Delivery process-review and improvement proposals
Case Hilti Vietnam Ltd.

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Hilti Vietnam Ltd. wanted to assess its outbound delivery process. The research was conducted in order to generate a review on the current delivery process at Hilti. In addition, the company expected to uncover obstacles remained in the process that prevent the process efficiency. The company was also eager to know if it should fully outsource the delivery service to external service providers.

A mixed method of quantitative approach and qualitative approach was used in the research. The first step of the research was to carry out a literature review which covered the topics of logistics activities and transportation management. The theory on transportation management focused on transportation cost, network design, performance measure and outsourcing. Data were then collected from a customer survey, existing performance indicators and interviews of Hilti’s staffs.

The research findings covered the figures regarding on-time delivery, vehicle availability, vehicle utilization, freight cost, order receiving peaks and customer satisfaction. The evaluation of these findings were completed together with improvement proposals. It was recommended that the problems should be addressed internally, and a fully outsourced delivery service was not necessary.
CONTENTS

1 Transportation management and its significant role in logistical performance.................................................................4

1.1 Introduction of Hilti Vietnam Ltd.........................................................5

1.2 Outbound delivery at Hilti Vietnam ..................................................6

2 Research Methodology...........................................................................7

2.1 Quantitative, qualitative and mixed methods ......................................7

2.2 Data collection methods ...................................................................9

2.3 Research questions ...........................................................................11

2.4 Research design and limitations .......................................................12

3 Logistics and Supply chain.....................................................................13

4 Transportation and distribution management.......................................17

4.1 Transportation cost ..........................................................................18

4.2 Transportation network design ..........................................................20

4.3 Performance measurement ................................................................24

4.4 Transportation outsourcing ...............................................................27

5 Research findings..................................................................................28

5.1 Performance measurement of outbound delivery ...............................28

5.2 On-time delivery ..............................................................................29

5.3 Vehicle utilization and availability ....................................................30

5.3.1 Vehicle availability .......................................................................30

5.3.2 Vehicle utilization .......................................................................33
5.4 Freight cost.................................................................37
5.5 Vehicles idling time at distribution center............................38
5.6 Customer satisfaction ..................................................40
6 Conclusions........................................................................43
6.1 Reviews on the current delivery process and problem identification ....43
6.2 Indispensability of complete purchase of delivery service ..............46
7 Discussion..........................................................................46
8 References...........................................................................50
9 Appendices..........................................................................52
Appendix 1. Key figures from Hilti’s annual report of 2015.............52
Appendix 2. Lead time dimensions.............................................53
Appendix 3. Delivery processes..................................................54
Appendix 4. Freight cost of Hilti Vietnam....................................55
Appendix 5. Questionnaire for main customers..............................56

FIGURES

Figure 1. Mixed research design. ...............................................9
Figure 2. The evolution of logistics............................................14
Figure 3. Variation in logistics cost and response time with number of facilities. ..................................................................................17
Figure 4. Milk runs from distribution center.................................23
Figure 5. On-time delivery .................................................................29
Figure 6. Average fleet availability for outbound delivery ......................31
Figure 7. Average fleet availability excluding annual leave .......................32
Figure 8. Average vehicle utilization .................................................35
Figure 9. Number of delivery orders outsourced to 3rd party ....................36
Figure 10. Breakdown structure of outsourced deliveries by ratio of the total delivered weight by party A and Hilti’s fleet unused capacity ..................37
Figure 11. Number of received orders by time frame (from the beginning of 2016) ...........................................................................40

TABLES

Table 1. Transport service providers used by Hilti Vietnam .......................6
Table 2. Transportation performance indicators. .......................................25
Table 3. Key answers from the questionnaire ...........................................42
1 Transportation management and its significant role in logistical performance

The contribution of transportation to the overall success of logistics operations has been amplified over the last decades. During the time prior to transportation deregulation, there was a limited number of transportation companies together. Furthermore, the transportation services was offered in a restricted scale with not many services available. Pricing strategy was also observed unattractive as customers did not have many price options. Starting from 1980, the transportation deregulation brought about much more dynamic transportation services. Transportation services now do not only referring to the movement of products from one place to another, but there is also an extensive range of value-added services such as product sortation, customized delivery. This wide range of services introduces price flexibility which allows customers to purchase services in a vast amount of prices. Consequently, companies are given more alternatives to operate their transport operation. Transportation in a company can now be done not only by the own fleet but also by for-hire vehicles. (Bowersox, David and M. Bixby 2002, 328)

