA/HACON	Germany	1994	*		*
Royal Commission on Environment al Pollution	UK	1994	*	*	*
Plowden and Buchan/Civic Trust	UK	1995	*	*	*
Bleijenberg/CE	Europe	1996	*	*	*
Holman/T & E	Europe	1996	*	*	*
Pastowski/Wupperthal Institute	Germany	1997		*	
Schipper et al/International Energy Agency	OECD	1997	*	*	*

Table 2.1 Road Freight Rationalization research in the period of the 1990s

Source: (McKinnon, Browne, & Whiteing, 2012)

In terms of the model of Rizet (Rizet, et al, 2012), increasing the vehicle lading capacity from 50% to 100%, every hundred tonne-kilometers fuel consumption will drop 42.9%. From the governmental perspective, take UK for instance, according to its Sustainable Distribution Strategy, diminishing empty run and enhancing lorry loading were the essential objectives (DETR, 1999). Undoubtedly, vehicle efficiency enhancement exerts the positive influence regardless of environment or society.

2.2.1 VEHICLE UTILIZATION MEASUREMENT

Before assessing vehicle utilization, we should understand the metrics of vehicle utilization in advance. In terms of resource utilization, vehicle utilization can be calculated based on following equation (Stevenson, 2010):

$$Resource\ utilization = \frac{\text{Actual outputs } \times 100\%}{\text{Nominal capacity}}$$

Nominal capacity

Under the theoretical condition, nominal capacity represents the maximum outputs achieved by the equipment (Stevenson, 2010). In this research, for example, the nominal capacity of a truck/van refers to its maximum permitted lading weight/volumes and operational hours per day.

Actual outputs

Actual outputs for vehicle utilization should take time and miles/kilometers into account as two measuring dimensions.

With regard to running kilometers, from a macro-level perspective, it is associated with weight to calculate the freight efficiency instead of volume (McKinnon, 2015). Hence, 'Tonne-kilometers' is a principal parameter to measure the vehicle productivity, and it means the actual travel distance of trucks carrying goods.

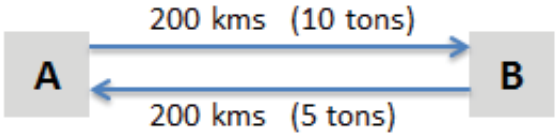


Figure 2.2 Vehicle Utilization Measuring Instance
Based on source: (Bretzke & Barkawi, 2013)

For example, figure 2.2 shows the situation where a truck fully loaded 10 tonnes takes a 200 kms delivery from customer A to B, and then the truck takes only 5 tonnes for back-haul from B to A. Therefore, from the perspective of lading capacity, the vehicle utilization should be 75%, details as follows:

$$Vehicle\ utilization = \frac{200\ \times 10 + 200\ \times 5}{200\ \times 10 + 200\ \times 10} \times 100\% = \ 75\%$$

With regard to another parameter, operation time is also a reference value to influence the vehicle utilization. Again, for the above example, what if the truck takes 5 hours to complete the job, and there is not another new job during the 10 working hours normally. The percentage of time utilization is only 50%. Theoretically, in that day, the total vehicle utilization should be 37.5% = 75% × 50%.

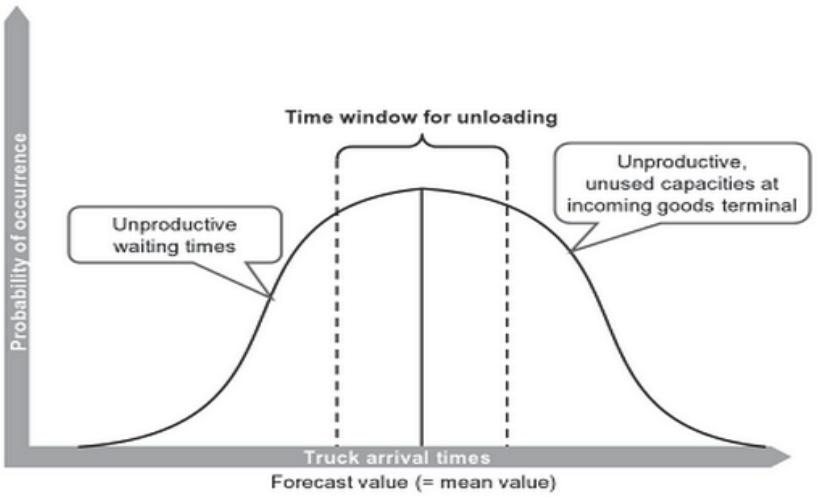


Figure 2.3 Unproductive Times Constitution

Source: (Bretzke & Barkawi, 2013)

In addition, unproductive time is another concern when conducting the operation. From figure 2.3, it is a scenario for truck arrival times in terminal. If the truck arrives too early or too late, unproductive waiting times will occur. Regardless of the unproductive operating time and standing time for waiting new business, Owner-Operators cannot run more profitably during the idle time. Therefore, time efficiency is a considerable element to improve the vehicle utilization.

2.2.2 CAUSE & EFFECT ON INEFFICIENT VEHICLE UTILIZATION

There are many factors resulting in poor vehicle performance. As is shown in Figure 2.2, five main classifications constrain the maximum usage of vehicle capacities (McKinnon, 2015). With regard to these five categories, some factors are objective ‘hard-constraints’

and cannot be optimized by management or SCM skills, such as ‘Health and safety regulations’, ‘Vehicle size and weight restriction’, ‘Limited capacity at facility’ and ‘Incompatibility of vehicle and products’. Consequently, these elements are excluded in the study.

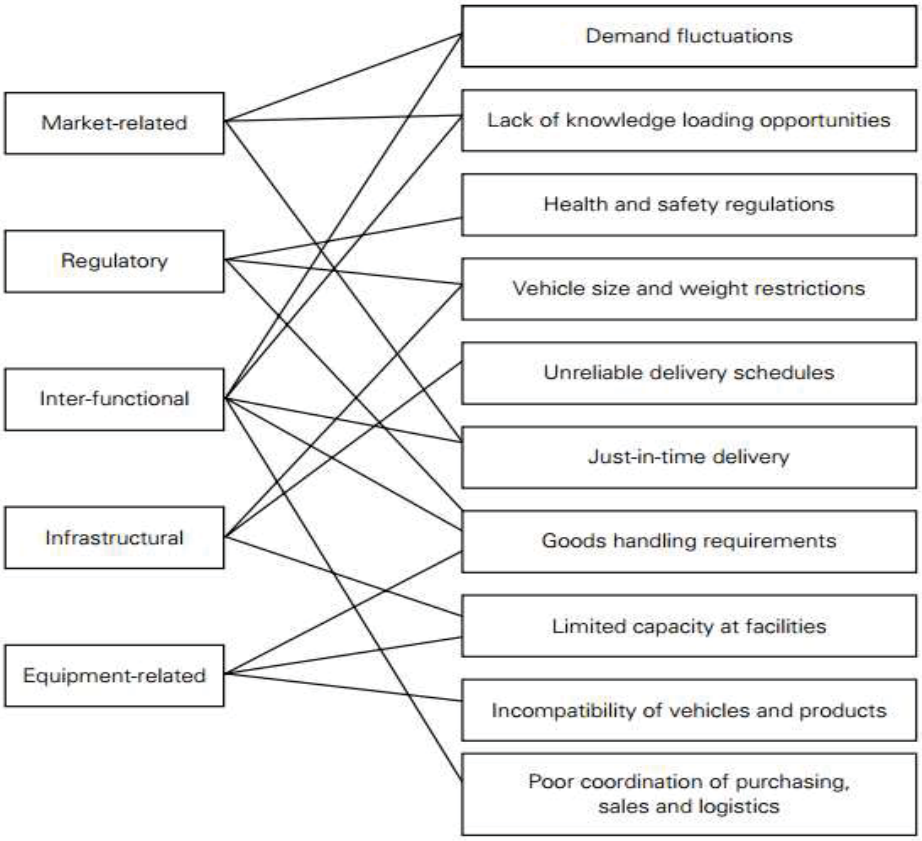


Figure 2.4 Five Influential Categories of Vehicle Utilization
Source: (McKinnon, 2015)

Likewise, through the observations, Wolf-Rüdiger shed light on the similar reasons of the counterproductive capacity usage, such as fluctuated daily demand, high service frequency, unpaired flow of shipments, completely order driven and too small delivery time windows (Bretzke & Barkawi, 2013).

As for the above mentioned elements, some factors like Unreliable delivery schedules and Poor coordination of purchasing, sales and logistics, are caused by unskillful internal management in logistics companies, while some factors are the consequence of

customers' unpredictable requirements. Therefore, from the perspective of Courier companies, we can classify above constraints in two categories: 'Intrinsic factors' and 'Extrinsic factors', detail as is shown in table 2.2.

Causes of Inefficient Vehicle Capacity Utilization	
INTRINSIC FACTORS	EXTRINSIC FACTORS
Unpaired flow of shipments	Fluctuated customer demand
Lack of network cooperation	Fragmented delivery location
Entirely order driven	Small delivery time window
Lack of business acquisition resources	Unsteady delivery frequency

Table 2.2 Causes of Inefficient Vehicle Capacity Utilization

Extrinsic Factors

- Fluctuated customer demand and Unsteady delivery frequency

These two causes are the results of uncertain customer requirements. Because of supply chain uncertainty, unnecessary or extra route/time could be occurred (Sanchez-Rodrigues, et al, 2010). It is difficult to predict the customer demand accurately. However, as early as possible to master the customer requirement, it is considerably essential. Notably for back loading enhancement (Esper and Williams, 2003), they found that truck efficiency could be increased by 10 to 42 percent in United States because of beforehand planning. Browning and White (2000) pointed out that it is a significant purpose of transportation management by managing the customer information at an early stage.

- Fragmented delivery location

Except for some nominated vertical logistics service providers, most clients of 3PLs are general business customers and they are uncorrelated. Hence, their requirements might be irrelevant, and it is not easy to integrate them on the same route. This might induce each transport route to be isolated. McKinnon, (2015) indicated almost all the road freight movement is one-way direction rather than A-B-A round-trip routing or complex

route like A-B-C-A model. This may result in the Empty Running journey. In the meantime, it is often seen in short trip backhaul (De Angelis, 2011), because there is more profit incentive of finding rear-loading for long distance return.

- Small delivery time window

Theoretically, because of the tight delivery time window, most of the drivers in logistics companies will depart earlier. Again, lead time for logistics service providers is the composition of supplier's loading, main-run and unloading time. In order not to be seriously affected by the upstream and downstream variances, drivers rather choose increasing unproductive waiting time due to the fears of delay (Forcher et al, 2004). Although the operations are different amongst Couriers, Freight Forwarders or other types of logistics service providers, it is conceivable that, in order to fulfill the on time delivery, most of them might have to spend more unproductive time.

Intrinsic Factors

- Entirely order driven and Unpaired flow of shipments

These two causes belong to internal management and coordination problem. Christopher, (2010) emphasized that cross-functional and departmental management is the core skills in freight forwarding company. It is conceivable that sales staff might neglect the vehicle utilization just for the purpose of making commitments to customers or missing the potential back load sales by the lack of communication with purchasing staff.
In addition, the reason why the truckers are reluctant to pair the back load shipment is the concerns of influencing the next customer's consignment (McKinnon and Ge, 2006).

- Lack of network cooperation and business acquisition resources

These two factors are related to the marketing strategy. in order to achieve the customer demands, logistics service providers can apply three executed options (X.WANG, 2015): 'self-fulfillment' (solely use their own vehicles to implement orders); 'subcontracting' (outsource the business to other forwarders); 'request exchange' (unlike the hieratical relation in 'subcontracting', 'request exchange' constructs the alliance and shares the joint benefits to the coalition members. All the fellow partners in this coalition have equal relationship). Nevertheless, many forwarders only use the 'self-fulfillment'

strategy. Due to the scarcity of customers or peers network cooperation, when their vehicles are unavailable, they cannot assign the most profitable jobs on their own and cannot adequately utilize the capacities.

Through the elaboration of intrinsic and extrinsic causes, we can understand that good planning in advance, quick response and vertical collaborations are essential to vehicle efficiency enhancement. As for customers, real-time visibility of logistics service providers enables them to select the proper 3PLs in proximity. All these functions cannot decouple from instant information exchange, and mobile commerce might be treated as the related platform.

2.3 INFORMATION TECHNOLOGY SUPPORT

According to the definition of modern logistics management (CSCMP, 2005), it is clear that material flow and information flow is interrelated as well as interdependent. Some of research suggests that the productivity increase, improvement of operation and customer service quality are dependent upon Information and Communication Technology (ICT) adoption (Bowersox and Daugherty, 1995; Calder and Marr, 1998; James et al., 2004; Lau et al., 2006, Chow et al., 2007; Liu et al., 2010).

In the pass decades, information technology has been widely used in road freight companies, and become the essential management skill of logistics services providers (Speakman, 2002). As a result, enabling the visibility, versatility and velocity throughout the supply chain is the major trend today of utilizing internet to implement the operational processes more quickly, cheaply, and accurately (Kalakota, Robinson, & Kalakota, 2000). With the wide spread use of information technology, there are many forms of information exchange. The research concentrates on the mobile app adoption, so this sector will focus on the literature of mobile technology.

With regard to the proposed causes from last section, Figure 2.5 shows which kind of information flow may mitigate the vehicle usage inefficiency. Firstly, Chopra and Meindl (2012) suggest that high efficient and agile responsive performance is the principle indicator in SCM. Conveying the ‘real-time information’ is significant for road freight companies to rapidly adjust the vehicle scheduling for the instant customer demands. Secondly, for the ‘Track and Trace’ service, GPS and mobile technology leads

to the cargos and vehicles status become visibility. Accordingly, supply chain operators and customers could assign the tasks precisely (Kalakota et al., 2003).

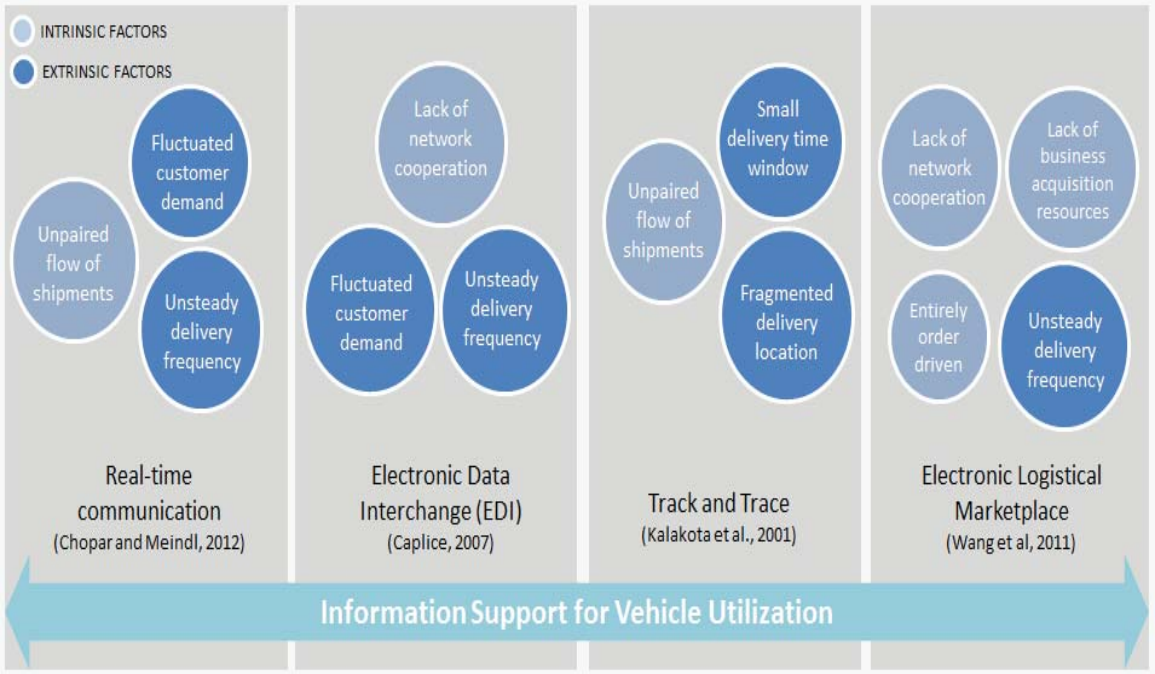


Figure 2.5 Information Support for Vehicle Utilization

Furthermore, some researchers i.e. Wang et al (2011); Caplice (2007); van de Klundert and Otten (2011) exploited the electronic logistical procurement and transaction marketplace, which helped the 3PLs and customers acquire the logistics resources easily. The above supporting information could enhance the capacity usage to some extent.

2.3.1 MOBILE APPLICATION

Mobile Commerce is using the wireless electronic device to conduct the E-commerce via telecommunication network (Siau et al., 2003). The activities of mobile commerce facilitate information exchange, electronic transaction, internet communication without the constraint of time and space. “APP” is a short form of the term “Application Software”, and it was listed in American Dialect Society, (2010). It is a computer program running on smartphones or other mobile devices. These applications penetrate into enterprises, staff, customers and relative supply chain partners against real-time

interaction (Kalaoka and Robinson, 2003). With the development of the mobile technology, mobile app's R&D (research and development) has been evolved to an industry serving a wide range of business including logistics.

Actually, it is an evolution from traditional paper and fax based process to highly integrated electronic mobile exchange platform. Before the broader proliferation of smart phones and the developments of mobile app, Ravi Kalakota, et al (2003) had tried to synchronize the information flow from off-line to on-line via a wide variety of mobile devices in supply chain management.

Specifically, as is shown in Figure 2.6, the offline orders are approved in terms of the workflow first, and then the information flow will be recognized and transmitted to wireless mobile devices. Subsequently, the other segments will be operated synchronically for the purpose of enhancing the supply chain performance.

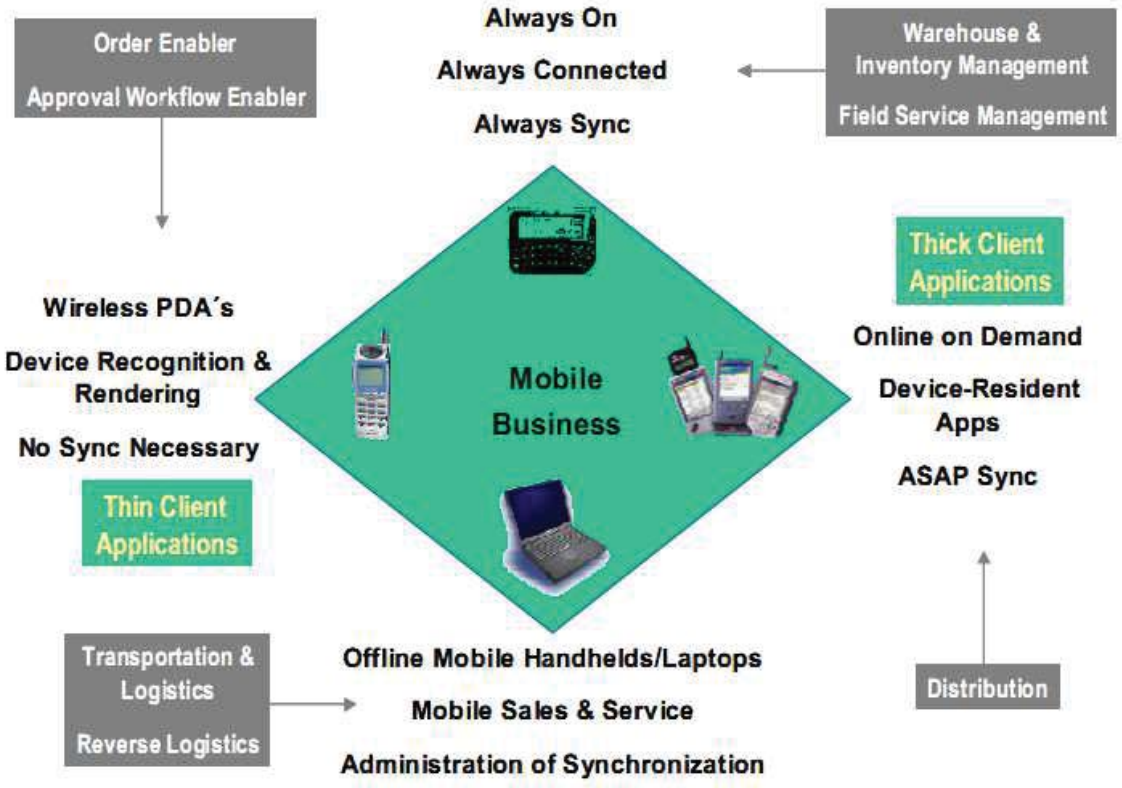


Figure 2.6 Mobile Device Capabilities
Source: (Ravi Kalakota, et al, 2003)

According to Siau, et al., (2003), all the mobile devices, including mobile phones, laptops, PDAs, and other offline handhelds, could be the information exchange platform of pushing the offline supply chain activities to online operations. With the development of ICT, the applications in smart phones are even able to alternate the relatively inconvenient device.

The relevant mobile technology plays an effective role within B2B (Business to Business) market. According to the supply chain frame work in Figure 2.7 (Ravi Kalakota, et al, 2003), the information technology aims to provide the functions of E-procurement, supply chain execution, visibility and service management.