This evolution of transportation definitely brings about a more significant impacts of it in logistical performance. Accurate planning and implementation of product delivery tends to reduce inventory cost and material handling cost. Additionally, performance measures of other logistics operations can only reflect target values if an effective and efficient transportation management is being executed. As a result, transportation management is very crucial to the success of overall logistics performance nowadays. (ibid., 329 and 355)

Discussions to identify the research topic took a while as there are quite many areas that Hilti wish to have reviews on. Following the fact that the business of Hilti in Vietnam is growing fast, it is crucial to be aware of the capability to fulfill customer orders because the increase in received orders now or in the future might offset the current capacity. Having this in mind, the research topic is then narrowed down to the delivery process of Hilti Vietnam. It has the aim to give a review of the delivery performance, and improvement proposals are
discussed based on the revealed issues. The research is expected to be a useful preparation which allows Hilti to handle a larger amount of orders in the future while ensuring its service level and managerial targets.

With the intention to tackle the problem at different angles of view, the research will include interview and questionnaires to different parties involved in delivery process at Hilti Vietnam. Firstly, it is important to gather data internally. This is done by having discussions and interviews with the Logistics Supervisor at Hilti Vietnam, hence an overview of the current performance can be acquired. Existing and potential problems then can be outlined and identified. By involving in the outbound delivery and working closely with the staff members, objectives of the research are continuously refined and materialized throughout the research time. Secondly, the freight cost of outbound deliveries will be checked if it has been under control or not. Thirdly, drivers who directly deliver the orders to customers are also interviewed, so that difficulties remained in the process under the eyes of a driver are revealed. Last but not least, a questionnaire is used in gathering main customer’ reviews regarding the delivery performance.

The application of this research, however, is restricted to the case of Hilti Vietnam only. Furthermore, a focus on operations in Ho Chi Minh City will make any efforts of using the research findings in other contexts unreliable. Other limitations will be mentioned in detail later in the report.

1.1 Introduction of Hilti Vietnam Ltd.

Hilti Vietnam Ltd. is a relatively young company with its 5 years of business in Vietnam since 2011. There are over 30 professionals who are contributing to the company’ success. The head office is located in the city center of Ho Chi Minh City, and the other office is set up in Hanoi. Hilti Vietnam offers a wide range of products (especially handheld devices) and services in the construction and energy industries. It involves in many large scale, residential and commercial buildings and infrastructure projects. In addition, national energy projects are served from the design phase to the completion.

Without a manufacturing plant in Vietnam, Hilti Vietnam imports its products from Hilti’s regional warehouse in Singapore. This leads to the situation in
which certain products are imported prior to the point of usage and kept as inventories, whereas other products will be imported according to the orders from customer. All Hilti' products are, then, stored in a distribution center which is under control of a service provider. In overall, logistics operations at Hilti Vietnam consists of the inbound operation (importing and transporting products to the distribution center) and the outbound operation (delivering products from distribution center to final customers).

The current logistics management is pretty simple since the company has been dealing with relatively small order volume. However, Hilti Vietnam is looking forward to setting up a more sophisticated logistics management in order to match up with its business expansion. Figures on total number of purchase orders, total revenue and customer pool of the year of 2015 are indicated in Appendix 1.

1.2 Outbound delivery at Hilti Vietnam

At the moment, outbound deliveries are executed using a combination of Hilti’s own fleet and vehicles from 3rd-party service providers. The delivery fleet consists of vehicles whose payloads are 300 kilograms and 500 kilograms relatively. Four transportation 3rd parties are contracted with different usage, shown in Table 1.

Table 1. Transport service providers used by Hilti Vietnam

| Party A          | • Intra-city delivery.  
|                  | • Under the circumstance that company’s fleet is unavailable.  |
| Party B          | • Chemicals delivery  
|                  | • Under the circumstance that delivery orders involve chemicals  |
| Party C          | • Full truckload delivery  
|                  | • Used when the order volume outweighs the company’s fleet capacity  |
| Party D          | • Long haul on rail  
|                  | • Used when shipments are transported from Ho Chi Minh City to Hanoi.  |
Considering the characteristics of the deliveries (product category and transportation distance) at Hilti, it is worth stressing that only party A offers the same service with Hilti’s fleet. This information is important to the analysis of the fleet utilization as service from party A should only be used when Hilti’s vehicles are not available or unable to deliver a particular shipment.

Delivery process starts with the action of picking up items for delivery by the driver. Hilti’s driver receives a notification for picking up items at the distribution center. As mentioned before, this distribution center belongs to a service provider, and it is located 30 kilometers away from Hilti’s office. The drivers have to drive there from the office, get the items and then deliver to the customers.

It is worth stressing that there are two time windows for delivery. Within a day, shipments are delivered in the morning and the afternoon. Orders receive in the morning will be consolidated and sent to distribution center for picking up, and they are shipped to customers in the afternoon of the same day. The same process is implemented for orders received in the afternoon which will be delivered in the morning of the next day.

2 Research Methodology

2.1 Quantitative, qualitative and mixed methods

Knowledge and understanding the surroundings can be achieved through experiences. Experiences then are analyzed to form further conclusions through the method of reasoning which generates conclusions from logical argument. There are deductive reasoning, inductive reasoning and a mix of them. Deductive reasoning brings about a particular conclusion that can be applied to a specific individual or group from a general statement, whereas inductive reasoning transforms a specific observation of an individual or a small group into a generalized conclusion for a larger population. Research is a combination of both experience and reasoning. It, however, provides more valid and reliable knowledge. Unlike experience, knowledge gained through research is obtained systematically in a controlled design, hence it is more reliable. Additionally, the aim of research is to gain a better understanding of
the phenomenon in our world and research results are tested in the real world, hence it is more valid than reasoning which can be based on abstract phenomenon. (Walliman 2001, 8-10)

The most known research approaches are quantitative and qualitative. The basic difference between them is that qualitative method tends to use words in preference to numbers while quantitative prefers using the latter. Another distinction can be seen from the purpose of qualitative research and quantitative research. Qualitative research is carried out in an exploratory approach which comes up with a theory or hypothesis in the end (hypothesis generating), meanwhile quantitative research is taken place in order to examine a theory or hypothesis that has already been predetermined (hypothesis testing). (Creswell 2009, 1-2) Furthermore, quantitative research identify the relationship among variables that are measurable and analyzed using applied mathematics. On the other hand, qualitative research gives insights into phenomenon or events that are not feasibly explained using mathematical skills. (Glenn 2010, 96)

Due to the truth that each research method has its own benefits and limitations, a study using both quantitative and qualitative research is expected to overcome the limitations while make the best use of the benefits. Based on this fact, a mixed approach of both quantitative and qualitative research methods is implemented to bring about difference perspectives of research topics and to mitigate the impacts of method bias. (Golicic and Davis 2011, 727)

Golicic and Davis (2011, 731-734) introduce a mixed approach design (Figure 1) in which researchers are able to engage in different phases of both quantitative and qualitative approach. In a single research project, a researcher may initiate the research with either quantitative or qualitative approach, go through that method’s phases and then involve the other method in the research as well. If the chosen initial approach is qualitative, related data of the phenomenon need to be collected in their natural form. These data forms the foundation for developing the description of characteristics of the phenomenon. Theories are then formed based on this description. The theories have to be substantive since they are derived from data in its natural
form. On the other hand, quantitative approach begins with a literature review which gathers knowledge and information on the research phenomenon from pre-existing studies. Based on the literature review, theories are generated. These theories need to be further tested in reality, hence they are formal. Finally, field verification has to be conducted in order to substantiate the formal theories.

![Mixed research design](image)

Figure 1. Mixed research design. (Golicic and Davis 2011, 731)

### 2.2 Data collection methods

**Observation**

Observation aims to collect information and knowledge about the world through human senses. It is also used to validate formal theories in the real world. Observation surely has its advantages but also disadvantages compared to other data collection methods. By observing, researchers possess the full control of the data collection process without relying on other parties. As outsiders, researchers may expose certain perspective of a phenomenon that cannot be seen by the direct participants. Furthermore, observation does not necessarily require data sources to be intellectual or communicable, since the researchers can just simply observe the phenomenon in its natural form. (Sapsford and Jupp 2006, 57-59)
In contrast, it is not always possible to perform observation because some phenomenon have very limited accessibility for observation. The reliability of data collected from observation should also be put in question. It is not easy to observe a phenomenon objectively, for instance behavior of people may be manipulated as they are aware that they are being observed. The data can also be collected and analyzed to better suit the intention of observers. Last but not least, observation is considered as a very resource-consuming method if researchers wish to capture the full occurrence of a phenomenon. (ibid., 60)