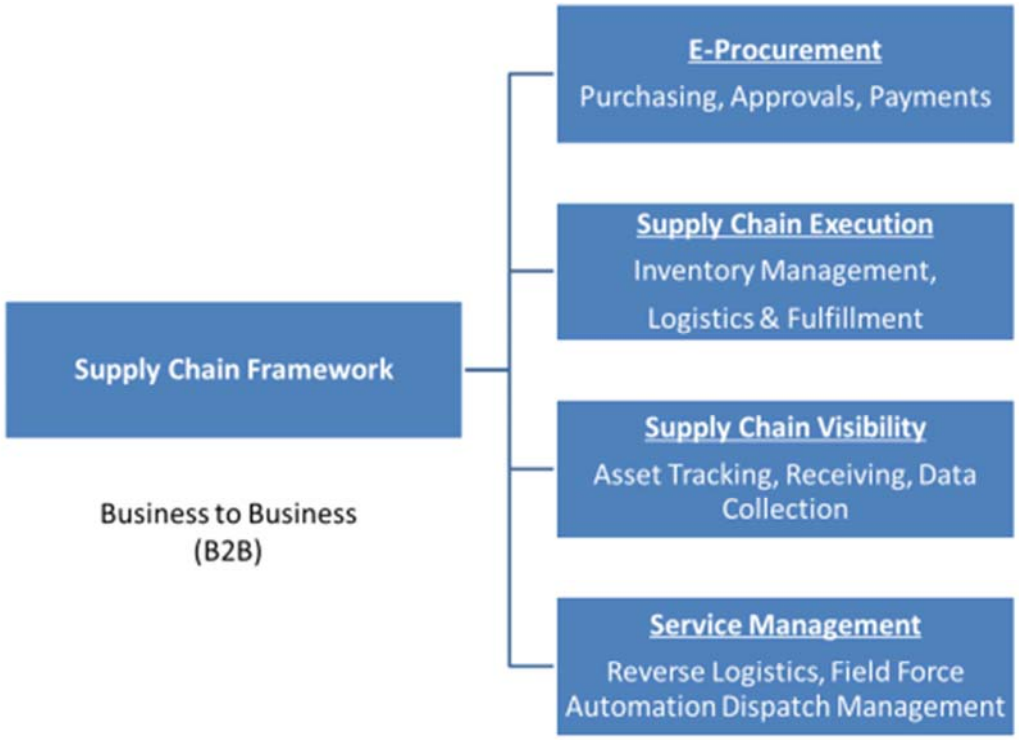


Figure 2.7 Supply Chain Frame Work in B2B Market

Source: (Ravi Kalakota, et al, 2003)

Undoubtedly, all the above functions could be achieved on a basis of process implementation or improved by sophisticated ICT system. As a result of the convenience, flexibility, responsive speed, and economic efficiency, mobile commerce solutions might noticeably influence those four segments more effectively. These four

segments are also the significant elements of vehicle utilization.

Regarding the effectiveness of Information and Communication Technology (ICT) adaptation in vehicle capacity utilization, from a research in Italy, the researcher Pietro Evangelista, (2012), conducted a survey in Italian basic logistics providers to investigate the impacts of using ICT.

Case Company	ICT Department /ICT Manager	ICT Expense	ICT Integration	e-Marketplace usage
Basic Logistics 1	No/No	Increasing technology costs to address technical standard to different ICT requirements of customer sectors	Very low integration with both customer and 3PLs	Yes: • To fully exploit the capacity of the trucks • To serve new geographic areas
Basic Logistics 2	No/Yes	Stability in technology costs due to price reduction in ICT products and service	Very low integration with both customer and 3PLs	Yes: • To reduce empty trips and to optimize vehicles capacity
Basic Logistics 3	Yes/Yes	**Decreasing ICT costs due to reduction of the budget devoted to external consultancy**	• High customer integration • Low 3PLs integration	No: • Considered not reliable

Table 2.3 Technological Profile of the Basic Logistics
(Source: Pietro Evangelista., 2012)

Table 2.3 shows that some basic logistics companies indicated the function ‘e-Marketplace usage’ of ICT had a positive influence on vehicle capacities improvement and empty trips decline. From the study of Pietro (2012), the ICT integration between customer and 3PLs are still very low in Italy, even though it is efficient within internal operations. In critical thinking of logistics technology adaptation, there must have some inevitable constraints or concerns when adopting the relevant technology.

2.3.2 CRITICAL THINKING OF TECHNOLOGY ADOPTION

Above sections has introduced the previous literature regarding the contributions of ICT and mobile technology in many aspects of logistics management. Critically, ICT adoption also has some inevitable risk as well as the benefits, which is shown in Table 2.4.

Scope of Application	Proponents	Opponents
• Route planning • Forecasting • Cargo tracing • Inventory management • Customer relationship management • Business development • RFID	• Cost saving by procedure simplification (Mansell, 2006) • Broader sales opportunities from E-market (Wang et al, 2011) • Information visualization (Sarkis, et al, 2000; Lewis, 2001) • Increasing 3PLs competitiveness (Lam SY, et al 2004)	• Higher service price (Khalifa, 2004) • Information capacity overload (Joyce D, 2006) • Data security risk (Michael H., et al 2011)

Table 2.4 ICT Adoption within Logistics Service

Regardless of implementing information systems internally or interchanging data with external customers, the investment, operation, and data security are the elements which should be taken in to account.

There are many forms of logistics technology, and they can be applied in various modules within logistics activities, from cargos movements to enterprise management (Wood, Reiners, & Pahl, 2015). No matter which types of technology, it is highly essential to plan effectively before the adoption of new technology; otherwise, some risks like overrunning cost, delaying in introduction, or a scaling back of functions, might overweigh the benefits of the technology (Brueggen & Luft, 2014).

In New Zealand, many companies are Small and Medium Sized Enterprises (SMEs), and they are still reluctant to invest significantly on logistics technology as a result of facing the operational, technological and external barriers, in terms of the exploratory research of Logistics Technology use in New Zealand (Wood et al, 2014). Therefore, the

cost and relevant functions of the logistics technology might be the significant elements influencing its adoption. Besides, Wood (2014) anticipates the trend of logistics technology is to use visual identification rather than the exorbitant system for scanning, recognizing and monitoring the products; meanwhile, the SMEs realize that it is significant to increase the competitiveness by Logistics Technology and specialized software system.

Information is always a very sensitive issue and security of information is the principal threat to the companies, notably in supply chain with involvements of many organizations. (Rajni Singh, 2015). Some logistics companies or material suppliers are likely to serve the customers who are the competitors at the same time. Hence, relevant data leakage might be resulted in the catastrophic destroy for the customers. Rajni (2015) points out that when the companies implement the online business dealings, in order to protect the information security, some ethical process should be conducted, such as authorized use, duplication, downloading, disruption, modification, and access of confidential reports.

2.4 CONCEPTUAL MODEL

From the literature review, a research conceptual model is constructed. This conceptual model establishes a theoretical frame work to explain how the Inefficient Vehicle Utilization occurs, and what the main causes are. In terms of different categorized causes, when the mobile application is employed, how the functions of mobile app assist to alleviate the relevant poor activities. The causal relationships will be demonstrated in the model.

According to Figure 2.8, inefficient vehicle utilization might represent on several specific activities: empty run, part-load shipments, unplanned route and the lack of business opportunities. All these poor performances are the consequence of intrinsic and extrinsic factors. For example, when a freight forwarder obtains an unscheduled customer request (extrinsic factor: fluctuated customer demand), if the company cannot

acquire the back-load to the new pick-up point (intrinsic factor: unpaired flow of shipments), unplanned route and an empty run probably occurs.

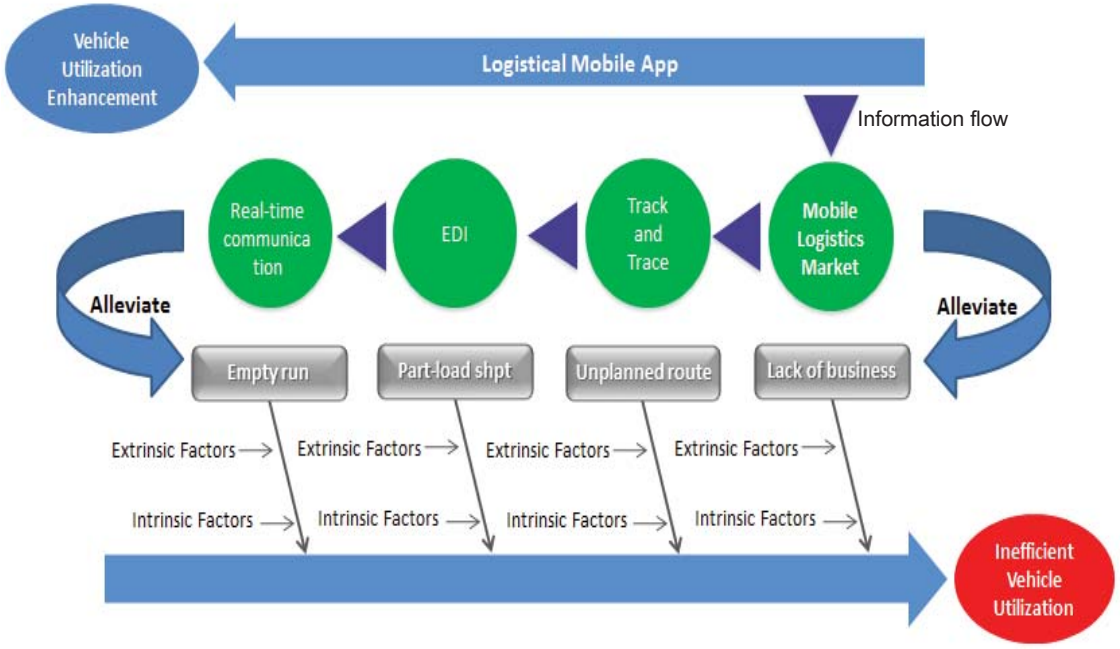


Figure 2.8 Conceptual Model

By implementing the mobile commerce, logistical mobile app will construct an electronic mobile logistics platform, which includes the functions of visibility in real-time and instant EDI exchange. By preceding literature review, all the information flows are the elements of alleviating intrinsic and extrinsic factors.

The following research method and data collection will be implemented on a basis of this conceptual model. In a New Zealand context, most Courier companies hire Owner-Operators as their fleet team members, whilst the vehicle utilization of Owner-Operators is also confronted with internal and external impacts. As a result, from the theoretical perspective, mobile technology could be considered an effective approach to integrate the in/external information flow for optimizing the operational procedures and increasing the performance.

2.5 RESEARCH GAP

From existing studies, Figure 2.9 shows that most outcomes have referred to the related aspects in Logistics management and Information management in supply chain, such as procurement, inventory, warehouse management, etc. But few of the studies have concentrated on Owner-Operators (Gunasekaran and Ngai, 2003) and ICT adoption in particular (Pokharel, 2005).

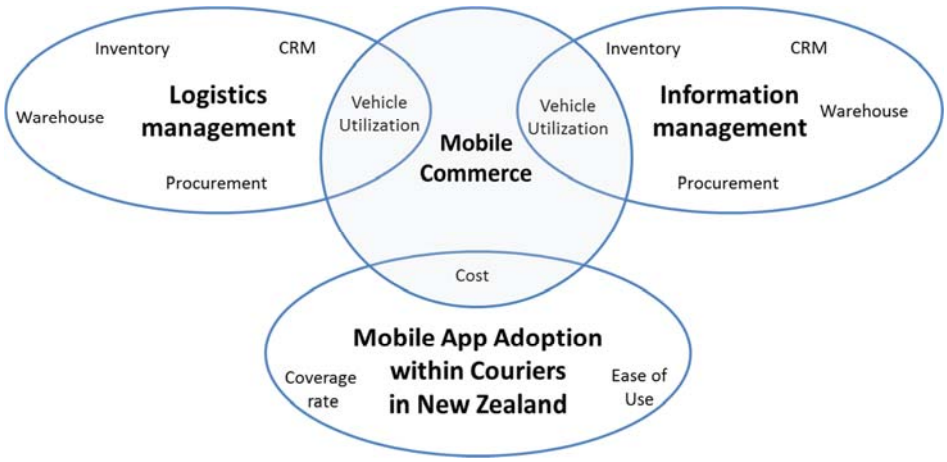


Figure 2.9 Research Gap

Likewise, there are several scholars (Pier Paolo Carrus and Roberta Pinna, 2013); (Pietro Evangelista. 2012) exploring the effects between ICT and logistics management, whereas the studies scarcely focus on vehicle usage by mobile commerce. Moreover, despite the wide spread use of ICT in 3PLs, most of them are required to set up a sophisticated IT system. However, logistical mobile application is designed on the principle of information and communication technology. Every smartphone users can download it without high-tech supporting equipment, while it can achieve some functions of ICT system, such as instant communication, EDI, transaction and locating.

Therefore, this study attempts to fill in the gap between the theory of logistics management and information management, and construct a theoretical picture of a cost-effective technological approach to enhance vehicle utilization in a New Zealand context.

2.6 SUMMARY

For many Courier companies, commercial vehicle is the unique instrument to produce the profit. Boosting the vehicle efficiency is not only the increase of profitability, but also the value added for the customers to some extent. Only the customers realize obtaining the greater value from one company instead of others, this company's service is more likely to be authorized (Lam, SY, et al, 2004). From the preceding literature review, vehicle utilization needs to be improved from intrinsic and extrinsic factors by information flow. Therefore, the conceptual model is constructed for the purpose of it. Undoubtedly, there are some objective constraints for vehicle capacity which cannot be varied by informatization (e.g. particular goods and industry). As a whole, if the research has positive outcome, it could contribute to logistics service providers, customers, society and environment.

Since the above literature illustrates that information technology contributes to vehicle utilization, most companies will adopt a strategy which is able to increase the speed and quality of exchanging information. Compared with the sophisticated IT system, Logistical Mobile Application is a cost-effective and appropriate platform for Owner-Operators.

3.RESEARCH METHODOLOGY

This chapter illustrates the comprehensive review of Ontological and Epistemological philosophy. According to the comparison between quantitative and qualitative methodology, qualitative method will be adapted for conducting this research. In addition, data collection and analysis methods will be discussed subsequently.

3.1 ONTOLOGICAL PERSPECTIVE

The word ‘Ontology’ originates from two Greek words: “Onto” and “Logia”, which means being real and science respectively (Kent Löfgren, 2013). Norman Blaikie suggested that ontological assumption is regarding the nature of social reality and the mode, composition of existence, as well as the relationships of each unit (Blaikie, 2000). Accordingly, ‘Objectivism’ and ‘Constructionism’ are two positions of implying above social entities.

	Objectivism	Constructionism
Nature of an organisation	Tangible object, external to the employees	Social construct, that arises from the interaction of individuals
Organisational drivers	Set rules, procedures, mission statements, processes and structures	Evolving negotiated order, rules and procedures act as principles leading to a community of practice
Organisational culture	Shared beliefs and values of employees who have internalize commonplace social norms	Emergent reality that is constantly being constructed and reconstructed through the interactions of the employees

Table 3.1 Comparison between Objectivism and Constructionism
(Source: Bryman and Bell, 2011)

Objectivism is an ontological perspective which conceptualizes the regulations and culture of tangible objects. By contrast, constructionism helps people understand the construction of social and natural world through their interactions, experiences, behaviors and perceptions (Grix, 2002; Potter, 1996). Table 3.1 shows the crucial comparison between objectivism and constructionism in three aspects.

On the basis of above difference in two viewpoints, as for this research, although the vehicle utilization is a tangible and measurable parameter, its performance is interrelated with the behaviors between freight forwarders and customers. From the external negotiation about the lead-time, place of delivery and quantities of each order to the internal coordination, all of these are the interactions and experience of social collaborations. The proposed research aims to find out the causes of influencing vehicle utilization, and then render the technological approach. Hence, constructionism is the ontological perspective.

3.2 EPISTEMOLOGICAL PERSPECTIVE

The word 'Epistemology' originates from two Greek words: "Episteme" and "Logia", which means knowledge and science respectively (Kent Löfgren, 2013). Epistemology is exploring how the reality exists by obtaining the knowledge and method (Blaikie, 2000). Therefore, 'Positivism' and 'Interpretivism' are two positions of a natural science and human interactions epistemology.

	Positivism	Interpretivism
Basis	Natural Sciences	Human interactions
Approach to social science	Explanation and generalisation of human behaviour	Causal explanation and interpretive understanding of human behaviour
Subject matter	Nature	Social reality
The subjects actions	Inanimate and unmotivated	Meaningful and engaged
Data collection	Observation, codification and measurement	Comprehend the perspective of the human subjects
Research & theory	Mostly deductive	Strong inductive leaning

Table 3.2 Comparison between Positivism and Interpretivism
(Source: Bryman and Bell, 2011)

Due to the position of natural science, Positivism is therefore to draw an accurate manner, and it mostly entails the elements of deductive approach. However, Interpretivism is a term of explanation of human behaviors and to study the social world

by profound understanding of human behaviors. Table 3.2 demonstrates the essential comparison of two approaches.

Personally, I believe that in order to better understand the social reality, human interactions should be the basis of the study. Inductive strategy is utilized through deeply engaging in the real life of Owner-Operators and comprehending their activities of vehicle operation. In terms of inefficient capacity utilization, the causal explanation and interpretive is pivotal to master the relevant factors. Therefore, Interpretivism perspective is the belief of researcher and the qualitative data will be collected by interviews when conducting the research.

3.3 APPRAISAL OF ALTERNATIVE RESEARCH METHODOLOGIES

The most common research strategy is qualitative and quantitative methodologies. Qualitative and quantitative research represents different theory of epistemology and ontology. Even so, some scholars argue that both of them can be combined within a research project (Bryman, A. and Bell, E., 2011).

3.3.1 QUANTITATIVE RESEARCH

In very broad terms, quantitative research methodology is a deductive perspective between the relationship of theory and research via the collection of numerical data; there are four features of the methodology: causality; measurement; replication and generalization. (Bryman, A. and Bell, E., 2011).

The common purpose of quantitative research is to deduce and test a hypothesis or a theory (Neuman, 2006) Therefore, quantitative research needs precise and numerical data collection, and utilizes statistical analysis (e.g. sampling, experiment) to verify the hypothesis.

On the other hand, there are four main criticisms of quantitative research (Bryman, A. and Bell, E., 2011). Firstly, it is failure to distinguish people and social organizations from ‘the world or nature’. It means that the quantitative researchers neglect the peoples’

interpretation of the world around them. Secondly, although the quantitative research is required to be precise and accurate, the measurement processes are artificial and spurious. Because the very test themselves are constructed on a fictive or sample basis. Moreover, the research might be divorced from everyday life due to the constraints of instruments and procedures. The conditions of instruments and processes hinder the sense of reality. Finally, it generates a static view between the variable human relationships. That means the researchers attempt to create a static social world by omitting the connections between individuals and everyday contexts.

Table 3.3 shows the key distinctions of two research method in different philosophy. We can see that the concerns associated with qualitative interpretivist epistemology and constructionist ontology (Bryman and Bell, 2011).

	Quantitative	Qualitative
Theory and Research	Deductive (testing out theory)	Inductive (generating new theory)
Epistemology	Positivism (natural science)	Interpretivism (social science)
Ontology	Objectivism (tangible and measurable)	Constructionism (social interactions)

Table 3.3 Research Strategy for the Methodology Aligns with Research Theory
(Source: Bryman and Bell, 2011)

With respect to the preceding explication of researcher's belief in Epistemology (Interpretivism) and Ontology (Constructionism), qualitative research methodology might be much appropriate to conducting the data collection.

3.3.2 QUALITATIVE RESEARCH

Qualitative research is a strategy in the collection and analysis of data via words rather than numbers. In very broad terms, the main features of the strategy are inductivist, constructionist and interpretivist (Bryman, 2012). From the epistemological perspective,

it needs an inductive view of relationship, understanding of interpreted social world and interactions between individuals.

According to (Neuman, 2006), the approach of qualitative research is to discover the meaning of a theory or hypothesis and create a theme by collecting the soft data in causes and contexts.

In qualitative research, it focuses on epistemologically grounded theory about the elements of consisting acceptable knowledge. Depends on studying the different reflection between people and objects of the natural science, the concept of qualitative strategy is induction. The primary compare and contrast of two research strategies have shown in table 3.4.

Differences		Similarities
Quantitative	Qualitative	
Numbers	Words	Distil Data
Points of view of researchers	Points of view of the participants	Answer research questions
Research distance	Researcher close	Relate data to literature
Theory testing	Theory emergent	Variation
Static	Process	Extinguish deliberate distortion
Structured	Unstructured	
Generalization	Contextual understanding	Frequency is a catalyst
Hard, reliable data	Rich, deep data	Importance of transparency
Macro	Micro	Appropriate
Behaviour	Meaning	Address questions of error
Artificial settings	Natural settings	

Table3.4 Compare and Contrast between Quantitative and Qualitative Methodology (Source: Based on Bryman, 2012)

Quantitative research is mostly testing the feasibility of a theory, and then deductive the outcome by collecting the precise numbers. On the other hand, qualitative research aims to outline a picture by inducting the perspectives and experience of individuals. Both of them are collecting a large amount of data then distil it and answer the research

questions while the data collection method and data analysis process is different.

By comprehensive understanding of the research methodology and philosophy, the synthesis of research strategy is outlined in table 3.5. Based on the qualitative research methodology, inductive approach conceptualizes the theory. In addition, the philosophy perspective of Ontology and Epistemology is Constructionism and Interpretivism respectively.

Research method	Qualitative
Theory and research	Inductive
Ontology	Constructionism
Epistemology	Interpretivism

Table 3.5 Synthesis of Research Strategy

Combining the research strategy with the proposed study, the research will be conducted in the following aspects;

- The researcher aims to generate a new theory that will promote a new technological approach for logistics service providers in optimizing their daily operation.
- The researcher attempts to elaborate the specific activities of inefficiency and then induct the statistics of their general capacity usage.
- In terms of the ontological belief, the researcher will go in-depth understanding of participants' real life about the social interactions and explores the causes of inefficiency.
- The researcher casts light on how the new theory works and obtains the rich information about the perspectives and attitude from the participants.

By preceding integration of research conduct, qualitative research is of compliance with the beliefs of researcher and the objectives of the study.

3.4 DATA COLLECTION METHODS

Data collection methods enable the researcher to answer the stated questions by gathering and analyzing the systematic and appropriate data. As for the data sources, primary data and secondary data are two different types of sources (Ghauri & Grønhaug, 2005).Secondary data, which is the information collected by others, could be completely different from the researchers' due to the diverse purpose from other scholars, but it is time and cost saving. Primary data, collected by researchers themselves, is primarily oriented toward answering research questions. Table 3.6 shows the main distinctions between two data sources.

	Primary	Secondary
Source	Ordinal	2nd hand
Collected	Researcher	Others
Focus	Our research problems	Their agenda
Reliability	High	Questionable
Accuracy	In own hands	Questionable
Time & cost	High	Low
Research value	Specific insights	Tools, Context, Theory

Table 3.6 Difference between Primary and Secondary Data Sources
(Source: Ghauri and Gronhaug, 2005)

Interviews and questionnaires are principal approaches to collect the primary qualitative data. This data should be collected from representative groups who are coherent the research conceptual theory and objectives. Hence, the sampling method needs to be applied on the proposed research.

Sampling frames

Since qualitative data within the context must be deeply understood, some background information should be collected first, and then the contextual framework needs to be established and understood (Collis & Hussey, 2009). Data about the content might be associated with time, location and economic influences. With respect to the proposed research, it focuses on mobile commerce effects within the Owner-Operators in New Zealand. In spite of that, we cannot interview all the logistical independent contractors

in New Zealand. Some elements, such as business environment, economic factors and location, affect who will participate in the research project. Diagram 3.1 shows the contextual and sampling framework for the research.