**Interview and questionnaire**

Apart from observation, data can also be collected from interview and questionnaire. These two methods share a similarity of using questions which generate desirable data from respondent’ answers. Questionnaire is a very popular method in collecting market information. It basically contains detail instructions that guide the respondent on answering a list of purposely-composed questions. It is then the respondent’s responsibility to complete the questions using his/her own words and opinions. The variability of answers can be either limited to predetermined options (multiple choice) or unlimited (free answer). Furthermore, questionnaire does not involve the direct interaction between inquirer and respondent in collecting data, since the respondent receives guidance from instructions given on the questionnaire itself. (ibid., 93-94 and 121)

On the other hand, interview is a technique that requires direct interaction between the interviewer and the respondent, either through face-to-face or phone call interview. There are many variations in designing an interview. A standardized list of questions can be repeatedly given to many respondents, and the sequence of questions appeared in the list remains unchanged intentionally to guide the respondent’ answers to a specific target. However, it is also possible to carry out an interview in a less-structured way. Interviews can be just conversations between people. As a result, there is no order in answering questions. Without any restrictions, the respondents can freely express themselves, while the interviewers can change the order or vary questions from respondent to respondent in order to gain the necessary insights. (ibid.)
Documents

Documents have become one of the major source for data collection. Literature review, as one of the earliest stage of a research, relies heavily on data collection from documents. Equally important, documents remain the significant impact on supplying data to other stages of the research. The traditional form of documents refers to written documents, such as books and articles. However, documents nowadays also cover other sources of materials like movies, radio channels. In addition, data in documents are not only presented under the form of texts, but also graphically depicted as maps, photos, etc. (ibid., 138-139)

2.3 Research questions

This thesis is conducted in order to answer these important research questions. The main research question is:

**Is the current outbound delivery process being executed efficiently?**

It is a good preparation from Hilti Vietnam to take one step further to carefully identify the issues remaining in its delivery process, since its delivered volume is and will be expanding. Having this in mind, these secondary research questions below will address the issues and support that preparation.

- **If it is not, what are the problems that hinder its efficiency?**
- **Considering the current fleet capability, is it necessary to totally outsource the outbound delivery process to a service provider in order to fully fulfill customer’ orders?**

The literature review will provide an overview of transportation management hence assist the review of outbound delivery at Hilti Vietnam. In addition, recommendations for improvement will be discussed in the thesis in order to better utilize thesis’ findings.
2.4 Research design and limitations

Research design

To assess the current outbound delivery at Hilti Vietnam, the first step is to carry out a literature review. This theoretical review should not only contain the topic of the outbound delivery but also an overview of different logistics activities and other areas under transportation management. The reason behind that is delivery process is very closely linked to other activities, hence understanding a broad picture will bring about more accurate and reliable research findings. The next step is to gather data and information regarding outbound delivery at Hilti Vietnam for its performance analysis. It is worth stressing that delivery performance needs to be viewed under different perspectives in which the most two important are internal financial performance and performance under customer's point of view. In order to do so, a questionnaire will be developed and given to the group of customers of Hilti with a strong focus on those who frequently handle deliveries from Hilti. Additionally, a review on the cost generated by the outbound delivery is done with the help from Hilti Finance Manager.

The collected results from previous actions, however, is not sufficient enough to pinpoint the issues that prevent the delivery process from excelling. To answer the first secondary research question, taking a look under the operational perspective would be a good move in this case. An interview with the drivers whose important roles in delivery cannot be denied is highly valuable in identifying the incurred difficulties as well as the gaps remaining in the process.

Research limitations

Due to the fact that data collected from Hilti Vietnam and the research design are very unique to the operations of Hilti, any research findings and recommendations are only valid to this case study. Additional researches and tests are required in order to testify the validity of thesis results in other contexts.
Shipment planning and management whose featured topics are transportation routing and scheduling, shipment frequency planning will not be covered in the literature review, even though it has direct impacts on outbound delivery performance. The driver behind this decision is the tightly limited applications of shipment planning and management in answering the research questions due to the characteristic of urgency of construction industry and the complicated traffic conditions in Vietnam.

Furthermore, the topic of transportation outsourcing is an interest of the company. However, since outsourcing is a very broad field involving different sub-topics, it is only possible to mention a small part of theoretical background on outsourcing. Designing a detailed framework of transportation outsourcing will be completed in another research in accordance to Hilti’s requirement.

The limited research time also restrict the scope of this research which only covers the operation in Ho Chi Minh City and not any other cities. As a result, any decisions on national or multi-regional level require further appropriate researches.

3 Logistics and Supply chain

Definition

In the past, the logistics was first mentioned in military, indicating the activities that are used for the purpose of maintain the fighting ability of troops. (Ghiani, Laporte and Musmanno 2004) The term then has expanded its impact scope into the private sector. (Frazelle 2002, 5-6)

Frazelle (2002, 6) describes this evolution which consists of 5 phases-workplace logistics, facility logistics, corporate logistics, supply chain logistics, and global logistics. Logistics development is presented on a timeline in Figure 2.
Workplace logistics takes place at a work-station and refers to the movement of material at that particular unit. Ergonomics is an alternative name for workplace logistics. (ibid.)

Facility logistics has been developed based on workplace logistics, and it refers to the flow of material among work stations in a facility. The flow of material happened in a facility has then been differentiated into 2 groups, physical distribution and business logistics. Physical distribution is inclusive of the material handling, warehousing, and transportation, while business logistics is formed of procurement, marketing and customer service. (ibid.)

The scope and impact of facility logistics was then expanded to corporation level, resulting in corporation logistics. Based on the concept of movement of material, corporation logistics presents the scenario in which material is passed through various facilities and functions within a corporation. (ibid., 8)

It is crucial to differentiate the term supply chain and logistics as misunderstanding and confusion often take place when the 2 terms are mentioned. Supply chain is the system of facilities that are linked together for the purpose of serving final consumers with finished products. For instance, a supply chain can be comprised of manufacturing plants, warehouses,
transshipment depots, distribution centers, selling outlets, and customer destination. (ibid.). Similar to this point of view, Ghiani (et al. 2002, 3) believes supply chain is a system that processes raw materials to create finished products which are then placed in distribution channels to reach consumers.

On the other hand, logistics represents the set of activities that occur within and join different objects of a supply chain, together with the management of these activities. In other words, logistics is “what happens in supply chain”. (Frazelle 2002, 8).

As a result, Frazelle (2002, 5) defines logistics as "the flow of material, information, and money between consumers and suppliers". Meanwhile, according to Bowersox (et al. 2002, 4), logistics refers to all the necessary activities that need to be done in order to create a flow of inventory, which Ghiani (et al. 2004, 6) describes as “stockpiles of goods waiting to be manufactured, transported or sold”, from the beginning to the end of a supply chain. The council of Logistics Management provides a more sophisticated definition for logistics: (Lambert, Stock and Ellram 1998, 3.)

*Logistics is the process of planning, implementing and controlling the efficient, effective flow and storage of goods, services and related information from point of origin to the point of consumption for the purpose of conforming to customer requirements.*

In the context of global trading, global logistics has been very important in connecting different supply chains in different nations, hence providing an international flow of material and products across the globe. Global logistics is becoming more and more complex as its scope and content have been expanded throughout the time. (Frazelle 2002, 10-11).

**Logistics Activities**

In order to obtain an effective logistics management, the understanding of logistics activities is very essential. Logistics activities remain in different stages along the supply chain. Three primary logistics activities are believed to be: order processing, inventory management and transportation management. (Ghiani et al. 2004, 6).
Order processing is a crucial key in a supply chain. Due to the fact that order processing reflects customer orders, it is considered as a trigger that drives the other functions in fulfilling customer demand. Order processing heavily relies on the flow of information, which was highly time-consuming due to a large amount of paper work, within its supply chain. Thanks to the advance of information technology, order processing has been a lot more efficient in terms of customer order making, order handling and real-time inventory checking from supplier. (ibid.)

Equally important, inventory management has been playing an essential role in logistics management. Its objective is to identify the optimal inventory levels of materials, semi-finished and finished products, hence allowing the business to be operated at the least cost and highest customer service. (ibid., 6-7)

In addition, a productive transportation management grants manufacturers the ability to expand its market geographically to reach their new potential customers. As a result, economies of scale can be fully utilized. Transportation management also contributes a huge part in managing the low cost and high customer service level of a supply chain. (ibid., 9)

Frazelle (2002, 13), however, believes that there are five core logistics activities. Apart from the three activities mentioned above, supply management and warehousing are likewise significant. The inventory levels that have been determined in inventory management will be collected through supply management. This can be done not only by means of production but also procurement. As a result, supply management in a particular firm involves many activities and measurements related to its supplier. On the other hand, warehousing serves as a connection between the order processing and inventory management. It includes all the related work that need to be done inside warehouses. Even though it is not always necessary to perform warehousing, warehousing in most of the cases is a catalyst that enables firms to achieve their desirable service level, which means the identified performance target (Bowersox et al. 2002, 2856), within the inventory constraints defined in inventory management. Similar to other logistics activities, it is also critical to operate warehousing at the optimum cost.
Last but not least, according to Bowersox (et al. 2002, 42-43), it is not possible to exclude facility network from the list of main logistics activity. The argument is developed based on the huge impact of network designing in customer service and operating expenses, and this impact can be examined in Figure 3. Setting up a network of facilities with a cautious consideration of the number, size and geographical location can be the solution to a successful supply chain. In the context of volatile market and heavy competition, network designing should be continuously reviewed and adjusted in order to tackle the variability in demand and supply.