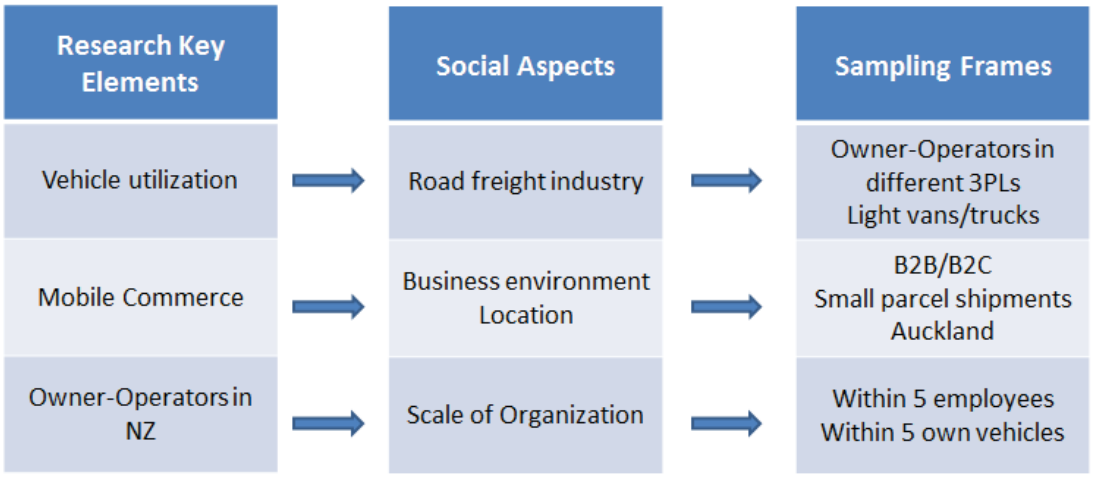


Figure 3.1 Contextual and Sampling framework

In terms of the Purposive or Theoretical sampling approach, researchers intend to use their own perspective and knowledge to determine which units will be appropriate to the study area (Collis & Hussey, 2009). From diagram 3.1, vehicle, m-commerce and Owner-Operators are three key elements in the research, which also determine the specific sample selection in New Zealand context. As the research objective is to enhance the vehicle utilization, 3PLs in the road freight industry is the target sampling population. Furthermore, mobile commerce is a booming cutting-edge technology, and it is much appropriate for business market with high turnover or tight schedule. Accordingly, 3PLs who provide the service to B2B/B2C market in metropolitan area are more likely to improve their efficiency via m-commerce. Therefore, the sampling frames will be selected in Auckland city for Owner-Operators who serve the 3PLs or commercial/consuming customers independently. Apart from that, the operations managers, coordinators or dispatchers, etc. in the logistics enterprise recruiting Owner-Operators could be the targeted respondents as well in the interviews.

Interviews

Interview is an approach for collecting data from the selected participants. There are three primary types of interviews: structured, semi-structured and unstructured (Myers, 2013).The main difference among these interviews is the amount of pre-formulated questions used by researcher and whether there is a time limit. Normally, structured interviews are set in a fixed time and strictly regulated with the sequence of predetermined questions. In contrast, unstructured interviews have no set time limit, and they are more likely to be open-ended to excavate the participants' answers in more depth.

In this research, semi-structured interview will be selected, because some pre-formulated questions might be used, the researcher needs to probe the profound causes of inefficient vehicle utilization. When the logistical mobile app is demonstrated as an approach to enhance the vehicle utilization, the perspectives and attitudes from participants will be collected.

Type	Example	Useful for	Not used for
Open question	Tell me what happened when ..?	Most openings to explore and gather broad information	Very talkative people
Closed question	Who did you consult ..?	Getting factual information	Getting broad information
Multiple questions	More than one in a sentence	Never	Never
Probes	What happened next?	Establishment of sequence of events or gathering details	Situations beyond the interviewee's scope
Comparison questions	Do you prefer weekly or fortnightly team meetings?	Exploring needs and values	Unrealistic alternatives
Summary questions	So, I am right in thinking that the main issues are ..?	Avoiding ambiguity, validating data and linking answers	Premature or frequent use

Table 3.7 Types of Interview Questions

Source: (Ghauri & Grønhaug, 2005)

Table 3.7 illustrates some types of questions used in the interviews. Some probes, open and closed questions will be stated; during the interviews, the ways of questions might be modified in terms of different interviewees. According to the research strategy of the

study, proposed interviews could be divided in three stages:

- Stage one (Research objective and importance)
  i. At the beginning of the interview, in order to motivate the interviewees to bring out more information, the researcher will explain the objectives and benefits in an attempt to help them improve their vehicle operational efficiency.
  ii. Elaborate the specific behaviors of inefficient capacity utilization, such as empty run, part load shipment, time waste for acquiring new business, etc.
  iii. Conduct a survey to collect some of their background and profiles (years of operating, vehicles, contracted relationship, etc.)

- Stage two (Interactions for investigating the causes of inefficiency)
  i. Deeply communicate with interviewees to obtain the rich information from their daily operations and conclude the primary causes resulting in poor performance.
  ii. Some open questions and probes will be stated:
    1 How many hours do you work on average per day?
    2 What is the running model of your daily operation?
    3 What are the reasons of failure dispatch?
    4 What might influence your vehicle operational efficiency?
    5 How many jobs do you finish per day on average?
      5.1 Have you planed the route for each delivery? Why or why not?
      5.2 Are there any connections between each job (locations or customers)?
      5.3 What is the proportion of full-load/part-load/empty-run on average?
      5.4 Could you pair the shipments from one job to another? Why or Why not?

6 What are the reasons of empty-run or part-load shipments?

7 What are the current approaches of mitigating empty-run or part-load shipments?

8 How much time do you wait for another new business?

9 Have you encountered the situation of unscheduled shipments? How often are they?

10 How do you deal with the fluctuated customer demand?

11 Have you ever cooperated with your competitors? Why or why not?

- Stage three (Perspectives of logistics mobile app)

i. Take a similar mobile app in other region for demonstration to elaborate how it works on improving the vehicle utilization.

ii. Explore the interviewees' opinions, feelings and attitudes about the logistical mobile app, and some open questions will be stated:

1. What if some customers in Auckland are willing to post the business requests on the mobile app, do you think it is an effective channel for acquiring business opportunities?
2. What if you are concerning about the empty running, do you think the mobile app can help you find some sales leads for back journey?
3. What if customers could timely master your location and capacity by the mobile app, do you think it is useful for enhancing the efficiency?
4. How would you characterize the importance of acquiring the customer demand as early as possible? Do you think the mobile app can help you?

iii. Sum up the perspectives for how they feel the mobile app.

When the interview is finished, a brief summary report will be provided to the participants, and the following research output will be distributed to the respondents as well. After the whole process of data collection, all the data will be filing, categorizing and statistics for the preparation of next step in data analysis.

3.5 DATA ANALYSIS

During the process of data analysis, it needs to be measured in two processes: conceptualization and operationalization. Conceptualization is the process to build up a construct by giving it a theoretical or conceptual definition (Neuman, 2006). For qualitative research, operationalization often precedes conceptualization process. During the data analysis process in empirical and operational level, a new conceptual definition will be formulated in the level of theory. Details are shown in diagram 3.2.

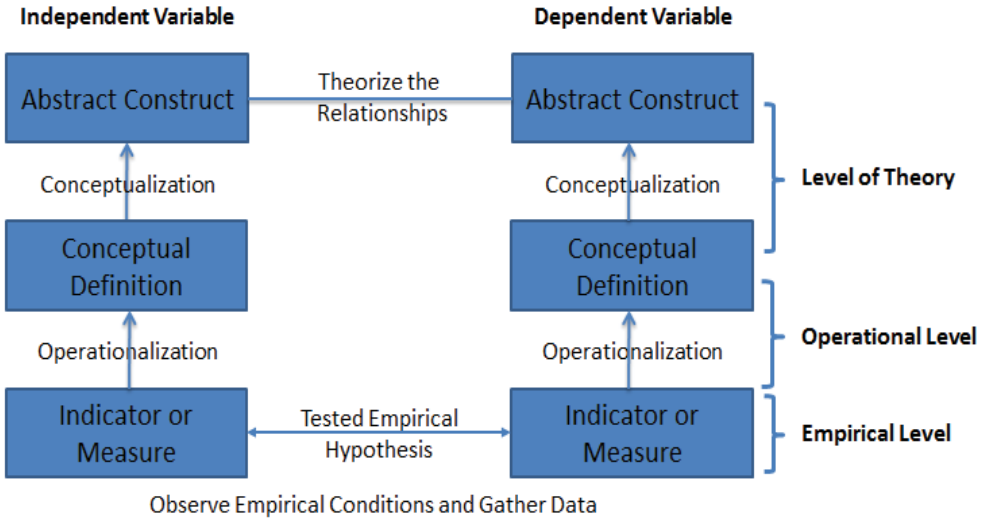


Figure 3.2 Inductive Measurement Process
(Source: Based on Neuman, 2006)

In this research, the empirical level of inductive measurement process aims to observe and gather the data of vehicle utilization. While the observation of daily capacity usage, the conceptual definition of intrinsic and extrinsic factors impacting efficiency is forming. Subsequently, the functions of logistical mobile app will be elaborated, and through an interactive process with Owner-Operators, the researcher will obtain the shared feelings, understandings, and perspectives for this logistical mobile app. Ultimately, the abstract construct will be operationalized by theorizing the relationships between mobile commerce and the causes of influencing inefficient capacity usage.

As the methodology of this research is qualitative, unlike numeral data, qualitative data mostly are multiple forms of text, sounds, or images. According to ‘Data Analysis Spiral’

(Creswell & Plano Clark, 2007), researcher needs to organize, analyze and links data measurement to the concept. In conclusion, represent and visualize them in matrix, tables or narrative forms.

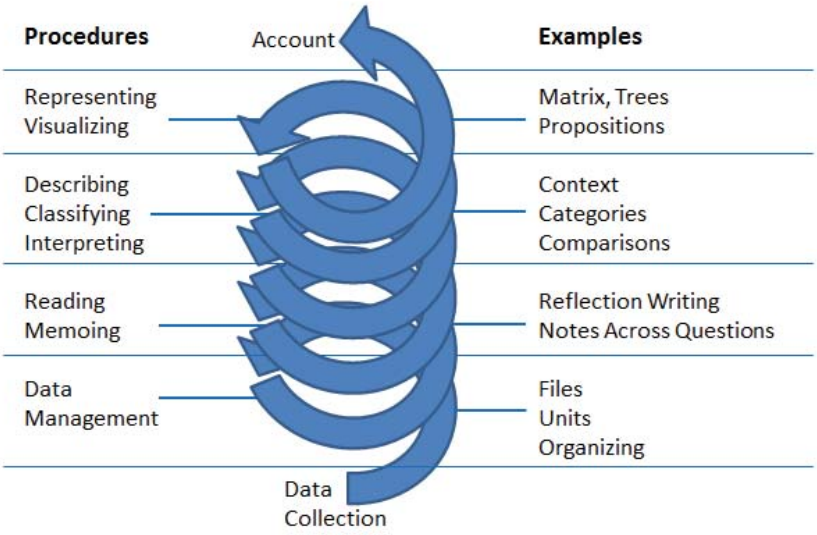


Figure 3.3 Data Analysis Spiral
Source: (Creswell & Plano Clark, 2007)

The collected describing and interpreting data needs to be categorized and summarized in text or visual images. In this research, during the interviews with participants, the specific activities and the causes of inefficient vehicle utilization might end up with over twenty categories. Hence, some key aspects which are logically consistent with the topic should be preserved for reference. For instance, some causes could be clustered in extrinsic or intrinsic factors, and some objective causes should be excluded like chemical cargos.

The categorized data should be related to the theory of the research. According to the Narrative research analysis and representation approach (Clandinin & Connelly, 2000), the researcher will retell the story based on three narrative elements: interaction (3PLs, customers and competitors), continuity (past, present and future), and situation (technological and economic environment). Eventually, the outputs or findings of the research will be presented by the analysis of cause/effect diagram and the interviewee's attitudes to mobile app, the researcher will construct the theory to explain the potentials

of mobile commerce in improving the vehicle utilization. The conceptual model and theory might be modified in terms of the data analysis.

Reliability and Validity

Reliability means consistency and validity implies truthfulness, and both of them are core issues throughout the measurement (Neuman, 2006). In this research, interview with the selected Owner-Operators is an approach to record the consistency. In order to improve the reliability, the researcher should conceptualize constructs clearly, and insure all the participants understand the specific performance of inefficient vehicle utilization and some social interactions will affect the efficiency. This will improve stability reliability so that render some similar causes regardless of their different experience in different time and conditions. With regard to validity, this research should consider 'Internal Validity' and 'External Validity'. Internal validity requires authenticity, which concerns that the viewpoints of participants (Owner-Operators in this research) are honest and truthful reflections from their daily experience. In addition, external validity concerns whether it is able to generalize the outcomes from particular groups to general public. The theory of this research is based on previous studies and it is the outcome from inductive experience of relevant insiders in logistics industry. Therefore, it can be applied to other settings with different contextual conditions.

3.6 ETHICAL CONSIDERATIONS

During the business research, ethical behaviors ensure all relevant participants including the researcher will not be harmed from research activities (Cooper & Schindler, 2008). In order to safeguard the interviewees, the researcher will follow the guidelines as follows:

1. Explain the study

   Before the interviews, I will introduce myself, and explain the objectives and benefits of the study without any bias to avoid deception. Besides, the reasons of their involvement and the research process will be introduced.

2. Explain the rights and protections

The contents of the interviews are related to their operational efficiency and cooperation with their customers and competitors. This might be the sensitive elements with respect to the reputation of individuals and organizations. The research will protect the privacy and confidentiality of the participants and their organizations. Again, I will restrict access to any identifying features (names, addresses, phone numbers, etc.) from respondents and transform them in anonymous format.

3. Obtain informed consent

   Oral agreement will be implemented to require the permission before the proposed interviews. In addition, audio or visual recording could be used unless obtain the approval of interviewees. When the interview is completed, respondents will get the debriefing which involves the summary of the interview and post research sharing of results.

Moreover, according to the Code of Ethical Conduct (Massey University., 2013), a plan will be developed to minimize the following risk of harm:

1. Participants

   As the research aims to refine the causes of inefficient vehicle utilization, some participants may feel embarrassed or stressful as soon as talking about their poor efficiency. Hence, I will emphasize the importance and the benefits of the research to put them at ease. Meanwhile, I will also concern the harms of pain, fatigue, emotional distress, cultural dissonance and exploitation

2. Researchers

   I will consider the safety factors when interviewing alone, and protect my private information.

3. Groups/Communities/Institutions

   As the mobile app is a new technology connecting service providers and customers directly, it might have potential interest conflicts to some traditional agents cooperating with the participants (e.g. paper advertising companies, call centers).

Therefore, the confidentiality of all involved groups/organizations will be protected.

4. Massey University

In this research, reputation of the institution will be protected.

Apart from that, unethical research analysis needs to be avoid, such as “changing data interpretations, creating false data, interpreting data prejudicially and omitting sections of data analysis and conclusions” (Cooper & Schindler, 2008).

3.7 CONCLUSION

In this chapter, the first section introduces the researcher’s perspectives of Ontology and Epistemology. The research concentrates on analyzing the causes of inefficient vehicle utilization, and then takes the logistical mobile app as an approach to alleviate the relevant factors, thus the interpretivist epistemology and constructionist ontology as the belief of the researcher is applied on the qualitative research strategy. Due to the characteristics of mobile commerce, geographic and economic features in New Zealand context, Owner-Operators, whose business focus is on B2B/B2C market in Auckland, are appropriate to be the targeted respondents. As the qualitative data collection method, semi-structured interviews are planned to gather the information of experience, perspectives and attitudes from participants. Through the inductive measurement process, after refining and categorizing data, the conceptual definition of influencing vehicle utilization factors has been formed. Ultimately, the abstract construct is operationalized by theorizing relationships between mobile commerce and decisive elements. Throughout the whole research activities, data reliability and validity needs to be considered, and ethics are norms of guiding the moral behaviors to mitigate the potential harm to participants, researcher, organization, institutions and Massey University.

Due to the constraints of time and resources, qualitative research method is selected rather than the quantitative method which needs to go in depth to test the theory of mobile commerce in one case. Although the data are collected and analyzed from regional groups of courier Owner-Operators in New Zealand, it is relatively representative.

4.LOGISTICS TECHNOLOGY – MOBILE APPLICATION

Logistics Technology facilitates the logistics activities relating to the flows of information and physical movement of goods, and it could be the innovation of transport means or sophisticated IT systems (Wood et al, 2014). With the broader adoptions of smart phones and portable electronic devices, Mobile Application, as a computer program running on mobile equipment, is much accessible than traditional massive information systems (IS) for individuals and companies. This sector will introduce how the mobile app plugs in the logistics market, notably for the courier industry in New Zealand. It is also significant to establish an entire picture of this technology before data collection and analysis.

4.1 ELABORATION OF THE MOBILE APP

Due to the undeveloped mobile app exclusive for couriers in New Zealand, this research will take Uber (the biggest mobile app adopted in taxi industry) for an instance to introduce how it changed the traditional public transport system, and illustrate the relevance between the logistics market.

Uber Technologies Inc. is an American international transportation network company. Consumers with smartphones submit a request of a trip via Uber app, and then the Uber drivers will use their own cars to carry the passengers (Rusli, Evelyn, 2014). By May 28, 2015, Uber has expanded the service to 58 countries and 300 cities worldwide. In April 2014, Uber announced a new pilot testing service called Uber Rush in Manhattan for courier parcels delivery.

Specifically, when the passengers are going to book a cab by the Uber app, their locations are pinpointed with the GPS on their phone. They can choose what kind of car they need (e.g. normal taxi, private passenger car, or limousine). In terms of the distance, the estimated price of the trip will be calculated automatically whilst the passengers are told how long they will need to wait for the taxi’s arrival. The instant location of the booked Uber car is shown on the map as well. In addition, the identity of their Uber driver, such as the name, profile picture, contact number, and previous customer

evaluation. When the ride is finished, it is unnecessary to pay cash, as the fare will be debited on the credit card, and a breakdown of the costs will be emailed to the passengers.

The mobile app itself is only a computer program, while the concept of Uber is on the basis of collaborative consumption in sharing economy. It provides the passengers and crowd-sourcing drivers with an online platform to satisfy the requirement respectively. It is a triple-win situation amongst the passengers, drivers, and public. As for customers, they are expecting the cheaper and faster service rather than grabbing a cab by luck. For the drivers, there are two types of the Uber drivers, traditional taxi drivers and crowd-sourced drivers. Traditional taxi drivers do not necessarily drive the empty vehicle throughout the city to catch the customers so that they can save the fuel cost and increase the vehicle utilization. The crowd-sourced driver means the citizen who has a car and leisure time can share the ride with peers requesting the same route. Consequently, Uber service is able to offer the lower price compared with the conventional taxi service. Apart from that, the society is also benefit from declining traffic congestions theoretically due to no extra traffic created by ride sharing.

Currently, it is controversial for Uber service in many cities because of the safety, user privacy, and unfair competition to taxi industry. This research focuses on the vehicle utilization in couriers industry, so the above mentioned problems will not be discussed.

4.2 MOBILE APP ADOPTION IN COURIERS MARKET

Nonetheless, the concept and some functions of Uber are applicable to the logistics market. Regardless of passengers or shippers, they are pursuing the faster and cheaper service. While in logistics market, shorter lead time and lower price are the contradictory factors to some extent. It is understandable that the logistics service providers are compelled to use the exclusive resource to hit the intense deadline. The underutilized capacity and unshared cost will be taken into the expense of customers. The crowd sourcing mobile app like Uber is able to make this exclusive capacity more accessible to the public. It is benefit from the rapid development of Web 2.0, social media and internet collective intelligence. Crowdsourcing was fist coined by Jeff Howe

(2006). Howe (2006) defined it as “the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and general large) network of people in the form of an open call. This can take the form of peer-production (when the job is performed collaborative), but is also often undertaken by sole individual.” The professional Owner-Operators or normal citizens might improve the profitability by sharing their residual capacities whilst the customers can get the cheaper and faster delivery service.

Actually, some Owner-Operators have realized the power of social networks and they are trying to find some back loads from social media or auction website. Table 4.1 is the capture of a backloads finding website in New Zealand.

41 entry(s)

Id	Pickup / Delivery	Note
1238	**Pickup:** 27/10/2015 Wellington - Wellington **Delivery:** 28/10/2015 Auckland City Suburbs - Auckland	I have approx 15m3 space available Wgton to Auck. Please call/text Rob for a reasonable backload quote.
1447	**Pickup:** 26/10/2015 Auckland City Suburbs - Auckland **Delivery:** 27/10/2015 Wellington - Wellington	I have approx 10m3 spare going Auck to Wgton. Please contact Rob for a backload quote.
1563	**Pickup:** 19/10/2015 Auckland City Suburbs - Auckland **Delivery:** 20/10/2015 Wellington - Wellington	I have approx 6m3 space available Auckland to Wgton. Please contact Rob for a reasonable backload quote.
1684	**Pickup:** 30/10/2015 Tauranga - Bay of Plenty **Delivery:** 30/11/2015 Auckland City Suburbs - Auckland	Regular runs from Tauranga to Auckland
1685	**Pickup:** 30/10/2015 Auckland City Suburbs - Auckland **Delivery:** 30/11/2015 Whangarei - Northland	Regular runs from Auckland to Whangarei
1686	**Pickup:** 30/10/2015 Whangarei - Northland	Regular runs from Whangarei to Auckland

Table 4.1 Backloads Finding on Internet

It shows that some carriers provide their schedules, routes, and loading space on internet

to find the freights. The freight rates and cargo details need to be further negotiated. However, most of the carriers posting on this website are running the regular schedules and intercity itinerary.

This kind of website is short of quick responsiveness, visibility, agility and flexibility. However, when the mobile commerce is employed in couriers market, it enables customers and carriers to interact in real time without the constraints of time and space. Again, this study uses Uber Rush (a testing Uber courier service) for example to compare with the traditional courier service.