![Figure 3. Variation in logistics cost and response time with number of facilities. (Chopra and Meindl 2007, 80)](image)

4 Transportation and distribution management

Transportation takes the responsibility of hauling goods from one destination to others, from the beginning to the end of a supply chain. It brings up a definition of place utility which is the value-added to products via the geographical flow of goods. Enhancing value of products can also be done by holding stocks till the right time for delivery in order to create the best value out of the goods. This capitalizing of time is called time utility. Not only
inventory management and warehousing that decide the time utility, transportation also plays a huge part since it affects the time frame of shipment to final users. As a result, transportation management significantly contributes to the success of supply chain. (Lambert et al. 1998, 217).

4.1 Transportation cost

One of the key features in transportation management is transportation cost. A major source of logistics expenditures comes from transportation. A deep understanding of cost factors and cost structure in transportation is required to gain an effective transportation management.

Cost factors

There are two groups of factors that determine transportation cost, product-based factors and market-based factors. The group of product-based factors consists of density, stowability, handling and liability. (Lambert et al. 1998, 218)

1. **Density** represents the weight-volume ratio. There are items that are very dense with a relatively small volume, and in the opposite there are products with high volume but relatively light weight. Due to the limited capacity of transportation vehicles, carriers introduce the density factor which is a factor used in calculating chargeable cost of a shipment, hence being able to reconcile the difference between weight and volume and make the most profits out of the service. In most of the case, high density products have lower transportation cost per unit of weight. (ibid.)

2. **Stowability** specifies the extent to which space utilization of transportation equipment can be reached. Each transportation equipment has its own dimensions and shape, and this fact is the same for each product. As a result, in order to utilize transportation equipment in the best way, it is necessary to find the best way to stow products inside these equipment. One of the solution enhancing stowability that has been on-going is the standardization in equipment
design and product packaging, resulting in a better fit between these two entities. (ibid.)

3. Loading and unloading transportation equipment involves **handling of goods**. Any requirement for special handling equipment or manual handling brings about more expensive handling cost. Therefore, the standardization in product packaging mentioned above not only improves the stowability but also allows goods to be handled with ease, hence reducing the needed handling cost. (ibid.)

4. **Liability** relates to the vulnerability of product value to potential damage. Generally, valuable goods are more vulnerable to damage and loss due to sabotage, fragility, etc. For this reason, due to a high liability, carries have to either transfer the risks to insurance companies or take the financial risk themselves. Neither of these two options prevents increased transport rates to be applied to high-value goods as insurance and/or strong security are required. (ibid.)

Moving on with a group of market-based factors, there are 6 factors. (ibid.)

1. The extent of competition in transportation
2. Hauling distance and location of markets
3. Authority regulations and laws regarding transportation
5. Seasonal transportation
6. Domestic Vs International transportation

**Cost structure**

Apart from transportation cost factors, it is necessary to understand the transportation cost structure. The cost structure is formed based on a set of categories in which the most common costs are variable, fixed, and joint cost. (Bowersox et al. 2002, 358-359)
According to Bowersox (et al. 2002, 358), variable costs in transportation are directly proportional to the level of activity, meaning the more transported volume results in higher variable costs. In general, variable costs are expressed as cost over a measure unit, such as a unit of weight or kilometer. The most common variable costs include staffs, equipment upkeep cost and fuel. Moreover, the minimum charge from a transportation firm for a shipment must be equal to the variable costs of that particular shipment as the firm want to remain its existence in the market.

Fixed costs refer to the cost that normally represents the operating assets. This group of cost relatively remains the same in the short run regardless of the level of activity. For instance, the capital that have already been spent on transportation equipment, terminals, technology and software do not change if the volume of new shipment varies. In order to cover the fixed cost, each shipment generally carries a fraction of the cost. (ibid., 359)

In addition to the variable and fixed cost, Bowersox (et al. 2002, 359) also mentions the concept of joint cost. From his explaining, joint cost can be clarified as the cost that is automatically and inevitably generated by having a specific service. A good example for joint transportation cost could be the backhaul empty miles. A transport service from one point to another create the joint cost as vehicles need to depart from the origin to the destination and head back to the origin. Even though the empty return trip do not generate profits, it is an unavoidable cost that need to be covered.