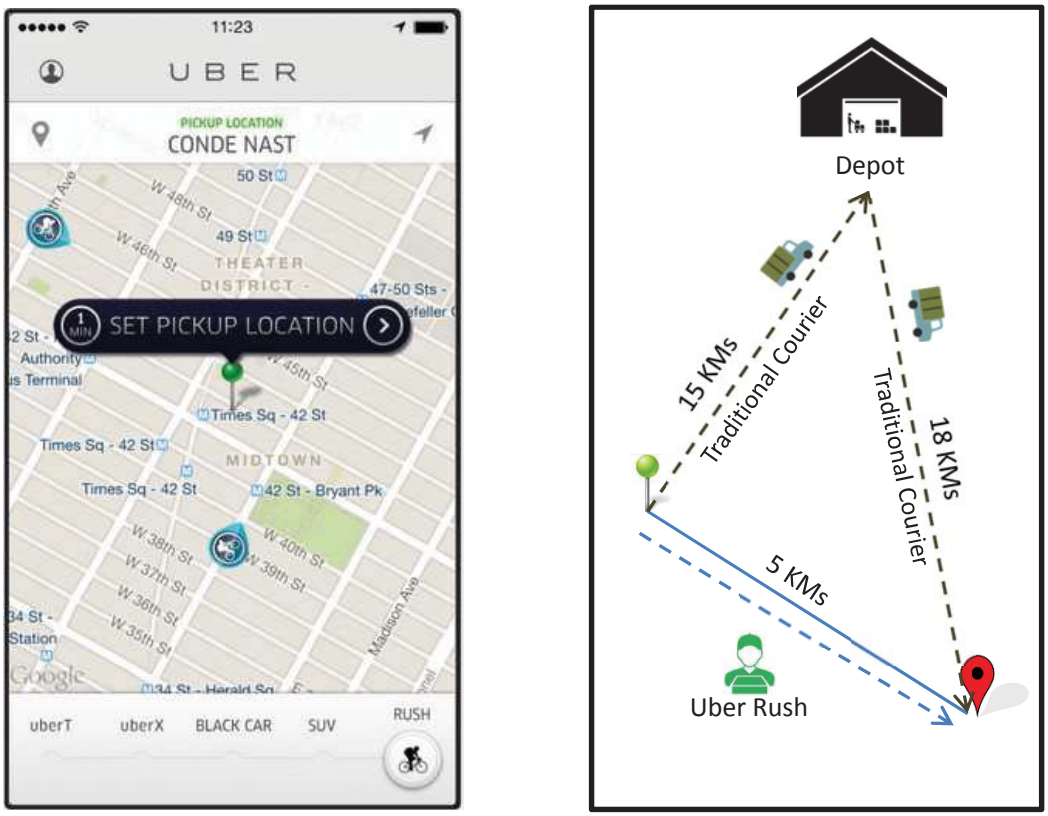


Figure 4.1 Uber Rush Service V.S. Traditional Courier Service

Using the Uber Rush, the customers only need to specify the pick-up location and cargo details on the mobile app, and then they can enlist the Uber messengers who are nearby the pick-up location to fulfill the trip. Individuals with cars, SUVs or bikes could be the Uber messengers; even they can deliver the cargos just by walk. It is quite convenient and fast especially for last mile delivery. As for the messengers, their locations are moving every minute, the app will push an alert of different delivery request in terms of

their varying locations. However, in comparison to the mainstream courier service, Uber style package delivery service is straight forward. For instance (Figure 4.1), a customer requests a delivery which is within 5 kilometers, if he or she uses enlist the job via the mobile app. The Uber messenger comes to pick up the cargo and deliver to the destination. The job might be finished within 30 minutes. While for the traditional courier service, the customer has to contact the call center of the company or hand it in the specific branch. In Figure 4.1, the traditional courier comes to pick up the cargo, and brings it back to the depot where maybe 15 kilometers away. After the sorting work and cargo reallocation in the hub, the parcel might be delivered in the next half day for another 18 kilometers. In this example, there are 33 kilometers ineffectual and several hours slower than Uber Rush service.

Apparently, above example is merely the comparison between the logistical mobile app service and traditional ‘depot-to-point’ courier service. In reality, there is the courier service of ‘point-to-point’, but the price might be much higher if the delivery is within one hour. When the mobile app used in logistics market, it can offer the instant communication, real time tracking, and electronic transaction. For the service providers, although they are the forms of crowd sourcing, the professional Owner-Operators can become the members as well, and it is another channel to increase the incomes.

This chapter attempts to describe the picture of mobile app adoption in couriers market. Through the case study of Uber service, it is much easier to understand how the mobile app works in logistics service. By a simple comparison to the traditional courier industry and some finding loads website, it is explained more deeply for the advantages of the relevant mobile application.

5.DATA ANALYSIS

This chapter introduces the major findings by analyzing the empirically qualitative data, and illustrates in visual expressions of statistics synthesis according to the outputs of the interviews and questionnaires. The overview of participants' backgrounds and profiles is explained first, followed by the summarizing results of the vehicle utilized performance. On the basis of their daily operations, some major causes and effects will be inducted. These factors are the drivers to cohere with the potentials of the mobile app. This type of mobile app connects customers, courier companies and Owner-Operators in real time by mobile technology. Customers can directly communicate with the Owner-Operator who is exactly delivering their cargos. Meanwhile, Owner-Operators are able to search for the appropriate business within specific radius. Internally, the courier companies could locate their contractors timely by this application. As a new theory of this integrated information platform, the insights of respondents are collected, whilst the comprehensive description will be presented clearly. The major findings of the research are the principal reasons of inefficient vehicle utilization, and how the respondents perceive the practical effects of the mobile app on efficiency enhancement. This will be elaborated at the end of the sector.

5.1 OVERVIEW OF DATA COLLECTED

Face to face interviews were conducted to collect the data, in keeping with the qualitative research method. As interviews concentrated on vehicle utilization within courier Owner-Operators, individual Owner-Operators and operational team staff with responsibility of transportation were invited to participate in the interviews. In-depth interviews were conducted in July 2015, and in-depth discussions were carried out for approximately one hour with each interviewee.

At the end of interviews, all the details and the answers of the questionnaires were written-recorded whilst reconfirmed with the interviewees, in order to protect the reliability of the data and minimize the bias from the researcher. When all the interviews were completed, the briefing summary report with the results and key findings had been submitted to the participants.

There are three main parts of the research data. The first part is the profiles of the respondents. According to some of their backgrounds, it is shown the generic situation of Owner-Operators in New Zealand road freight market. The second part is the information of their daily operations, the causes of part-load shipments or empty-run, and their current approaches of mitigating the poor performance. During the interviews, after the visual demonstration of the mobile app, the third part of the data is to present their attitudes and perspectives of its effects.

5.2 SAMPLING FRAME

The questionnaires are distributed by face to face interviews, and issued to fifty respondents. There are thirty valid respondents and the valid response rate is 60%. Among these thirty respondents, there are eighteen Owner-Operators and twelve staff in Operations team (including managers, coordinators, dispatchers, etc.).

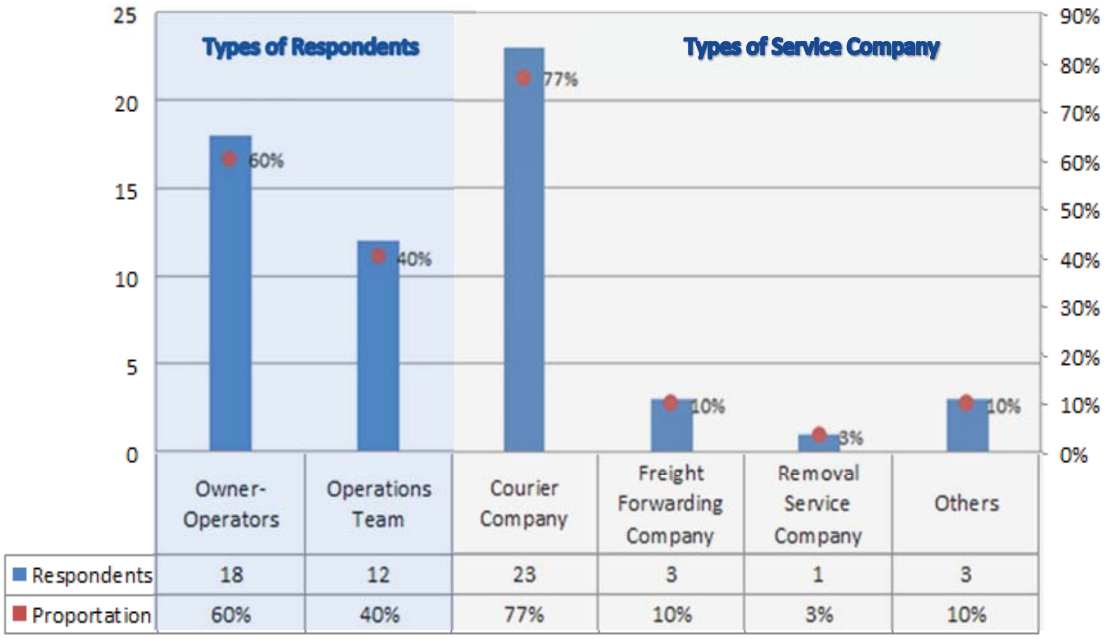


Figure 5.1 Sampling Frame

As is shown in Figure 5.1, the respondents come from different types of companies, 77 percent of them serve at Courier companies, and other 20 percent of them come from Freight Forwarding companies and other companies respectively. Although these 20 percent of the companies do not mainly run the business for courier market, they also

provide the courier service, and the interviews were conducted on the focus of their Owner-Operators providing courier service.
As the confidentiality of respondents is protected, there is not specific information of themselves and their companies.

Even though there are twelve respondents who are not Owner-Operators, their companies hire the Owner-Operators as independent contractors providing delivery service. Meanwhile, they are the supervisors of the contractors and familiar with their operations. Therefore, the results of Operations Team are also representative and valuable for reflecting the situation of Owner-Operators.

According to the responses of the respondents, in New Zealand, Owner-Operators are the primary resources of transport capacity for couriers companies rather than company owned vehicles and employed drivers.

5.2.1 OWNER-OPERATORS IN NEW ZEALAND

As an Owner-Operator who is going to be an independent contractor for a courier company, there are some prerequisites that need to be fulfilled.

According to the instructions of officially published courier contracts from six mainstream courier companies (due to the commercial sensitivity, the relevant contracts will not be shown in the research) in New Zealand, the common conditions and requirements for a new contractor are summarized in Table 5.1.

Initial Setup Requirements		Ongoing Cost (monthly)	
Category	**Details & Cost**	**Category**	**Details & Cost**
Vehicle	less than 10 years, or under 80,000 kms ($24,000 - $52,000)	Fuel	Depends on vehicle type and runs ($700 - $1,200+)
Redecoration	Painting/Sign-writing/Logo ($400 - $1,000)	Communication Fee	Phone + data ($40 - $250)
Uniform	Required ($170 - $600)	Uniform	Optional (annual renewal) ($14 - $50)
Hazardous Substance Endorsement	License (including training) ($150 - $360)	GPS/RT Rental PDA Rental + Data Pager	Any potable devices for lease ($40 - $130)
Scanner	Required ($1,600 - $3,000)		
GPS/RT Combo Unit Installation	Required ($200 - $378)		
Pager	Optional		
Insurance	Required ($1,500 - $3,600)	Insurances*	Varies
Living Expenses*	Varies (4-8 Weeks depending on start date)	Tax*	Varies (depends on runs)
Total Setup Costs (Approx)	**$28,020 - $60,938**	**Total Ongoing Costs (Approx)**	**$1,000 - $2,000+**

Table 5.1 General Situation of Owner-Operators

(Remark: Some categories vary depending on different companies)

For the initial setup requirements, Owner-Operators must provide their own vehicle which could be a passenger car, light van or truck, and normally it is required less than 10 years old or under 80,000 kms mileage. Accordingly, the vehicles are needed to be redecorated with the color, signs, and logos of the companies. Certainly, some large scale courier companies will provide the Owner-Operators with the concessional terms of purchasing vehicles. However, the costs of vehicles account of the biggest amount of setup cost. The majority of the respondents indicated the purchasing cost of the vehicle was a huge burden when they commenced this job. And none of the other jobs required the employees to pay a fortune before they got the salary.

Some courier companies also require the Owner-Operators to purchase the uniform, scanner, pager, and GPS/RT combo unit installation. Apart from that, in order to run the business legally, they must acquire the endorsement for hazardous goods delivery and commercial insurance. Furthermore, once they commence the running, they will not be paid until the 20th of the following month, and that is around 4 to 8 weeks depends on the starting date. So they must prepare to have some funds put away to cover the living expense during that period. Some respondents believed that it was still a lucrative industry, so they were willing to engage in courier service in spite of accepting the rigorous conditions.

As a result of different runs, ongoing costs vary by different running distance and area. In other words, their incomes are different. Even if there is minimum paid (about $140 - $170 per day, 22 days per month), sometimes the incomes might be a huge discrepancy. However, although the Owner-Operators have contracted relationship with the companies, they are treated as self-employees; they invest themselves, and take the risk respectively. Hence, in order to augment the ROI (Return on Investment) and cover the high cost of running, they have to raise the incomes by means of enhancing the vehicle utilization.

5.2.2 PROFILES OF RESPONDENTS

As is shown in Figure 5.2, sixty seven percent (67%) of the respondents indicated that Owner-Operators themselves or Owner-Operators who had been serving their companies have more than 4 years' operating experience as a contractor. In the respondents, all of Owner-Operators have three or less than three vehicles, and 24 of them (accounting for 80%) have only one vehicle for the service. The types of the vehicles are light van or light truck, and the light vans are the dominant transport means. This shows that light van is more appropriate to their business model of small parcel delivery.

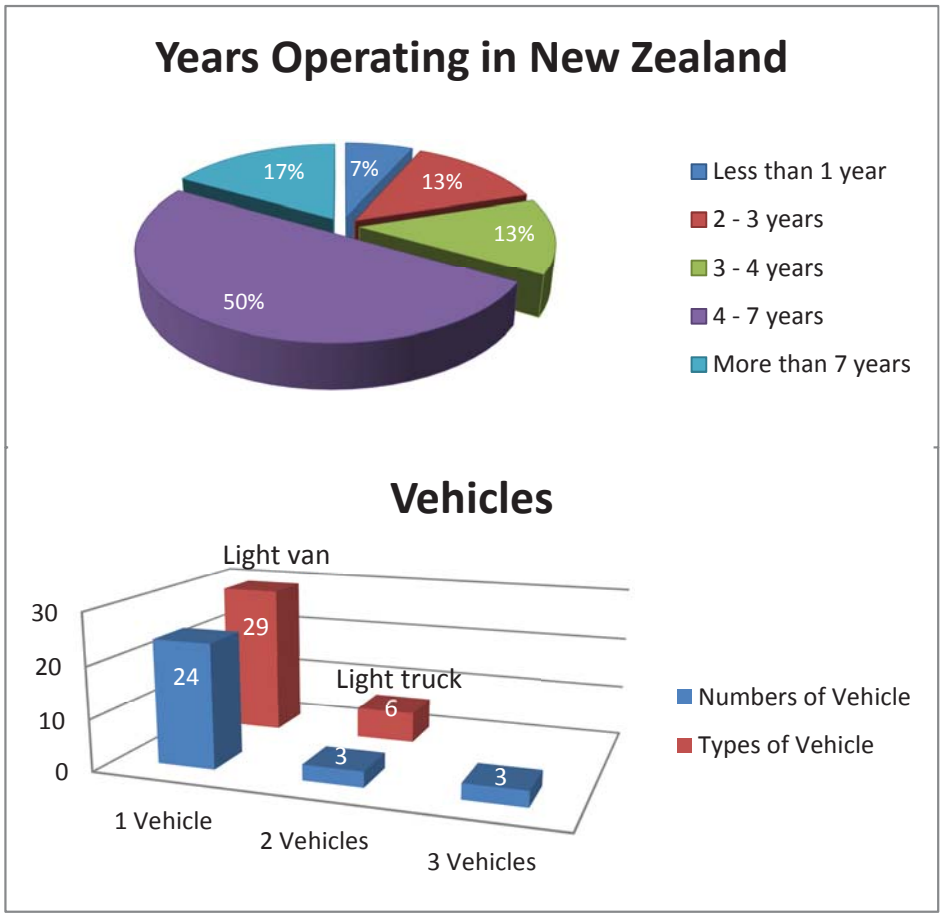


Figure 5.2 Overviews of Owner-Operators

Regarding the contracted relationships, from Figure 5.3, eighty seven percent (87%) of the respondents interpret that Owner-Operators only work for one company, which means that only they can work for that company exclusively. In spite of the independent

contractors, the policy of the company prohibits them accepting other jobs from competitors or privately during the working time.

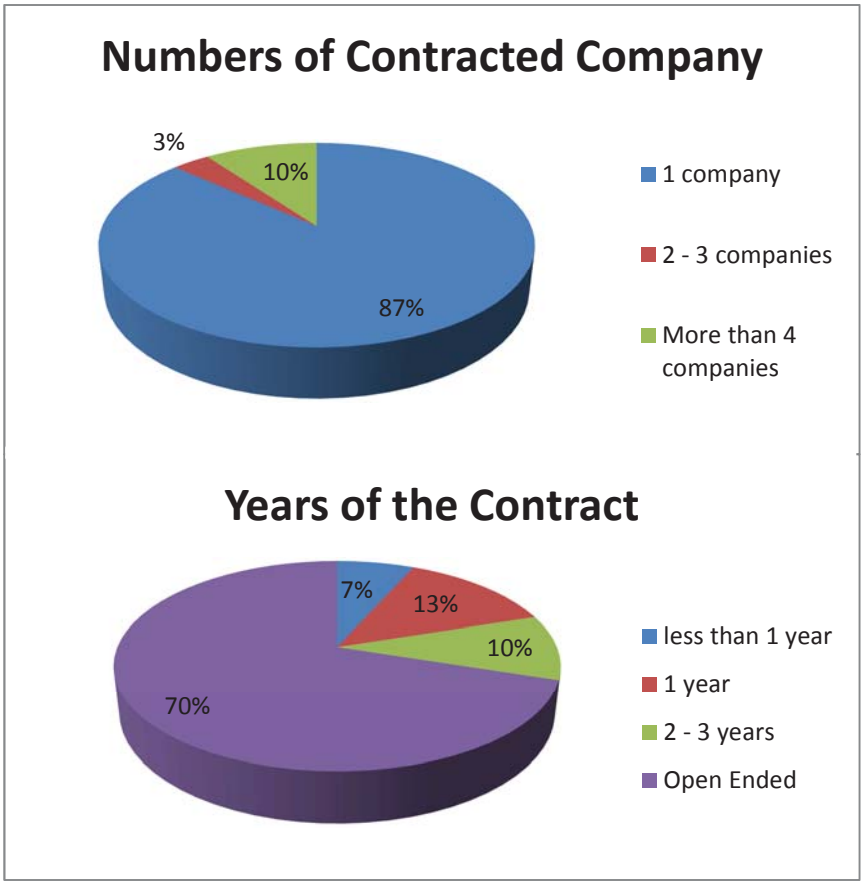


Figure 5.3 Contract Relationships

In addition, seventy percent (70%) of the Owner-Operators have permanent relationships with the cooperated companies, and the remainders have to renew the contracts depending on the expired date. Despite the open ended contacts for most of the Owner-drivers, the companies will evaluate their annual performance to adjust their operations for the purpose of protecting the service quality.

Under this cooperative mechanism, the respondents pointed out that they would spare no effort to their work, because the approach of earning more was trying to get the sweet run (commercial territory) or obtain more jobs from operations manager. They said they could start working at 10:00 am and just worked 5 hours per day, but if they did this, the operations manager would keep decreasing their jobs so that they could not maintain the cost. Even though the Owner-Operators were not been fired, they would

leave because of earning nothing.

5.3 DAILY OPERATIONS OF RESPONDENTS

Apparently, vehicle utilization hinges on the efficiency of daily operations. Different running model, customer type, and responsible area will directly influence the Owner-Operators' running distance, idle time, workload, routing, and other KPIs, which results in varying performance and income.

5.3.1 RUNNING MODEL

First and foremost, running model is the crucial parameter to distinguish two different types of Owner-Operators. In Figure 5.4, there are 70% of the Owner-Operators providing the service of 'depot-to-point', and the remainder is 'point-to-point'.

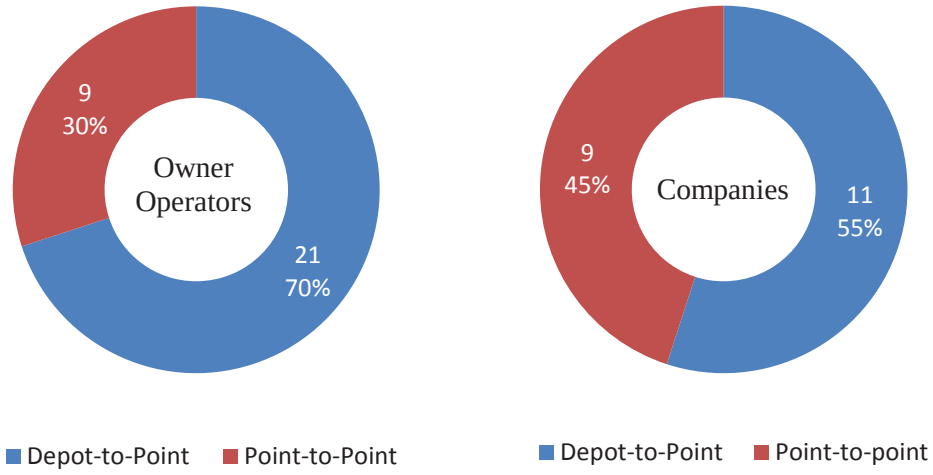


Figure 5.4 Proportion of Running Model

In addition, among these twenty companies, the numbers of the companies which provide 'depot-to-point' service are slightly higher than the 'point-to-point' service. None of the companies provide both services at the same time; even though there are six companies belonging to two same groups.

As for the model of 'depot-to-point', couriers have to pick up the cargos from their local

depot, and then dispatch the parcels to a variety of customers in their nominated territories. Vice versa, they pick up the cargos from customers and bring them back to the depot afterwards. The round-trip could be several times a day. On the other hand, for the ‘point-to-point’ service, generally there are not regular routes or customers, so the couriers travel all the corners throughout the city without any limitation. Moreover, due to the unique job between location A and B, time window is much tighter than the service of ‘depot-to-point’. Accordingly, on the basis of proximity principle, dispatchers or customer service will assign the appropriate work to them by their current locations.

According to Figure 5.5, the biggest distinction between two services is the routings. Couriers, who provide ‘depot-to-point’ service, are inclined to plan the routes well as a result of getting all the destination details before they commence delivering, while the routes are normally irregular for ‘point-to-point’ couriers because of the random delivery orders and their varying locations.

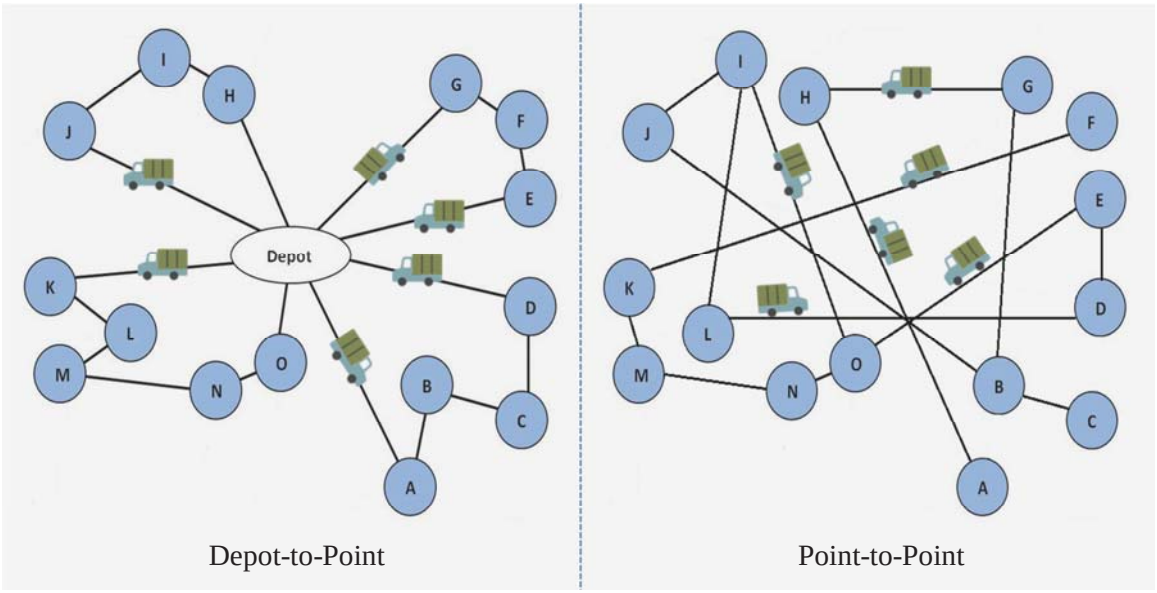


Figure 5.5 Running Models

Consequently, it is conceivable that, for ‘depot-to-point’ couriers, they are familiar with all the streets and roads in their territories because of the limited customer amounts and daily repeated running routes. Meanwhile, it is much easier for them to build up the good relationships with the customers due to the contacting on a regular basis. In other words, they can work more actively. Some experienced ‘depot-to-point’ couriers

showed that they could even estimate the income per month. While the ‘point-to-point’ couriers work more passively, all the jobs, routes, customers and time are arranged by the company.

5.3.2 KEY PARAMETERS OF DAILY OPERATION

Time

No matter which types of the service model, the Owner-Operators work for five days a week (90% of the respondents), and more than nine hours, even more than twelve hours a day (total 90% of the respondents). For the duration of such a long working time, not all the couriers work in the full hours. There is a huge discrepancy of the Idle Time between two different running models. The Idle Time here means objectively unproductive time (Bretzke & Barkawi, 2013). It is caused by objective situation like waiting for the next job, while the subjective situation will not be taken into account, such as traffic accident, lunch break, etc. According to Figure 5.6, 95% of the 'depot-to-point' service providers have no idle time during the working hours, while the couriers of 'point-to-point' service (approximately 90%) have varying degrees of idle hours between tens of minutes and three hours.

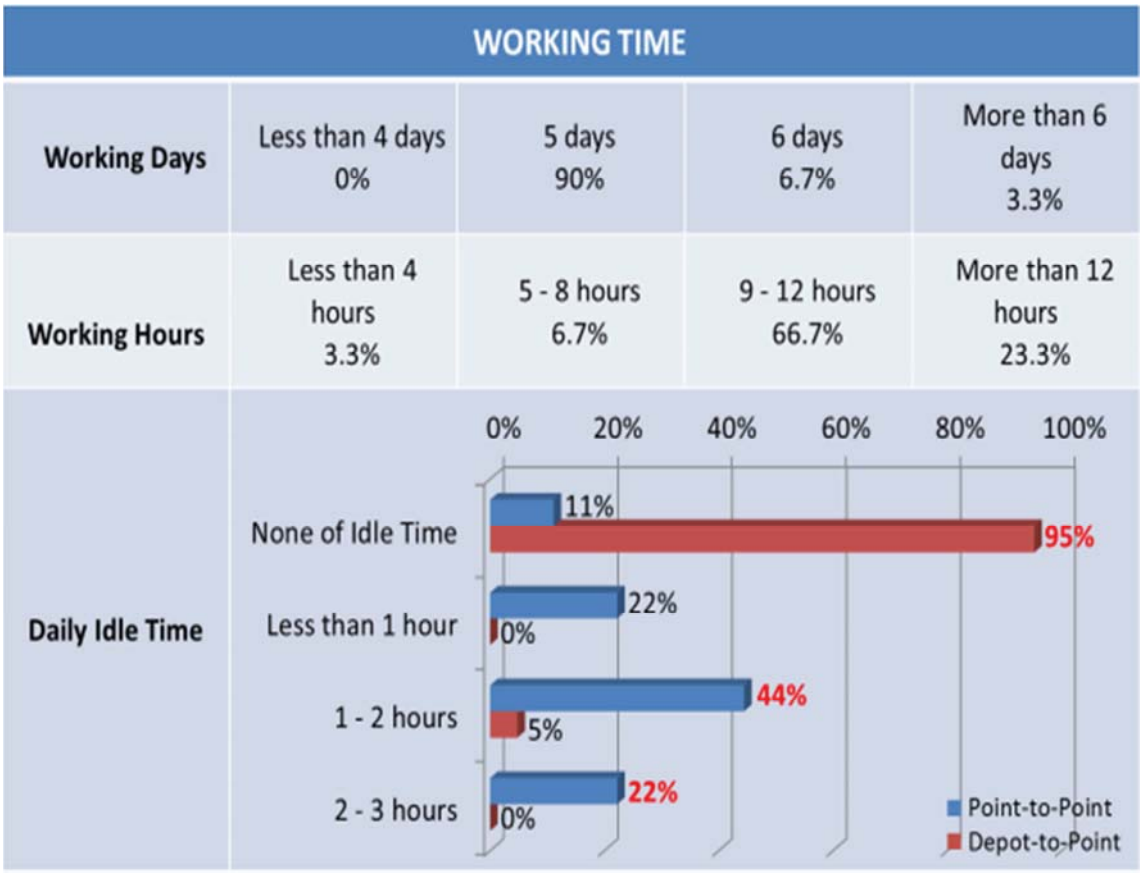


Figure 5.6 Comparisons of Working Time

Orders Amount & Running Distance

This discrepancy is completely related to the amount of daily delivery orders and running distance. As is shown in Figure 5.7, for the couriers of 'point-to-point' service, 89% of them have no more than 50 pieces of delivery orders per day. In contrast, the orders of 'depot-to-point' double even triple the amount of the counterparts, peaking at over 300 pieces per day. This massive amount consists of both pick-up and delivery jobs which is different from the exclusive dispatching orders of 'point-to-point' couriers. Even so, it does not mean the incomes of 'point-to-point' couriers must be lower than 'depot-to-point' couriers, because the customers have to pay much more for 'point-to-point' service.

Surprisingly, although the couriers of 'depot-to-point' have to arrange much more orders per day, they run almost the same distance as 'point-to-point' Owner-Operators. As is shown in Figure 5.7, around 80% of both couriers run 100 to 300 kms per day. This implies that the distance of each delivery for 'point-to-point' service is much higher than 'depot-to-point' service.

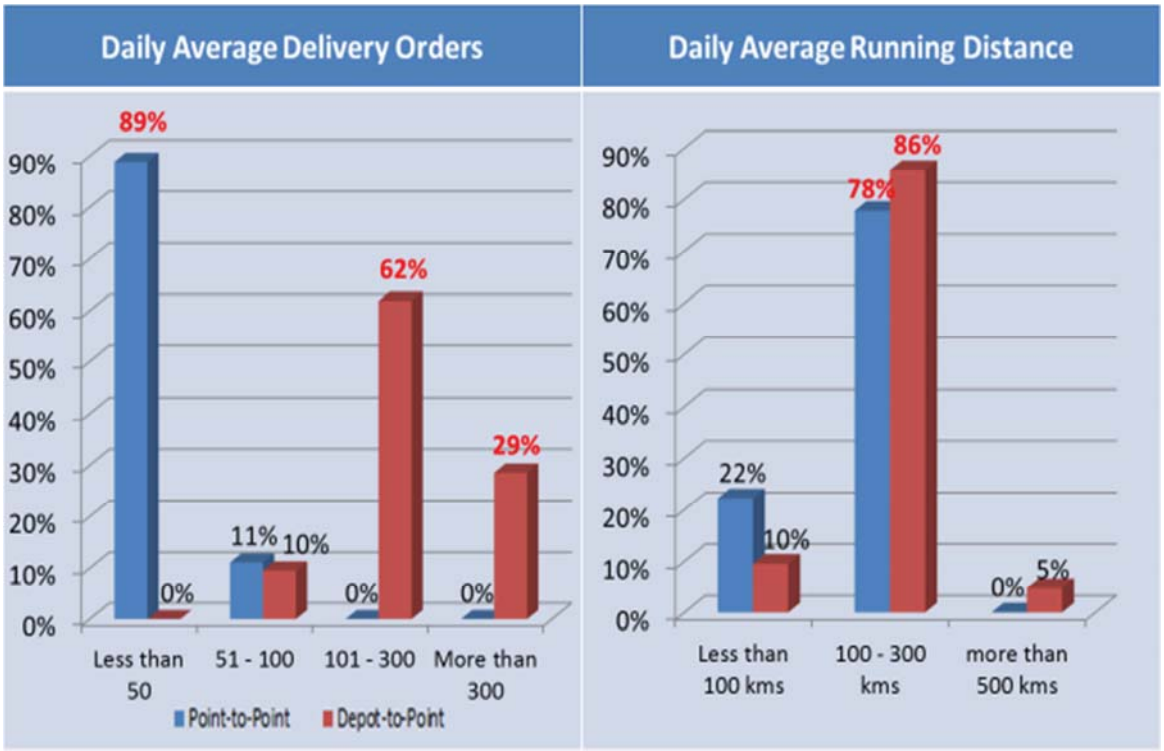


Figure 5.7 Comparisons of Daily Delivery Orders & Running Distance

Combining with above three parameters (daily working time, delivery orders, and distance), it is easy to estimate the unit delivery distance and handling time for each order. For example, according to Figure 5.6 and Figure 5.7, most of the depot-to-point couriers are working in the range of 9 to 12 hours per day, 101 to 300 orders and 100 to 300 kilometers per day on average. Taking the median of working time, orders amount and kilometers, if they work 10 hours a day; deliver 200 orders and run 200 kms, the average distance is 1 km for each order and it costs 0.05 hours (3 minutes) per order. In other words, a depot-to-point Owner-Operator has to finish one order in 3 minutes including 1 kilometer's driving, and picking up/dropping off parcels. According to the speed limit (50km/h) of majority streets in New Zealand, it will spend 1.2 minutes to run 1 km excluding the traffic conditions, so there are only 1.8 minutes to finish all the other process (e.g. drop off, communication, signature, loading, inspecting, etc.).

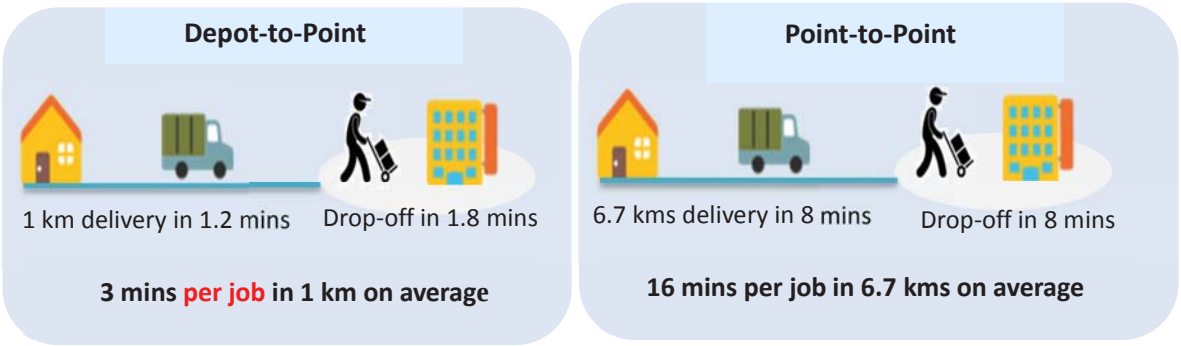


Figure 5.8 Comparisons of Operations for Each Delivery

It is essential to consider more factors for above assumption. Firstly, there are a wide variety of picking up and dropping off modes. For instance, it is possible to pick up/drop off multiple orders in one single building, or only one order in several kilometers whilst confronted with traffic congestion. Above calculation is based on the median figures of their daily operations which have balanced these different situations.

Secondly, above calculation takes all the running hours and distances for delivering cargos only, but realistically, these parameters also include the time of loading/unloading cargos in the depot and running back distance from customers to the depot. Because it is totally different for every Owner-Operator on working time in depot

and returning distance to depot, these two elements are shared in each delivery. It is conceivable that the average drop off time (1.8 minutes) might be shorter if they spend more time on working in the depot or returning to the depot.

Likewise, for an instance of ‘point-to-point’ courier, if they work 8 hours (average two hours idle time is deducted) a day; deliver 30 orders and also run 200 kms, the average distance per order is 6.7 kms, and each order needs 16 minutes.

According to the above analysis, as a result of different operations models, there are different performances. In terms of these characteristics, they should have the tailor made strategies for increasing the vehicle utilization respectively. With respect to the ‘point-to-point’ couriers, the relatively adequate time and long distance promotes the potentials of loading match resources in order to boost jobs amount. At the same time, well planned routes and rational connection for the next job could shorten the time and distance on road.

In contrast, the time is comparatively tight for ‘depot-to-point’ couriers. Any unsuccessful delivery will affect the next, even the entire deliveries, because they are likely to repeat the routes for redelivery. Therefore, real time communication and well planned schedule are highly essential to avoid any failure of dispatching.

Dispatch Failure

There are several reasons for unsuccessful delivery, and it is inevitably affects all the Owner-Operators, to a varying degree in the failure percentage. Generally, the proportion of the failure is quite low; 30% of the couriers deliver unsuccessfully at 1% or lower. But there are still one third of the couriers who have 5% or more failure rate.

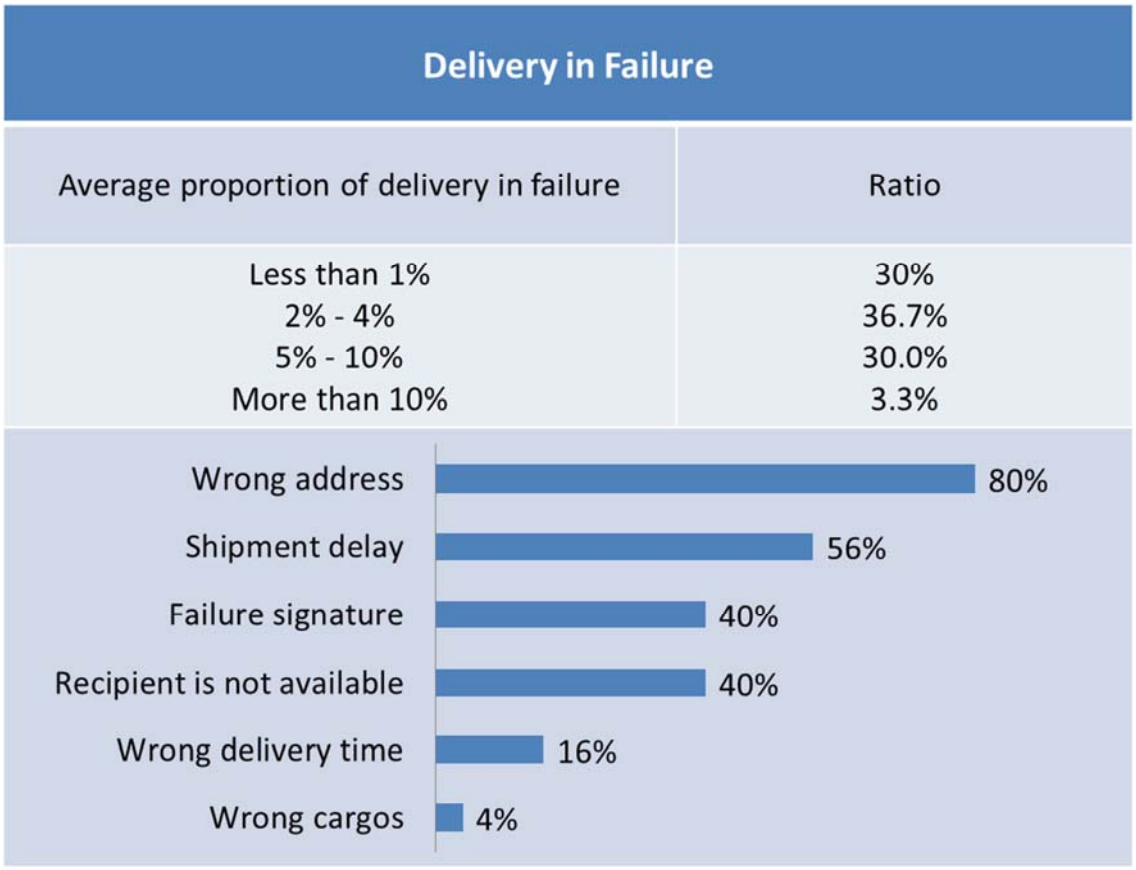


Figure 5.9 Deliveries in Failure

The majority of Owner-Operators indicated that wrong address, shipment delay, failure signature and unavailable recipient are the four main reasons resulting in failure, which is shown in Figure 5.9 When they could not deliver successfully, ‘depot-to-point’ couriers would bring the parcels back to the depot, and subsequently the customer service or couriers would contact the client for the redelivery time. From the economic perspective, it is not cost effective, because the couriers need to consume more time, space, and fuel on second or the third times redelivery. To some extent, vehicle utilization and incomes might be affected by redelivery. For example, if one parcel is

needed to be delivered in three times, the courier can only get the profit in once, but he or she has run the distance for three times longer. Nevertheless, in terms of preceding statistics, there is relatively small room for optimization. The following sector will introduce the primary causes of inefficient vehicle utilization.

5.4 CAUSE & EFFECT OF INEFFICIENT VEHICLE UTILIZATION

In terms of inefficient vehicle utilization, the main featuring performance is the unutilized vehicle capacity, such as part-load and empty-run.

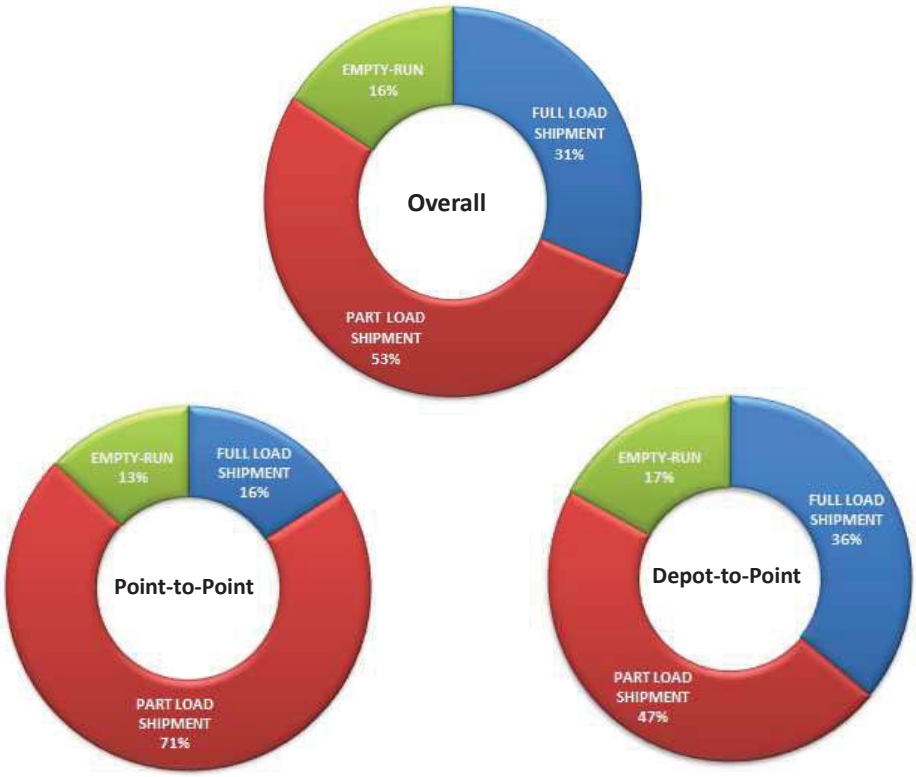


Figure 5.10 In Comparison with Inefficient Vehicle Utilization

According to analysis of the daily-runs from all the respondents, overall, only 31% are full for the whole day shipments; the part load shipment and empty-run accounts for 53% and 16% respectively. It is shown in Figure 5.10; there is different performance on account of different running models. For ‘point-to-point’ couriers, they run partly more than ‘depot-to-point’. This is because of the different customer types and business models, they only finish one job from location A to B independently, and the previous

job is irrelevant to the next order, so it is much harder for them to run full load all the time. Some ‘point-to-point’ respondents explained that mostly they just delivered one or two small pieces of parcels in each journey. Certainly, they had tried three or four shipments on the same route, but even so, the cargos volumes were not big enough to load fully in their vehicles. By contrast, the couriers of ‘depot-to-point’ have more clients in their deliveries. The respondents said, normally, they got full load of picking up the cargos from the depot, and sometimes they could not even load all the day’s cargos in the vehicle in once. For the duration of deliveries, they might also pick up the cargos from the customers at the same route. This will increase the opportunities of full load shipments.