4.2 Transportation network design

Due to the fact that transportation is functioned within a network of geographical locations, transportation network design is one of the key player in determining the performance of logistics service. An effective and efficient transportation network allows firms to take advantages on both service level and cost-effectiveness dimensions. There are a few typical designs of transportation network which are mentioned and discussed by Chopra and Meindl (2007, 395).

Direct shipment network
Direct shipment network is the scenario in which goods are directly delivered to a single customer from a single supplier without any intermediate stations such as warehouses or distribution centers. This design brings about faster deliveries due to its direct characteristic. Not only that, direct shipment is considered as the most simple and easiest network design which is favored by small enterprises. (Chopra & Meindl 2007, 395)

However, direct shipment produces conflict in the cost structure, specifically between inventory cost and transportation cost. Direct delivery system from suppliers to customers involve a large number of shipment, hence resulting in many delivery trips and a high transportation cost. The cost can even be amplified if the ordered volume is nowhere near the truckload capacity (the full operating capacity of a vehicle), hence many less-than-truckload (less than the full operating capacity of a vehicle) trips are applied. Delivery at truckload helps carriers to obtain a lower transportation cost as compared to less-than-truckload, however it generate high inventory cost in the supply chain as goods are transferred in large quantity. From this angle of view, argument can be raised on the fact that this high inventory cost occur at the customers and not the suppliers, hence truckload delivery does not give any negative impact on the supplier’s financial report. (ibid.)

Regarding this matter, Martin (2011, 27) thinks any attempt from a single company to push the cost going upstream or downstream along the supply chain does not improve the company’s competitiveness. Effort of cost reduction should aim at the overall supply chain cost instead of passing over the cost from firms to firms. Any costs that occur along a supply chain is shared among all members of the chain since these costs will be reflected by the final price offered to the end consumer. For this reason, there should not be any competition among firms in the same supply chain but cooperation between them.

In fact, orders from customer seldom match the truckload capacity. They are often in small quantity. In order to counter this issue, one method is to implement milk run in direct shipping. Milk run is based on the concept of shipment consolidation (the act of combining shipment from different sources to achieve economies of scale) in which goods are collected either at one
supplier to serve different customers or at different suppliers to serve one single customer. This method improves the utilization of vehicle capacity in the context of small ordered quantity from customer, hence contribute to a lower transportation cost. (Chopra & Meindl 2007, 396)

**Shipment through distribution centers**

Distribution centers can serve as intermediate stations in moving goods from one place to another. Demand of products from one geographical area should be taken care of by the distribution center in that area. As a result, distribution centers also store inventory. The reason behind setting up distribution centers is to best utilize the economies of scale in transportation. Without distribution centers, small shipment are moved back and forth on a long distance to reach customers. This fact, however, is no longer true with the help of distribution centers as small shipment from different suppliers is combined and transported to distribution centers, hence reduce the long-distance transportation cost. The goods then reach and are stored in distribution centers before picked up and delivered to local outlets in the region. The transportation cost for these short-distance deliveries is relatively small even with small quantity as compared to the small shipment in long-distance transportation. (ibid., 396-397)

In addition to the reduction in transportation cost, the best scenario in having distribution centers is that the inventory cost is minimized as well. This scenario introduces the concept of cross-dock in which incoming goods are being sorted and delivered to customers once they reach distribution centers without being stored as inventory. In crossdocking, the goods are only processed in the facility within few hours before being shipped to customers. By applying cross-dock, minimizing inventory cost is a possible objective. However, it is crucial to notice that incoming goods from suppliers is either preordered or ordered within a short time windows before the goods are stored. Therefore, it requires a sophisticated information coordination between the managing of incoming and outgoing goods. To capitalize cross-dock technique in the best way, the regional demand should approximately match the supply coming to the distribution center of that region, otherwise part of the supply is kept as inventory. In reality, this case is not usual. (ibid., 397)
Again, milk runs can be carried out to obtain the large shipment of outgoing goods, illustrated in Figure 4. Each delivery trips from distribution centers need to take care of orders from many customers, hence transportation vehicles are used at their full load. (ibid., 398)