With respect to the causes of inefficient vehicle utilization, the Owner-Operators in two different models have the similar perspectives. Both the findings of (McKinnon, 2015) and (Bretzke & Barkawi, 2013), show there are eight intrinsic and extrinsic factors of influencing vehicle capacity usage, which are also identified to some extent by the respondents. Apart from that, they put forward three more causes of ‘customer types’, ‘lack of communication with customers’, and ‘schedule or cargos problems’.

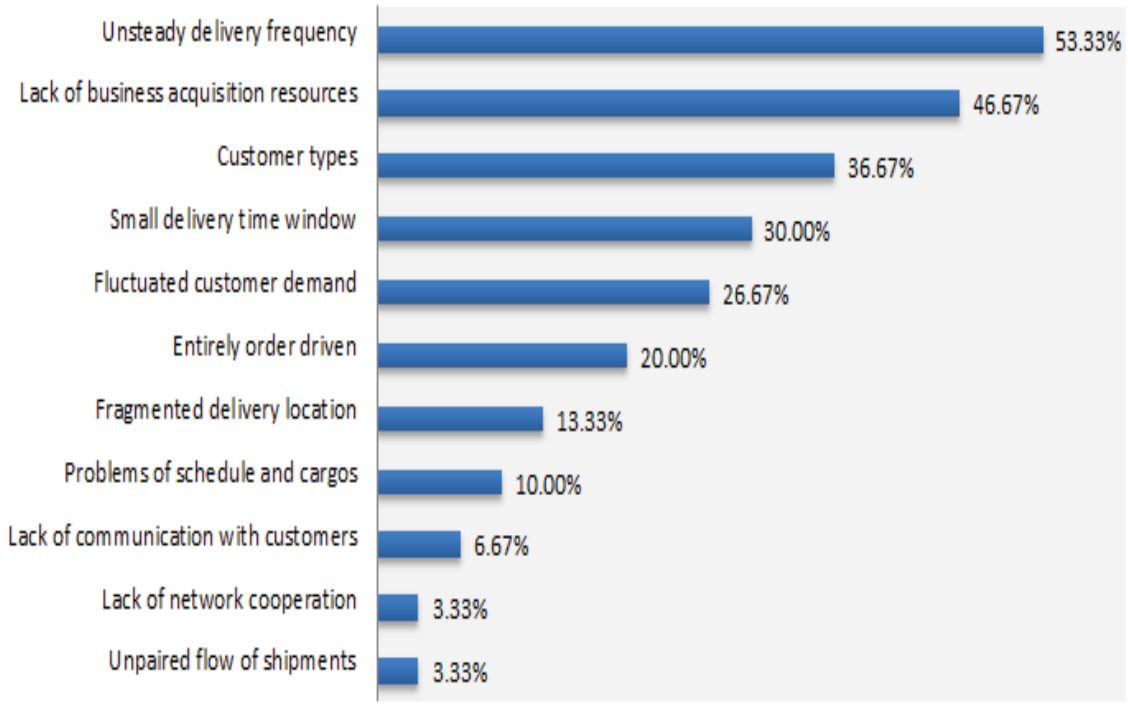


Figure 5.11 Causes of Inefficient Vehicle Utilization

Among all these causes, over half of the Owner-Operators perceive that unsteady delivery frequency brings about the poor vehicle utilization, notably for the slack season. The other two high ranking causes are the lack of business acquisition resources and customer types. There is an ad hoc and notable characteristic in the top three causes, namely insufficient load volume. Operators hope their sales teams in the companies or other channels will expand the business volume, especially in low seasons or residential areas.

With regard to the unpaired flow of shipments, only 3.3% of the respondents consider this to be the reason of poor efficiency. Regardless of the ‘depot-to-point’ or ‘point-to-point’ couriers, they believe that they can organize the routes rationally, and the excellent capability of route planning is the prerequisite of the Owner-Operator. Other two causes stated by the respondents are the problems of customer communication and schedule.

Ten percent (10%) of the respondents indicate that due to the lack of communication with customers, they cannot master the detail information of loading cargos, pick-up or drop-off time, so that they cannot arrange the vehicle capacity well. In addition, 6.67% of the respondents consider the problems of schedule and cargos could be the reason of low performance. In the practical daily operations, some schedules are fixed because of the appointed time. Hence, operators have to spend more time or distance on fulfilling the requirements.

5.5 CURRENT APPROACH TO EFFICIENCY IMPROVEMENT

While all of the respondents realize the existing underutilized vehicle capacity, not all of them have positive or effective approach to optimize the poor performance. Definitely, due to the different running model, the couriers of ‘depot-to-point’ and ‘point-to-point’ have distinctive strategies respectively. Overall, regardless of which types of Owner-Operators, most of them have been utilizing the approaches of expanding business channels, locating, and maintaining customer relationships. However, some of them have no strategy to alleviate the relevant causes, or even ignore the vehicle utilization.

Current Approach	Overall No.	Overall Ratio	Diagram
Expand loading match resources	14	47%	47%
GPS	11	37%	37%
CRM	7	23%	23%
None of approach	6	20%	20%
Advertisement	4	13%	13%
Ignore vehicle utilization	4	13%	13%
Real time communication by phone	3	10%	10%
Adjust runs	2	7%	7%
Price	1	3%	3%
Education	1	3%	3%

Figure 5.12 Overall Proportion of Current Approach

It is demonstrated in the Figure 5.12, currently, nearly half of them believe that it is necessary and effective to enhance the vehicle utilization by expanding the loading match resources, and it has been implemented by themselves or the sales team. Similarly, GPS is also a common device to locate where precisely they are for the purpose of assigning the appropriate jobs by dispatchers, so that the couriers could

approach the customers in the shortest time by the shortest route.

In terms of the CRM (Customer Relationship Management), 86% of the couriers in 'depot-to-point' service are taking measures to improve the customer relationships.

Current Approach	Point-to-Point		Depot-to-Point	
	No.	Ratio	No.	Ratio
Expand loading match resources	6	43%	8	57%
GPS	5	45%	6	55%
CRM	1	14%	6	86%
None of approach	2	33%	4	67%
Advertisement	0	0%	4	100%
Ignore vehicle utilization	4	100%	0	0%
Real time communication by phone	0	0%	3	100%
Adjust runs	0	0%	2	100%
Price	0	0%	1	100%
Education	0	0%	1	100%

Table 5.2 Approach Comparisons between Two Models

They believe that the good customer relationship is significant to increase the business opportunities, because they have their own territories, and they will get connect with the same clients several times a week. On the other hand, only 14% of the 'point-to-point' couriers concern about the CRM. As a result of their random locations, the cargos of the same client are delivered by different couriers, so it is hard to maintain the relationship by Owner-Operators themselves.

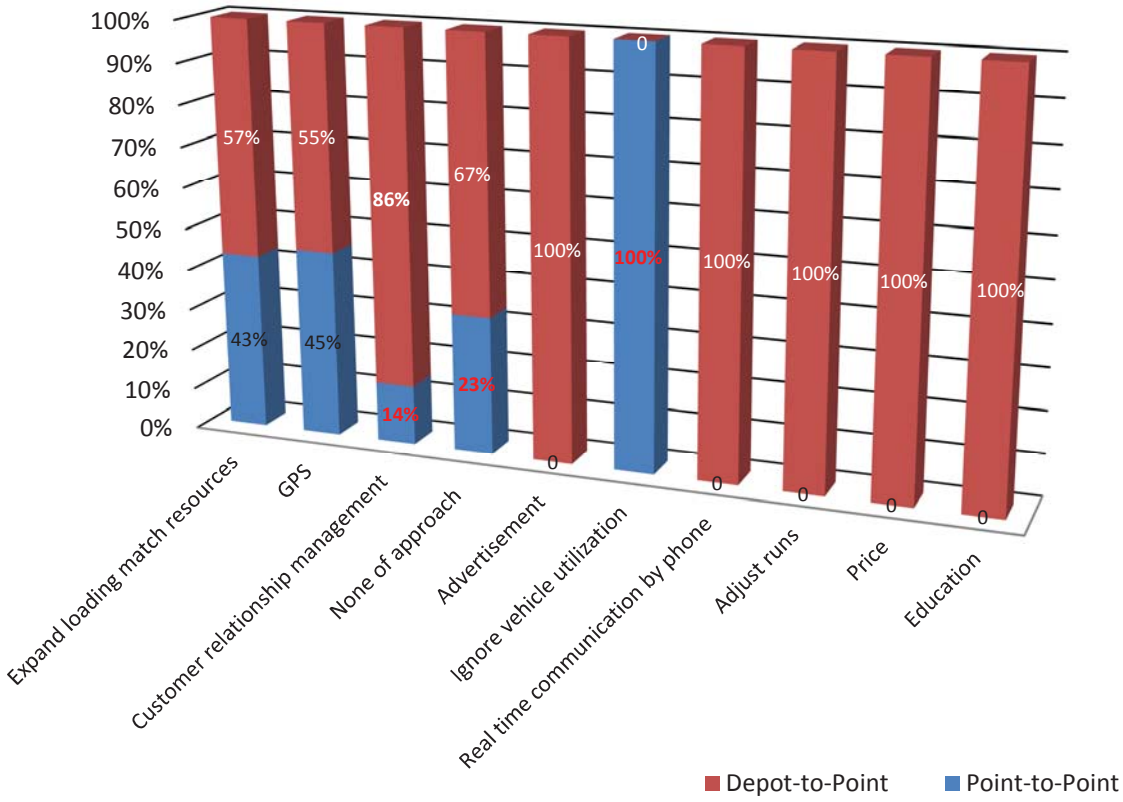


Figure 5.13 Approach Comparisons between Two Models

However, according to Figure 5.12, 20% of the respondents have no approach to increase the efficiency, whilst 13% of them even ignore the vehicle utilization completely, and all of them are the couriers of 'point-to-point' service. The customers, who need the point-to-point service, usually require the stringent time window, and pay more for the instant gratification. This higher price is calculated to buy the unique service even though there is only one small piece of parcel, and that is the reason why some couriers will not concern with the part load shipment or empty run.

It is concluded that of all the stated approaches, operators have two major strategies for enhancing the vehicle utilization, sales and operations. Firstly they try to spread the sales channels and maintain the good customer experience in an attempt to boost the loading in the repeated routes. Secondly, via the GPS, and through runs adjustment and education, they aim to increase the efficiency, and decrease the unprofitable operations. Apparently, these current measures are on the processed basis. When these two

strategies might be achieved by the mobile technology, their perspectives and attitudes of the technology will be elaborated in the next section.

5.6 PERSPECTIVES OF THE MOBILE APP

Through the preceding two parts of the interviews, the researcher had acquainted with the profiles of the respondents, the details of daily operations, the cause and effect of their operational inefficiency. Subsequently, in the third part of the interview, the researcher tried to mitigate those poor performances by using the technological approach (Mobile App). Some questions will be stated for the purpose of obtaining their perspectives and attitudes to the effects of this new technology.

5.6.1 INTERPRETATION OF THE MOBILE APP

First and foremost, it is significant to shed light on how this mobile app works. Due to the unpublished app in New Zealand, the researcher could not explain the functions by using an actual mobile app. Meanwhile, due to the constraints of time and budget in the research, a relevant mobile app had not been developed for adopting in couriers' daily operations. However, in order to make sure the participants fully understand all the functions of the mobile app, the researcher utilized the visual demonstration of similar mobile app, such as Uber. When they had the initial concept and picture of the mobile app, the researcher further explained what the mobile app was. It is based on the business model in Sharing Economy, and this technology is used to provide the individuals or organizations with goods, capacity and service sharing or reuse (Hamari, Juho; et al., 2015). Ideally, users are entitled to have access to the nearby couriers via the mobile app.

In addition, the researcher had discussed with respondents in depth by proposing a hypothesis. A virtual scenario in Figure 5.14 is assumed that the mobile app has been used by both of customer and courier. In this circumstance, customer on the pick-up location can search the couriers who are nearby within the specific radius whilst the system will calculate the shortest time for their approaching.

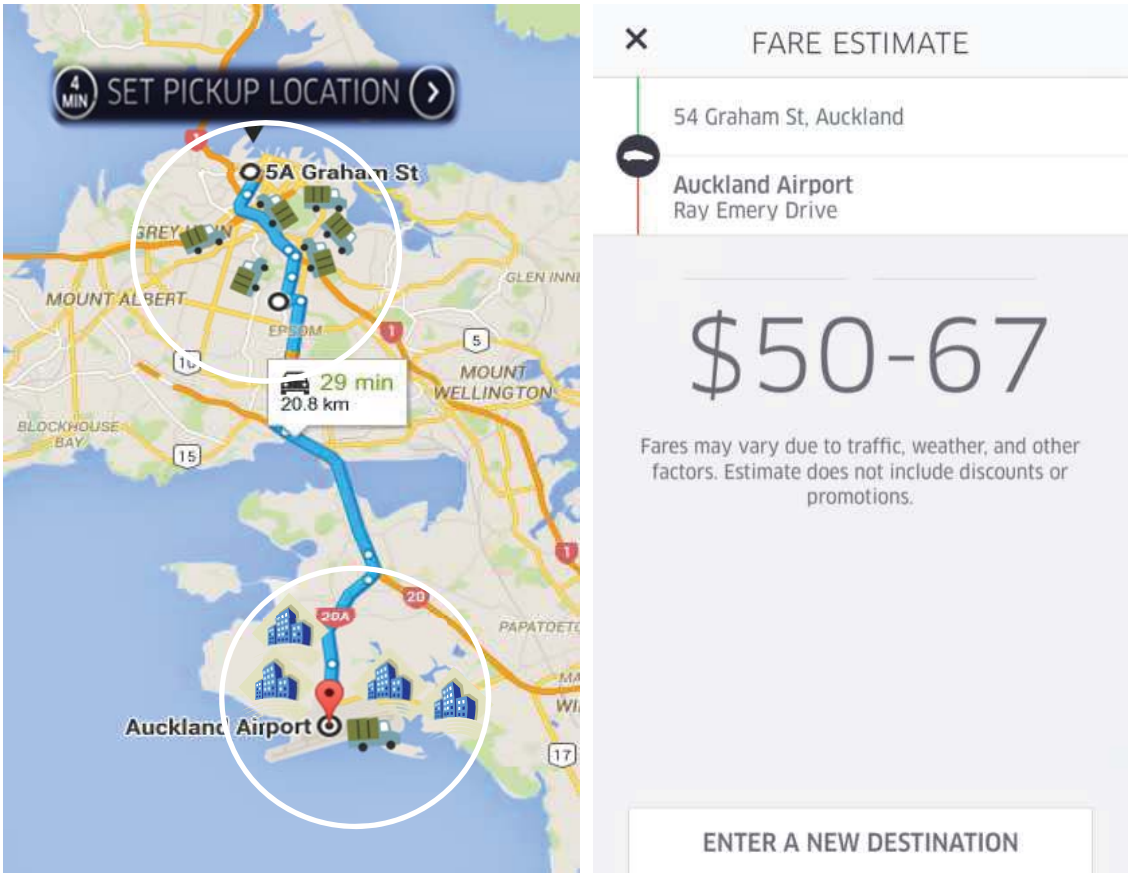


Figure 5.14 Virtual Scenario of Adopting Mobile Application

Similarly, when the Owner-Operators finish deliveries, if they are concerned about the empty back load, they can also use the mobile app to search whether there is appropriate business around them. During the whole dispatching, the customer is able to monitor the cargos running route and communicate with the couriers constantly. As for the experience of recipient, when the courier is approaching the destination within the pre-set distance, the recipient will get an alert message from the app for the preparation of receiving cargos. The entire transaction is implemented by the electronic payment platform.

Through the video demonstration of similar mobile app, the researcher's explanation of the concept, and the hypothesis of adopting the app in their daily operations, all the respondents reflected that they could completely understand how this type of mobile app worked. Apart from that, they have different voices and concerns with regard to the

mobile app of affecting their work. The following sector will explore their perspectives, attitudes and concerns in depth.

5.6.2 ATTITUDES OF THE MOBILE APP

The participants consented that there were some effective functions of the mobile app assisting their operations to some extent, such as instant communication, GPS, and electronic logistics market. The following questions in Table 5.3 were issued to acquire the positive or negative attitudes from the respondents.

Do you think the kind of mobile app is useful to:		Yes	No
1	Increase the efficiency in real time communication with customers?	83.3%	16.7%
2	Expand the opportunities of acquiring business?	90%	10%
3	Pair the routes effectively?	36.7%	63.3%
4	Improve the vehicle utilization?	93.3%	6.7%
5	Increase the income?	90%	10%

Table 5.3 Perspective of the Mobile App

1. Communication.

   Over 83% of the respondents agree that it is useful to increase the efficiency in real time communication with customers. According to their responses, regardless of Depot-to-Point couriers or Point-to-Point couriers, they currently communicate with the customers in the traditional ways by phone, text message or through the customer service. Sometimes it is delayed. That is the reason why ten percent (10%) of the respondents indicate the lack of communication with customers is one of the causes of inefficient vehicle utilization in previous chapter.

   However, via the mobile app system, some of the communications between Owner-Operators and customers are implemented automatically. The systems will push an alert to the customers and recipients once the couriers have picked up the

cargo and are approaching the drop off point. In the meantime, the arrival time will also be estimated, and the recipients could response accordingly for acceptance or not. The visibility for both couriers and customers is increased by the app, and the rate of unsuccessful delivery might be decreased by more effectively real time communications. As such, it is unnecessary for the customers to call or text message the couriers for checking the status of the parcels. The cost of phone calls and test are likely to decrease accordingly.

Even so, there are a small proportion of respondents denying the positive aspect of communication. Firstly, some of the participants explained that they were responsible for the rural areas, and the signal is quite weak in their territories. Secondly, even though the costs of phone calls might be reduced, the mobile data costs are going to be increased. Furthermore, some of the respondents felt anxious about exposing the tracks entirely. For some experienced Depot-to-point couriers, because they are familiar with the customers in their territories, they understand the client who can finish the receiving process quicker. For example, with respect to some customers in a commercial building, they have to choose the right place to park their vehicles, and then spend the time on communicating with the security guard, receptionist, and waiting for elevator. Therefore, sometimes they plan the drop-off sequence not just by the distance. These respondents concerned that if the mobile app allocated the jobs sequence by nearest location merely, the work efficiency might be lower.

2. Business Opportunity

   During the interviews, the majority of the participants indicated that they obtained the new business passively by sales team or the advertisements. According to the figures in Table 5.3, ninety percent of them believe that the mobile app is offering a new sales channel for acquiring business actively. In particular to the couriers in rural areas and residential areas, they were eager for the new tools assisting new business acquisition. The app provides the couriers and customers with the mutual platform for posting accessible capacities and requirements.

   In the discussion of the hypothetic scenario stated in chapter 4.6.1, it was the business model for Point-to-Point service, so all the participants in this category

agreed with the positive effect. With regard to Depot-to-Point couriers, even though they could not deliver the parcel directly from central Auckland to Auckland Airport in terms of the mentioned example, they needed to pick it up to their local depot, and the parcel would be delivered by another courier. Theoretically, it is boosting the business opportunities for both couriers.

On the other hand, regarding the ten percent of the opponents, all of them were Depot-to-Point couriers, and they queried the customers, who matched by the mobile app, might not the appropriate clients. It has been explained in the Chapter 4.3.2; the running time for Depot-to-Point couriers is extremely tight. As for the mentioned opponents, their workloads were considerably full, and they could not even finish all the deliveries until the night. Therefore, they rather sacrificed the vehicle utilization in empty back load than spent time on looking for new business, because it was likely to influence the following shipments.

3. Route paring

   Surprisingly, around two thirds of the respondents did not consider the technology as an effective tool for route planning even though the GPS function is able to calculate the shortest route connecting each point. But the traffic congestion, traffic lights, and cargo loading sequence may also be taken into account by the seasoned couriers. They believe their experience is more useful than the technology.

   As for the Point-to-Point service providers, they were the supporters of using the app to assist the route planning. Those respondents indicated that they had the similar tools or operations team which could help them pair the shipments more effectively. In their daily operations, each of deliveries was mostly independent and random. Sometimes they had to go to the places where they had never been to before. Hence, they believed that an effective tool for route planning was noticeably useful for their works.

   In contrast, Depot-to-Point couriers only work in their territory which is a relatively small region. They said most of the fresh Owner-Driver, who worked for two or three months, could almost master all the streets in the area and arranged the routes rationally. Consequently, the participants reflected that route selecting was not the

first priority of the duties. Even though they had the GPS in the vehicles, they used it to reflect their current locations to the company rather than planning the routes. Accordingly, most the respondents disagreed the mobile is helpful to plan the route in their daily works.

4. Vehicle utilization and income

   Vehicle utilization and incomes are interrelated, so it is conceivable that there is an approximate proportion for both perspectives. Over Ninety percent (90%) of participants have positive attitudes for improving performance and incomes. To some extent, they perceive the mobile app could optimize the customer experience, and promote the possibility of sales. Meanwhile, some of the functions might decrease the ongoing cost and make them arrange the daily operations more efficiently.

To sum up, ideally, most of the respondents believed the functions of mobile app could increase the efficiency of vehicle utilization, while some inevitable constraints and concerns were considered by the respondents as well.

5.6.3 CRITICAL THINKING OF THE MOBILE APP

After collecting the perspectives of mobile app's function, when the respondents were asked whether they would adopt this type of mobile in their real work, the answers were surprising.

With regard to the perspectives of mobile app functions, although the positive opinions occupy the majority, only Forty percent (40%) of the respondents look forward to adopting the mobile app in their daily work. It is shown in Figure 5.15.

The respondents (accounted for 60%) who were reluctant to use the mobile, mainly considered below factors. First and foremost constraint is the policy of the company. Currently, they are not allowed to acquire any business privately by any ways. The operations managers explained that, from the perspectives of Courier companies, the business volumes which allocated to the Owner-Operators were calculated feasibly.

This work load was considered about the customer amount, income, running hour, distance, and the capability of the contractors. Regardless of ‘depot-to-point’ or ‘point-to-point’ couriers, too small business volume will affect the incomes of the contractors. That means the company may spend more on compensation. By contrast, too heavy work load might influence the service quality. The operations managers understood the mobile app enabled the customers to connect the couriers by the principle of proximity, but from the perspective of holistic management, they would not permit the contractors to accept the orders optionally.

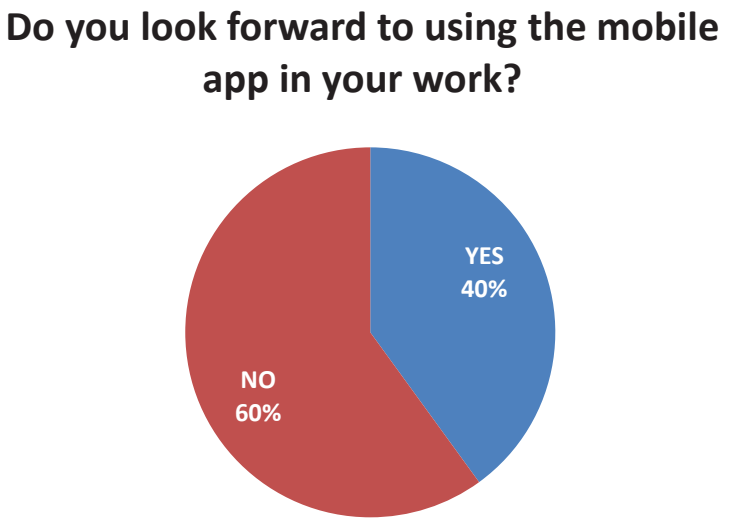


Figure 5.15 Attitudes of Adopting Mobile App in Real Work

Secondly, except for the probably increased mobile data cost, the respondents expressed the concerns about the distraction by the mobile app. They assumed that if most of the functions were assembled in the mobile app, they had to stare at the mobile phone all the time or touch the screen for using the app when they were driving. Moreover, some of the respondents were worried about the cost of purchasing a new smart phone in order to use the app.

On the other hand, with respect to the supporters amongst the participants, a question was stated that if they could use the mobile app in reality, what was the concern of the mobile app?

The following elements are the focuses of attention in terms of their response.

- Cargo Details

  According to the profiles of respondents in preceding chapter, eighty percent of the Owner-Operators possess only one vehicle which is mostly the light van, and usually they work solely. Despite the unanimous acceptance of the mobile app in boosting business opportunity, they have to consider if they can handle this job. Some details of cargos, such as cargo weight, volume, type, special requirement, are taken into account. For example, if they are required to deliver a piece of furniture like couch or bed, they will be worried about whether the size is fit to the van, and whether they are strong enough to move such a heavy cargo.

  Consequently, the respondents pointed out that all the cargo details should be elaborated clearly via the app once the customer placed the order. They could estimate the order which was eligible or not. In addition, the respondents who were ‘depot-to-point’ couriers also cared about destination which was located in their territories.

- Customer Types

  The respondents mentioned the majority of their customers who were commercial clients in contracted relationships with their couriers companies. All the deliveries were commercial transaction, and the freight would be paid monthly by the companies. Nevertheless, they deemed the delivery service transaction by mobile app belonging to comparatively personal behaviors. The participants were skeptical about feasibility in B2B model, and they concerned that the commercial customers would use the mobile app to place an order rather than the existed systems in their desk top computers.

  Therefore, the respondents speculated about the applicable areas for the mobile app where should be the residential areas, and the targeted users would be the individual consumers. From this perspective, it reflects one of the conditions of the mobile app is the population density. It requires the higher density area like Auckland to provide the couriers with adequate customer supplies.

- Security Confidence

In previous sector, it is introduced that the Owner-Operators represent their respective courier companies, even though they are the independent contractors. They have to wear the uniforms, and the van must be painted with the logos. In this conventional business model, the customers are conducting the transaction with the courier companies, and they believe the brands of the companies rather than the couriers themselves, because the companies can offer the insurance and the guarantee of the service quality. The respondents scrupled to trigger the insecure emotion of the customers, when the delivery service became the personal consumption between the individual and couriers. Again, they concerned that how the customers could pass their expensive stuff to a stranger who they have never seen before. Hence, they believed that it is highly essential to eliminate the insecurity from the customers when they used the mobile app.

5.7 SUMMARY OF FINDINGS

Through the analysis of qualitative data within thirty respondents, the general introduction of the Owner-Operators in New Zealand is explained first. The background issues such as initial setup threshold, ongoing cost, and other generic profiles have been introduced. According to this information, it is understood that there are two main running models for Owner-Operators. Their incomes are highly bound with the performance of vehicle utilization. Subsequently, by analyzing their daily operations, couriers in respective service model perform inefficiently at varying degree. ‘Point-to-point’ couriers have more runs of part-load while the ‘depot-to-point’ couriers have more full-load shipments due to the different business model.

However, although they have different performance in terms of vehicle utilization, they have common perspectives of the causes impacting the inefficiency. They believe that the unsteady delivery frequency, the lack of business resources and customer types are the top three causes. Despite the existed poor performance, not all the Owner-Operators have effective approaches to alleviate it, and there are 13% of them even ignore the vehicle utilization.

Therefore, when there is a technological tool in low cost integrating the functions of track and trace, business acquisition, and instant communication, around 90% of them believe that it is useful for improving the vehicle utilization. In comparison to the current operations model, the mobile app is able to connect the customers and couriers more efficiently, and decrease the possibility of empty backload. Meanwhile, as for the track and trace function, the parcels are shown the running routes in every second instead of some location points in some time period.

However, despite the functions of the mobile are theoretically useful to enhance the vehicle utilization, not all of the respondents are looking forward to using it in their daily operations. There are sixty percent of the respondents who indicated that some constraints handicapped the possibility of using the mobile app, such as the policy of the company, distraction, the costs of device and data. As for the supporters, although they hope to use the app in the operations, they still express some concerns of the feasibility which are the cargo details, customer types and security confidence.

In conclusion, due to the different running model, there must be varying performance in vehicle utilization. Despite the similar perspectives of the causes, when using the mobile app as an approach to enhance the daily operations, different types of Owner-Operators express a wide variety of concerns and suggestions. It is meaningful to discuss the development of the mobile app contributing to all types of logistics service providers more effectively.

6.DISCUSSION

This chapter will compare the summarized data with preceding literature and conceptual model. In terms of the results and findings, there are some recommendations to the couriers market and further research. In critical thinking, the critique and limitation of the research will be elaborated as well.

6.1 REVIEW OF CONCEPTUAL MODEL IN LIGHT OF DATA

On the basis of preceding literature, the logical structure of preceding conceptual model is to construct the framework for alleviating the relevant intrinsic and extrinsic causes of inefficient vehicle utilization by means of mobile app. To overview the collected data combining with the conceptual model, firstly, although the Owner-Operators are running in two main different models, the underutilized vehicle capacities which represent at the part load and empty shipments are existed ubiquitously. Overall there is fifty five percent of part load shipment and sixteen percent of empty movement.

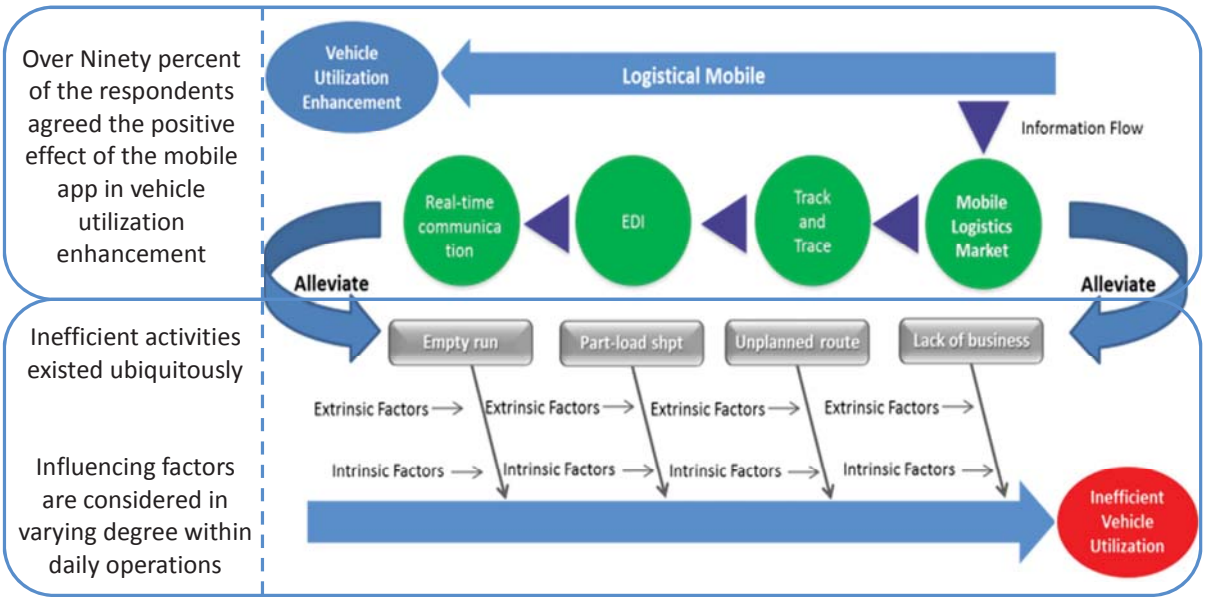


Figure 6.1 Conceptual Model Review

Secondly, to some extent, those contextual factors indicated by the respondents, were taken into the determinants of influencing the operational efficiency. Referring between the collected data and conceptual model, those referred contextual factors, such as

unsteady delivery frequency (53.3%), lack of business acquisition resources (46.7%), customer types (36.7%), and other eight more causes in varying percentage, are the considered as the Intrinsic and Extrinsic factors. Surprisingly, the unplanned route expressed in conceptual model is not the primary concern by most of the ‘depot-to-point’ couriers. In actual daily operations, they are adept at route planning and it is the first priority of their duties.

Reviewing the conceptual model, Logistical Mobile App is utilized as a technological approach to alleviate the inefficient activities. According to the visual demonstration and interpretation of the relevant mobile app, over ninety percent of the respondents agreed with the functions of app which were useful to enhance the vehicle utilization.

Consequently, this model is useful to practitioners and researchers working in couriers industry as guidance to figure out the cause and effect of inefficient vehicle utilization, and use the mobile app as a new approach for the efficiency enhancement.

6.2 CORRELATION OF FINDINGS WITH LITERATURE

There are three parts of the key findings in the study, the generic situation, principal causes of inefficient vehicle utilization within Owner-Operators in New Zealand, and the perspectives of logistical mobile app.

According to the daily operations statistics from the participants, the overall proportion of empty run is 16%, while in the EU countries the average empty run for trucks is approximately 25% (Eurostat, 2007). Although the rate of empty run is nine percent lower than average level of Europe, it cannot reflect the holistic level of vehicle utilization throughout the New Zealand, because the respondents are merely the Owner-Operators in courier industry excluding other road freight models and services, such as heavy haulage, etc.

In addition, from the study of (McKinnon, 2015) and (Bretzke & Barkawi, 2013), some factors have been concluded that affecting the vehicle capacity utilization. Among those elements, unsteady delivery frequency is considered by 53.3% of the respondents as the

primary cause which is shown in Figure 5.11, and the second highest factor is insufficient business resources. Notwithstanding, the factor of unpaired shipment flow is one of the causes in previous literature. Only one of the respondents take it as the driver of inefficiency, and most of the 'depot-to-point' couriers believe they can well organize every shipment flows. As for 'point-to-point' couriers, there is the dispatching team assisting the shipments scheduling. Hence, neither the 'point-to-point' couriers consider it as a barrier.

Regarding the aspect of mobile technology, the studies of Kalakota et al., (2003); Wang et al (2011), and Chopra and Meindl (2012) suggest the effective approach of establishing real time communication, track and trace, as well as an electronic logistical platform using information technology. When these functions can be integrated in one mobile app and be used in the public, around 90% of the respondents take positive attitudes on its effectiveness.

More specific, in terms of the SCOR model on Level 1 (Bolstorff & Rosenbaum, 2012), the supply chain metrics are used to measure the performance of the mobile app.

Performance Metrics	Performance Metrics Definition	Respondents	
		No.	Ratio
Supply Chain Reliability	Delivery to the right place, right time, right quantity, in right condition, with right documentation	10	33%
Supply Chain Responsiveness	The speed that supply chain provides products to customer	26	87%
Supply Chain Flexibility	The agility to respond changes in marketplace to maintain or gain competitive advantage	23	77%
Supply Chain Costs	The costs of operating supply chain processes	25	83%
Supply Chain Asset Management	The effectiveness of managing all asset; both fixed and working capital	5	17%

Table 6.1 Evaluate Mobile App Performance by Supply Chain Metrics

Firstly, only ten of the respondents believed that the mobile was reliable to deliver the products due to lacking confidence of the crowd sourcing drivers. Most of the

respondents assumed this kind of online platform could not provide the crowd sourcing drivers with adequate training for the professional delivery service. Meanwhile, the personality and service attitude of amateurish drivers were the concerns in terms of their responses. With regard to the responsiveness, flexibility and cost, the numbers of respondents are approximate. They generally agreed that it was a much accessible tool for both customers and couriers; when the customer demands and couriers supplies were matching, the speed and cost of delivery, as well as the agility should be optimized effectively. As for the supply chain asset, even though the mobile app is assembling many functions and is likely to take place of existed equipment, such as pagers, scanner or digital camera, there are many respondents concerning the cost of the smartphones upgrade.

6.3 RECOMMENDATION

This research is developed from analyzing the daily operations of Owner-Operators in New Zealand. By interviewing thirty respondents comprised of Owner-Operators and the professional staff of operations teams, the qualitative data reflects their overall behaviors in daily operations. In comparison with a wide variety of operational parameters in two running models, there are different emphases for improving the vehicle utilization. Therefore, the findings of the research might be recommended to the Owner-Operators and logistics companies.

- Owner-Operators

  Owner-Operators need to have awareness of their incomes closely bounding up with the vehicle utilization. A high proportion of empty run or part load shipment implies that they spend more fuel on unprofitable runs. For couriers of ‘point-to-point’ service, to find more loading resources in slack season and residential area is highly essential to optimize the underutilized capacities as well as declining the idle time. While for the couriers of ‘depot-to-point’, mobile technology enables them to increase the communication efficiency, maintain the excellent customer experience, and decrease the ratio of failure delivery. Both of the Owner-Operators should be able to identify their individual causes of idle time and capacities, and then try to use mobile app as a new channel to acquire more business.

- Logistics Companies

  It is significant for the logistics companies to identify the causes of poor performance by analyzing the daily usage of vehicles. It is useful for the logistics managers to calculate the general performance of empty run and part load shipments. By collecting the data of underproductive time, the proportion of failure delivery, and the variety of business volume in different seasons, they can explore the actual reasons of inefficiency. When they divide the business territory among the Owner-Operators, they can consider the customer distribution throughout the city avoiding the unbalance of work allocation.

  In addition, regarding the investment of Logistics Technology, developing a mobile app could be a cost effect strategy. From the perspective of cost saving, the mobile app could achieve the functions of scanner, pager and GPS, so it might help the companies save the equipment expenditures. There are two strategies for utilizing the mobile app.

  The first strategy is to develop the own branded mobile app. From technological perspective, except for using the smart phone to knock out the other old equipment, it is useful to set up a paperless process in placing orders, billing, signature, and transaction. Under the direct connection between the customers and couriers, it is possible to save the labor cost in or customer service department or call center. From the operations point of view, it is useful for enhancing the vehicle utilization within the contracted couriers according to the preceding research. As a new business model of combination between crowd sourcing and mobile technology, crowd sourcing drivers might be the new army of transport resource. If there are more protecting legislations for peer-to-peer collaboration in the future, the amount and reliability of crowd sourcing should be growing rapidly. At that time, when the public sharing resource becomes the mainstream transport force, it is unnecessary for the logistics companies who focus on B2C/B2B market to maintain the fleet or employ the drivers.

  The second strategy is to use the developed mobile app like Uber. It is the platform opening to the public, certainly including the professional couriers. Unlike normal individuals, professional drivers are running more time on the road. They are

supposed to have more opportunities to obtain the jobs. Meanwhile they are more familiar with the traffics in the city so that they can probably finish the order quickly. The new delivery orders are not only for mitigating the empty movements, but also adding on the same route. Normally, those customers using the mobile apps are individual consumers, and this category of clients is not the sales target for the business development team in the company. Therefore, to develop these customers by Owner-Operators themselves is effective to fill up the sales vacancy. These strategies empower the logistics company with two roles simultaneously, logistics service providers and subcontractors. In the peak season, when the business volume is greater than their own transport capacity, they can be the subcontractors to consign some deliveries to the crowd-sourcing drivers.

6.4 CRITIQUE OF THE RESEARCH

The research should be critiqued in broad aspects of strengths, limitation and policy.

- Strengths

  By the combination between theoretical supporting and valid qualitative data, this study provides the Owner-Operators and logistics enterprises with a clear and generic scenario of daily operations in all aspects. Meanwhile it might be a guidance of figuring out the causes of unutilized capacities. The mobile app, as a new approach to achieve the theory of information integrating, may effectively alleviate the activities of low performance. Other than traditional process based measures, it is a new theory and concept to improve the communication, business acquisition, and capacity usage from technology point of view. The structure of the research is consistently logical with a holistically theoretical framework. The conceptual model is reasonable to support the inductive argument. The valid data reflects the actual behaviors and perspectives from practitioners. This research is worthwhile for stakeholders in logistics industry to improve the vehicle utilization.

- Limitations

  The research only focuses on the Owner-Operators serving the third party logistics service providers in couriers market. Other Owner-Operators, who independently

serve the manufacturers, retailers or other industries, are not taken into account. The base of the respondents is primarily in Courier industry, and the results cannot reflect the entire road freight situation in the New Zealand context. In addition, because the mentioned mobile app is still not launched in New Zealand, the practical effect cannot be tested within the respondents.

- Policy

  With regard to the mobile app, it provides the Owner-Operators and customers with a public platform for acquiring mutual available resources. However, it seems to be fair and efficient for each other, but it is not necessarily approved by the logistics companies. Despite the roles of independent contractors, they work for the contracted companies exclusively and are not acceptable to get the business from nonmembers of the companies. The reason is to highly protect the service quality for the cooperated customers. Apart from that, the separate territory is also another constraint. ‘Depot-to-point’ couriers are not allowed to deliver the cargos across their responsible territory. They have to bring the parcels back to the depot, and it will be reallocated to another relevant courier for dispatching. From managerial perspective, to make this app applicable, the companies need to adjust the existed policy accordingly.

6.5 FURTHER RESEARCH

It is necessary to continually investigate the practical effects of the mobile app on enhancing the vehicle utilization, in spite of the positive perspectives from the respondents. Specifically, using the mobile, what percentage of sales could rise within the slack season and residential area. The simulation might be applied in one specific Owner-Operator.

Revolving two core aspects of the research are cause and approach of the inefficient vehicle utilization. It is interesting to research further in the following areas.

6.5.1 WORKLOAD DISTRIBUTION FOR COUIRERS

In terms of previous daily operations analysis, the income of ‘depot-to-point’ couriers hinges on what kind of territory they dominate. From the perspectives of holistic management in Courier Company, it is significant for operations manager to balance the workload and income of each contractor. Usually, the layer of the city is planned from the core commercial area to residential area, expanding to rural area. Likewise, the business volume is decreasing progressively by this sequence. The operations managers amongst the respondents indicated their companies had to compensate the couriers who were responsible for the rural areas, because they usually ran the longest distance with the least business volume. They could not earn enough to maintain the ongoing cost, but the companies must cover the rural areas in order to guarantee the service quality, so the company had to pay the minimum wages to the couriers. It is conceivable that, actually, the compensation is coming from the profits of commercial areas.

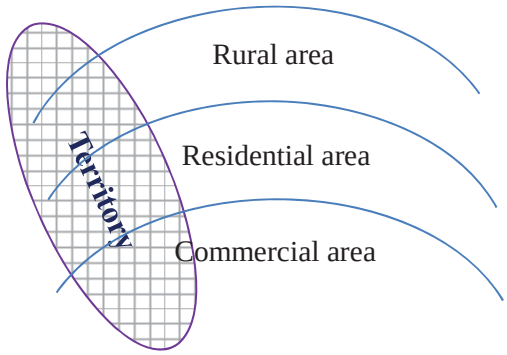


Figure 6.1 Territory Arrangement

In Figure 6.1, the ideal measure is to designate the territory covering various areas for the couriers. Operations manager can arrange the area to some fresh couriers in this pattern and adjust the different business proportion in each layer (e.g. 50% of commercial area, 30% of residential area, 20% of rural area).

Similarly, for ‘point-to-point’ couriers, if all the scattered couriers are assembled in a commercial area, when there is an order in rural area, the courier will get a long run to complete the job whilst empty run back for such a long way. Hence, for the ‘point-to-point’ couriers, it is important to analyze the historical sales data to identify

and divide the geographic territories in terms of the business volume. Operations managers need to spread the couriers throughout the city rationally and try to use the mobile technology for acquiring more business around their current location.

6.5.2 MOBILE APP ADOPTION IN LAST MILE SOLUTION

The terms “Last Mile”, “Last One Mile” or “Local Delivery” in supply chain management refer to the ultimate deliveries to end users from local stores or distribution centers. Currently, the service of last mile is often accomplished by local couriers, and the service level encompasses same day, next day delivery or requested schedule. With the widespread use of the internet, E-commerce becomes a catalyst to escalate the customer requirements. The difficulties of last mile delivery are the fragmented locations, more stringent lead time requirements from consumers, and higher cost. Even though many approaches have been tried, there is no single clear solution emerged. Apparently, the conventional ‘point-to-multipoint’ model cannot achieve the instant gratification of online shoppers, because they expect the faster deliveries with lower price.

However, in logistics industry, shipment density makes the dilemma between the service quality and cost. In order to solve this problem, some industrial leaders are trying to use the technology. They are testing the pilotless airplane – ‘Drone’ to alternate the couriers. On the other hand, some experimental entrants like Uber are involving in the same day delivery service. Why do these start-ups have the competiveness? Firstly, brick and mortar retailers have realized the rising expectation of consumers, and they are changing the inventory strategy, moving the inventory as closer as possible from regional DC to local shops for the better local coverage. Theoretically, compared with traditional couriers, the crowd sourced business model of the mobile app provides more supplies of messengers. They can approach the shippers much quicker. With more amounts of supplies, shorter running distance, and without the limitation of business scale, this kind of companies is able to offer the lower price of deliveries. In addition, via the mobile app, increased visibility and route auctions will produce better user experience. In critical thinking, the reliability is still a big concern for these app companies, but it should be a trend to use the app for local delivery in the future.

6.5.3 THREAT OR OPPORTUNITY

The similar mobile apps like Uber are entitled ‘Disruptive Technology’. The term was coined by Clayton M. Christensen, (1995). Christensen argues that when the market is fragmented with the very tight profit margins, and customer demands driven, disruptive innovations can hurt the well-established and successful companies. Uber has wounded the taxi industry in many countries. When they involves in local delivery industry, is it also disruptive to the traditional courier industry? During the interviews for this research, the similar question was asked to the respondents at the last moment. “If this kind of mobile app steps in New Zealand, do you think it is a threat or opportunity?” There are eleven respondents (36.7%) considered it as a threat while five respondents (16.7%) believed it might be an opportunity for their work, the remainders with no comments.

Indeed, these types of mobile apps provide the users with a more accessible platform to look for the delivery service. Undoubtedly, professional Owner-Operators are also the beneficiaries. At the current stage, although the Owner-Operators are so-called self-employed, they are dependent on courier companies and work exclusive for them. It is not a genuine self-employment. If the market is matured enough in the next few years, Owner-Drivers can directly benefit from this electronic sales pipeline. Meanwhile they can truly control their own situation and successfully escape from working for a courier company. Once the Owner-Operators could be economically independent enough from the app, the traditional relationships with the courier company must be affected.

However, the research believes that it is a trend for the ‘Uberization’ of local delivery, and the opportunities it brings about outweigh the threats. As the start-up companies are booming to propel local delivery by mobile technology in many cities, it is a signal for conventional courier companies to convert their business models. When they are investing the massive funds on DCs or transport capacities for serving the last mile delivery, they need to realize that, with the involvement of mobile technology, the entire deliveries has been gradually segmented into more and more routes. They must have a more precise and clear market positioning.

7.CONCLUSION

This research has presented an exploratory of the causes impacting vehicle utilization within Owner-Operators in New Zealand, and plugging in the logistical mobile app as a new approach to alleviate the relevant negative effects. Under the broad topic area of Logistics management, combining the coherent literature with analysis of the valid qualitative data, insufficient business resources and unprofitable operations are two main directions resulting in the inefficient behaviors. Accordingly, relying on the proliferation of mobile technology, there are some potential functions of logistical mobile app in mitigating the relevant inefficient activities, such as unsteady delivery frequency and the lack of business resources. By the majority of the respondents, they are looking forward to digging out more opportunities from existing underproductive customers via this new technology. Undoubtedly, by integrating the upstream and downstream information flow seamlessly, the stated mobile app assembles the current utilizing functions of locating, tracking, automatic communicating, and data exchanging. This effectively improves the customer experience; avoids the repeated and unprofitable journey. Although the routes paring are not treated as a useful function via the mobile app, a perfect paired shipment is essential to improve the unutilized capacities. Therefore, most of the respondents have positive perspectives of this new theory in optimizing the vehicle utilization.

Despite the unavailable service of the logistical mobile app on current stage, this new theory provides the Owner-Operators and 3PLs with some insights for improving communication efficiency and boosting sales activity. In an attempt to enhance the vehicle utilization, except for the process optimization, information technology might be the trend of improving vehicle utilization, even the entire supply chain performance in the future.

The Mobile Application brings about an electronic platform to assist the performance optimization. Traditional logistics companies should be inspired to adjust the operational model. Otherwise, the mobile technology is not only a tool, but probably a disruptive innovation to smash the monopoly.

REFERENCE

1. "App" voted 2010 word of the year by the American Dialect Society (UPDATED) American Dialect Society". Americandialect.org. 2011-01-08. Retrieved 2012-01-28.
2. Bhatt G., Emdad A. (2001), "*an analysis of the virtual value chain in electronic commerce*", Logistics Information Systems, Vol. 14, pp. 70-85.
3. Blaikie, N. (2000). *Designing Social Research*, Cambridge: Polity.
4. Bower, Joseph L. & Christensen, Clayton M. (1995). However the concept of new technologies leading to wholesale economic change is not a new idea since Joseph Schumpeter adapted the idea of creative destruction from Karl Marx. Schumpeter (1949) in one of his examples used "the railroadization of the Middle West as it was initiated by the Illinois Central". He wrote, "The Illinois Central not only meant very good business whilst it was built and whilst new cities were built around it and land was cultivated, but it spelled the death sentence for the [old] agriculture of the West."["Disruptive Technologies: Catching the Wave" Harvard Business Review, January–February 1995
5. Bowersox, D. J., & Daugherty, P. J. (1995). *Logistics paradigms: the impact of information technology*. Journal of Business Logistics, 16(1), 65–80.
6. Bretzke, W.-R., & Barkawi, K. (2013). Sustainable logistics : responses to a global challenge. Heidelberg: Springer.
7. Browning, B., & White, A. (2000, April). *Collabarative Transportation Management – A Proposal*. Logility Inc.
8. Brueggen, A., & Luft, J. L. (2014). Cost Estimates, Cost Overruns, and Project Continuation Decisions (SSRN Scholarly Paper No. ID 2434217). Rochester, NY: Social Science Research Network. Retrieved from http://papers.ssrn.com/abstract=2434217
9. Bryman, A (2012), *Social Research Methods*: 4th Edition, Chapter 17 - The Nature of Qualitative Research, Oxford University Press, P. 379-414.
10. Bryman, A. and Bell, E. (2011), *Business Research Methods*: 3rd Edition, Chapter 6 - The Nature of Quantitative Research, Oxford University Press, P. 149-171.
11. Button, K., & Hensher, D. A. (Eds.). (2003). Handbook of transport and the environment. Boston: Elsevier.
12. Calder, R., & Marr, P. (1998). *A beef producer initiative in traceability: Scottish borders TAG*. Supply Chain Management: An International Journal, 3(3), 23–126. doi:10.1108/13598549810230822
13. Caplice, C (2007) *Electronic Markets for Truckload Transportation, Production and Operations Management*, 16 (4), July–August, pp 423–36.
14. Chopra, S., & Meindl, P. (2012). *Supply chain management: Strategy, planning, & operations (5th ed.)*. Upper Saddle River, NJ: Pearson
15. Chow, H. K. H., Choy, K. L., Lee, W. B., & Chan, F. T. S. (2007). *Integration of Web-Based and RFID Technology in Visualizing Logistics Operations - a Case Study*. Supply Chain Management: An International Journal, 12(3), 221–234. doi:10.1108/13598540710742536
16. Clandinin, D. J., & Connelly, F. M. (2000). Narrative inquiry : experience and story in qualitative research (1st ed.). San Francisco: Jossey-Bass Publishers.

17. Collis, J., & Hussey, R. (2009). Business research : a practical guide for undergraduate & postgraduate students (3rd ed.). Basingstoke, UK New York: Palgrave Macmillan.
18. Cooper, D. R., & Schindler, P. S. (2008). Business research methods (10th ed.). Boston: McGraw-Hill Irwin.
19. Creswell, J. W., & Plano Clark, V. L. (2007). Designing and conducting mixed methods research. Thousand Oaks, Calif.: SAGE Publications.
20. CSCMP, 2005. *Council of Supply Chain Management Professionals*, from www.cscmp.org.
21. De Angelis, L (2011) *A fall in average vehicle loads*: Average loads, distances and empty running in road freight transport – 2010, Statistics in Focus 63/2011, Eurostat, Luxembourg.
22. DETR, 1999. *Sustainable Development*: A strategy, DETR, London.
23. Esper, T.L. and Williams, L.R. (2003), *The value of collaborative transportation management (CTM): its relationship to CPFR and information technology, Transportation Journal*, 42 (4) pp. 55-65.
24. Eurostat (2007) Average loads, distances and empty running in road freight transport – 2005, Statistics in Focus, Transport 117/2007, Eurostat, Luxembourg
25. Forcher, R., Mink, A., Focke, M.: *Intelligente Zulaufsteuerung durch telematikgestutzte Transportevents*. Logistik Management (4), 47 (2004)
26. Ghauri, P. N., & Grønhaug, K. (2005). Research methods in business studies : a practical guide (3rd ed.). New York: Financial Times Prentice Hall.
27. Grix, J. (2002), *Demystifying Postgraduate Research: From MA to PhD*, Birmingham: Birmingham University Press.
28. Gunasekaran, A., & Ngai, E. W. T. (2004). *Information systems in supply chain integration and management*. European Journal of Operational Research, 159(2), 269–295. oi:10.1016/j.ejor.2003.08.016
29. Hamari, Juho; Sjöklint, Mimmi; Ukkonen, Antti (2015). "The Sharing Economy: Why People Participate in Collaborative Consumption". Journal of the Association for Information Science and Technology. doi:10.1002/asi.23552
30. Harrison, A., Hoek, R. I. v., & Skipworth, H. (2014). Logistics management and strategy : competing through the supply chain (Fifth edition. ed.).
31. Henry C.W. Lau, Carman K.M. Lee, G.T.S. Ho, W.H. Ip, Felix T.S. Chan, Ralph W.L.(2006). *M‐commerce to support the implementation of a responsive supply chain network.* P.169-178.
32. Howe, J. (2006). The rise of crowdsourcing. Wired Magazine, 14(6), 1–4.
33. Hughes, J. and W. Sharrock (1997). *The Philosophy of Social Research* (3rd edn), London and New York: Longman.
34. James, M., Grosvenor, R., & Prickett, P. (2004). *E-Distribution: internet-based management of a merchandiser supply chain*. Supply Chain Management: An International Journal, 9(1), 7–15. doi:10.1108/13598540410517539
35. Joyce D. Jacksona, Jae S. Parkb, Janice C. (2006). *Probstc Understanding information technology acceptance by individual professionals*: Toward an integrative view
36. Kalakota, R., Robinson, M., & Gundepudi, P. (2003). *Mobile applications for adaptive supply chains: A landscape analysis*. In E.-P. Lim & K. Siau (Eds.), Advances in Mobile Commerce Technologies (pp. 298-311). Hershey, PA: Idea Group Publishing.
37. Kalakota, R., Robinson, M., & Kalakota, R. (2000). E-business 2.0 : roadmap for success. Boston, MA: Addison-Wesley.

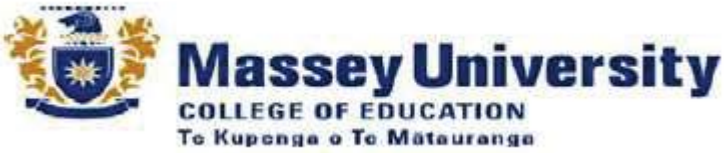
38. Kent Löfgren, (2013). *What is Epistemology*. http://www.youtube.com/watch?v=II9-YgSzsEQ
39. Kent Löfgren, (2013). *What is Ontology*. http://www.youtube.com/watch?v=XTsaZWzVJ4c
40. Khalifa AS. (2004) *Customer value: a review of recent literature and an integrative configuration*. Manag Decis 05 42 (5):645-666
41. L. Puigjaner, A. Espuña (2005). *European Symposium on Computer-Aided Process Engineering*-15. p. 1234.
42. Lam SY, Shankar V, Erramilli MK, Murthy B. (2004). *Customer value, satisfaction, loyalty, and switching costs: an illustration from a business-to-business service context*. J Acad Market Sci Summer 2004 32(3):293-311
43. Lau, H. C. W., Lee, C. K. M., Ho, G. T. S., & Ip, W. H. (2006). *M-commerce to support the implementation of a responsive supply chain network*. Supply Chain Management: An International Journal, 11(2), 169–178. doi:10.1108/13598540610652564
44. Lewis, I (2001) *Logistics and electronic commerce: an interorganisational systems perspective, Transportation Journal*, 40 (4), P. 5–13.
45. Liu, X., McKinnon, A. C., Grant, D. B., & Feng,Y. (2010). *sources of competitiveness for logistics service providers: a UK industry perspective*. Logistics Research, 2, 3–14. doi:10.1007/s12159010-0024-7
46. Mansell, G (2006) *Transport tendering comes of age, Transport and Logistics Focus*, 8 (4), pp 26–28.
47. Massey University. (2013). Code of ethical conduct for teaching and research involving human subjects (Rev. ed.). Palmerston North, N.Z.: Massey University.
48. McKinnon, A. C. (2015). Green logistics improving the environmental sustainability of logistics. Third edition., from http://ezproxy.massey.ac.nz/login?url=http://massey.eblib.com.au/patron/FullRecord.aspx?p=1931712
49. McKinnon, A. C., Browne, M., & Whiteing, A. E. (Eds.). (2012). Green logistics : improving the environmental sustainability of logistics (2nd ed.). London Philadelphia: Kogan Page.
50. McKinnon, AC and Ge, Y (2006) *The potential for reducing empty running by trucks: a retrospective analysis, International Journal of Physical Distribution & Logistics Management,* 36 (5) pp 391–410
51. MFE. 2009. *Vehicle Kilometres Travelled By Road*. Ministry for Environment Technical Report.
52. Michael Hulsmann, Anne Schwientek, Benjamin Korsmeier, and Linda Austerschulte. (2011). *Autonomous Cooperation and Control in Logistics: Creating Customer Value in Logistics: Contributions and Limitations of Autonomous Cooperation-Based Technologies*. P.15-25.
53. Myers, M. D. (2013). Qualitative research in business and management (2nd ed.). London: SAGE.
54. Neuman, W. L. (2006). Social research methods : qualitative and quantitative approaches (6th ed.). Boston: Pearson/AandB.
55. NZBC. 2011. *Future Freight Solutions:* An Agenda for Action. Technical Report from the New Zealand Business Council for Sustainable Development.
56. Pier Paolo Carrus and Roberta Pinna, (2013). *Information Technology and Supply Chain Management Coordination*: The Role of Third Party Logistics Providers.
57. Pietro Evangelista., (2012), *Adding Value to Logistics Service Using ICT: A case study analysis of small logistics companies in Italy*. P.111.

58. Pokharel, S. (2005). *Perception on information and communication technology perspectives in logistics - A study or transportation and warehouse sectors in Singapore.* The Journal of Enterprise Information Management, 18(2), 136–149. doi:10.1108/17410390510579882.
59. Potter, J (1996). *Representing reality: discourse, rhetoric and social construction.* London. Thousand Oaks. Sage Publications.
60. Rajni Singh, (2015). *Online Supply Chain Management and Business Ethics*. Edited by Fawzy Soliman. (December 2014). *Cloud Systems in Supply Chains* . [Online] Available at: http://www.palgraveconnect.com.ezproxy.massey.ac.nz/pc/doifinder/10.1057/9781137324245.0001. (Accessed: 8 October 2015).
61. Ravi Kalakota, Marcia Robinson, and Pavan Gundepudi, E-Business Strategies, Inc. (2003). M*obile Applications for Adaptive Supply Chains: A Landscape Analysis*
62. Rizet, C., Browne, M., Cornelis, E., & Leonardi, J. (2012).*Assessing carbon footprint and energy efficiency in competing supply chains: Review – Case studies and benchmarking.* Transportation Research Part D: Transport and Environment, 17(4), 293-300.
63. Ruppenthal, K. M. (1963). *New dimensions in business logistics, proceedings of the First Annual Business Logistics Forum 1962*. Graduate School of Business, Stanford University, Stanford (CA).
64. Rusli, Evelyn (June 6, 2014). "Uber Dispatches trips". Wall Street Journal. Retrieved November 7, 2014.
65. Russell, D. M., & Hoag, A. M. (2004). *People and information technology in the supply chain*: social and organizational influences on adoption. International Journal of Physical Distribution & Logistics Management, 34(2), P.102–122.
66. Sanchez-Rodrigues, V, Potter, A, Naim, M, McKinnon, A and Darby, J., (2010). *Measuring the time and distance impact of transport uncertainty*: A FMCG case study, Logistics Network Research Conference, Harrogate, UK, 8–10 September 2010.
67. Sarkis, J, Meade, LM and Talluri, S (2000) *E-logistics and the natural environment, Supply Chain Management: An international journal*, 9 (4), P. 303–21.
68. Siau, K., Lim, E.-P., & IGI Global. (2003). Advances in mobile commerce technologies. from http://ezproxy.massey.ac.nz/login?url=http://services.igi-global.com/resolvedoi/resolve.aspx?doi=10.4018/978-1-59140-052-3
69. Siau, K., Lim, E.-P., & Shen, Z. (2003). *Mobile commerce: Current states and future trends*. In E.-P. Lim & K. Siau (Eds.), Advances in Mobile Commerce Technologies (pp. 1-17). Hershey, PA: Idea Group Publishing.
70. Simchi-Levi, D., Bramel, J., & Chen, X. (2014). The logic of logistics : theory, algorithms, and applications for logistics and supply chain management (Third edition. ed.).
71. Speakman, J. P. (2002). *Innovation leads to new efficiencies*. Logistic Management, 41, 71
72. Stevenson, W. J., (2010), *Operations Management*, 10th, Ed.McGraw-Hill Higher Education.
73. TERNZ, 2010. An Overview of Commercial Vehicle Operations in New Zealand 2010, Transport Engineering Research New Zealand Limited
74. Van de Klundert, J and Otten, B (2011) *Improving LTL truck load utilization on line, European Journal of Operational Research*, 210, pp 336–43.
75. Wang, Y, Potter A, Naim, M and Beevor, D (2011) *A case study exploring drivers and implications of collaborative electronic logistics marketplaces, Industrial Marketing Management*, 40, pp 612–23
76. Waters, D. (2007). *Global Logistics. London and Philadelphia*: Kogan Page.

77. Wood, L. C., Wood, A., Reiners, T., Duong, N. K. L., & Wang, X. (2014). An exploration on the New Zealand use of technology to facilitate logistics. Proceedings ACIS 2014. Auckland, New Zealand: AUT.
78. Wood, L. C., Reiners, T., & Pahl, J. (2015). Manufacturing and logistics information systems. In M. KhosrowPour (Ed.), Encyclopedia of Information Science and Technology (3rd ed., pp. 5136–5144). Hershey, PA: IGI Global.
79. Xin Wang., (2015). *Operational Transportation Planning of Modern Freight Forwarding Companies*. Vehicle Routing under Consideration of Subcontracting and Request Exchange. P.1-10.

APPENDIX A

QUESTIONNAIRE



Research Thesis for Master of Supply Chain Management
School of Engineering and Advanced Technology
Massey University, Private Bag 11 222
Palmerston North, 4442, New Zealand

Mobile Commerce Improves Vehicle Utilization for Owner-Operators in New Zealand

Questionnaire

Thank you for participating in this study. The objective of this research is to investigate the elements impacting inefficient vehicle utilization particularly with courier owner-operators, and attempts to explore a potential solution using mobile technology app. The researcher sincerely hopes to obtain the details and persepctives of mobile commerce via face to face interviews with owner-operators. The questionnaire and interview will be annoymous, and the confidentiality of all involved respondents, groups, and organizations will be protected.

Instructions:

All questions require a single choice answer, except for those marked with an asterix * where multiple answers are permitted.

Section One: Profiles

1. How many years have you worked as an owner-operator in New Zealand?

☐ Less than 1 year ☐ 2 – 3 years ☐ 4 – 7 years ☐ More than 7 years

2. How many commercial vehicles have you owned for business currently?

☐ 1 vehicle ☐ 2 vehicles ☐ 3 vehicles ☐ More than 3 vehicles

3. *What is the type of your commercial vehicle?

☐ Light passenger car ☐ Light van ☐ Light truck

4. How many companies have contracted relationship with you?

☐ 1 company ☐ 2 companies ☐ 3 companies ☐ More than 3 companies

5. How long is each contract on average?

☐ Less than 1 year ☐ 1 year ☐ 2 – 3 years ☐ More than 4 years

6. *What is the type of the contracted companies?

☐ courier company ☐ 3PL ☐ retailer ☐ E-retailer ☐ factory ☐ others

Section Two: Daily Operations

In this section, according to the communication with the respondents, the interview aims to explore the relevant factors of influencing vehicle utilization by their sharing experience of daily operations.

1. How many hours do you work on average per day?

☐ Less than 4 hours ☐ 5 – 8 hours ☐ 9 – 12 hours ☐ More than 12 hours

2. How many days do you work on average per week?

☐ Less than 3 days ☐ 4 – 5 days ☐ 5 – 6 days ☐ More than 6 days

3. *What is the running model of your daily operation?

☐ From depot to points ☐ point to point

4. How many orders do you dispatch on average per day?

☐ Less than 50 ☐ 51 – 100 ☐ 101 – 300 ☐ More than 300

5. What is the proportion of failure dispatch?

☐ Less than 1% ☐ 2% – 4% ☐ 5% – 10% ☐ More than 10%

6. *What are the reasons of failure dispatch?

☐ Failure signature ☐ wrong address ☐ shipment delay ☐ others

7. How many kilometers do you run on average per day?

☐ Less than 100 kms ☐ 101 – 300 kms ☐ 301 – 500 kms ☐ More than 500 kms

8. What is the proportion of full-load on average?

☐ Less than 10% ☐ 10% – 30% ☐ 31% – 50% ☐ 51% – 80% ☐ 81% - 100%

9. What is the proportion of part-load on average?

☐ Less than 10% ☐ 10% – 30% ☐ 31% – 50% ☐ 51% – 80% ☐ 81% - 100%

10. What is the proportion of empty-run on average?

☐ Less than 10% ☐ 10% – 30% ☐ 31% – 50% ☐ 51% – 80% ☐ 81% - 100%

11. *What are the reasons of empty-run or part-load shipments?

☐ Fluctuated customer demand ☐ Fragmented delivery location

☐ Small delivery time window ☐ Unsteady delivery frequency

☐ Unpaired flow of shipments ☐ Lack of network cooperation

☐ Lack of business acquisition resources ☐ Entirely order driven

☐ Lack of communication with customers

☐ Other (*explain*)_____

12. *What are the current approaches of mitigating empty-run or part-load shipments?

☐ None of approach ☐ Real time communication by phone

☐ GPS ☐ Expand loading match resources

☐ Other (*explain*)_____

Section Three: Mobile Commerce

At the beginning of this section, the researcher will play a video clip or demonstrate some pictures in order to explain and make the respondents understand the functions of new mobile technology much easier. Moreover, collect their perspectives and attitudes of the mobile application.

Do you think the kind of mobile app is useful to:		**Yes**	**No**
1	Increase the efficiency in real time communication with customers?		
2	Expand the opportunities of acquiring business?		
3	Pair the routes effectively?		
4	Improve the vehicle utilization?		
5	Increase the income?		
6	Do you look forward to using it in your work?		
7	If the answer of No.6 is "No", please explain the reason. _____ _____		

*If you can use this kind of mobile app, what is your concern?

☐ Details of cargo (weight/volume/type/special requirement) ☐ Fare

☐ How to mitigate the safety concern from customers ☐ Transaction

☐ Other (*explain*)_____

If this kind of mobile app steps in New Zealand, do you think it is a threat or an opportunity?