Moving further from this discussion, freight consolidation is the key point in making a successful network design since it contributes to low cost of transportation and inventory. Bowersox (et al. 2002, 372-374) presents a few consolidation methods: market area, scheduled delivery and pooled delivery. With small orders from the same geographical region, shipments are consolidated to serve this market area on a regular basis. This simple method is called market area. Under the circumstance of fluctuating daily demand of a market, the freight consolidation in market area seems to be not effective. Consequently, a repeated delivery schedule can be set up to replace the regular shipment. Based on the method of market area, scheduled delivery functions in a way that any orders from the same market region received before the closure of buying time will be handled and shipped to the customers few times a week. Adding to these 2 methods, pooled delivery represents the collaboration of different firms whose customer orders are from the same market region. They are willing to share same shipments, so that freight consolidation can be feasible.

Figure 4. Milk runs from distribution center. (Chopra & Meindl, 2007, 398)

**Tailored network**
We cannot deny the fact that each product has its own characteristics and demand. It is not possible to apply the same distribution design to a wide range of products. In fact, products with different demand and characteristics should have different network designs. Having this in mind, tailored network contains different designs and techniques that have been mentioned above. The sophistication and complexity of this network are the main obstacles that hold firms back from implementing it. An advance information technology is the key in simplify the tailored network. (Chopra & Meindl 2007, 398)

4.3 Performance measurement

Frazelle (2002, 38-39) shares his view about human nature and performance measurement. He believes performance measurement cannot be neglected in order to motivate our behaviors since the human nature responds to a benchmarking system. Our activities need to be measured, and this set of measures define the outcome of our work. If the performance indicators cover a certain aspect and goals, the indicators drive us towards the intention to materialize those goals. Without any measures, there seems to be no underlying motivation in determining our expectations from our behaviors. By appointing the correct measures to the right functions, huge impact on performance improvement can be expected.

Logistics performance measurement typically should cover 3 aspects which are finance, productivity and quality. Starting with a broad spectrum, overall logistics cost should be reflected through logistics expenses, logistics asset value, logistics capital charges and total logistics cost. (Frazelle 2002, 42-44)

Logistics expenses (LE) cover all the expenditures that are spent to operate and maintain logistics activities excluding the logistics assets. A few examples would be expenses on personnel, fuels, outsourcing fees.

Logistics asset value (LAV) refers to the aggregate value of logistics assets own by a company, such as inventory, logistics infrastructure (terminals, facilities), information systems, transportation equipment, etc.

Logistic capital charges (LCC) shows the annual capital cost of maintaining logistics assets. Its calculation involves the asset carrying rate (ACR) which
can be understood as the annualized factor of the generated cost of logistics fixed assets. LCC is equal to the product of LAV and ACR.

Total logistics cost is a very important key financial indicator. It measures the total cost that is summed up from all the logistics-related costs. Total logistics cost is calculated either by summing up all the total costs of all the logistics activities or summing up LE and LCC.

Under the perspective of transportation management, popular performance indicators regarding productivity and quality are presented in Table 2. (ibid., 53-60)

Table 2. Transportation performance indicators. (adapted from Frazelle 2002, 53-60)

<table>
<thead>
<tr>
<th><strong>Productivity</strong></th>
<th><strong>Quality</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivered orders per hour</td>
<td>On-time delivery percentage</td>
</tr>
<tr>
<td>Weight capacity utilization</td>
<td>Damage-free shipments percentage</td>
</tr>
<tr>
<td>Cube capacity utilization</td>
<td>Claims-free shipment percentage</td>
</tr>
<tr>
<td>Percent of idle times</td>
<td></td>
</tr>
<tr>
<td>Percent of empty miles</td>
<td></td>
</tr>
</tbody>
</table>

Additionally, Chopra and Meindl (2007, 54-55) demonstrates 2 important cost measures of transportation. These measures include average inbound transportation cost and average outbound transportation cost. The 2 indicators respectively specify the cost of carrying materials or products into and out of a facility. Furthermore, the authors also introduce average inbound transportation cost per shipment and average outbound transportation cost per shipment through which the costs are presented on the per delivery basis.
Time is also an essential factor in transportation management that should be carefully monitored and measured. In their research Forslund, Jonsson and Mattsson (2008, 43-46) highlights the importance of lead time. Lead time is defined as the period of time that takes place in between the order recognition and the delivery of goods. Before moving further, a clear understanding of anticipated lead time, offered lead time, confirmed lead time, adapted lead time and actual lead time is necessary. Anticipated lead time refers to the lead time that has been pre-determined before an order is received. Offered lead time is given to customers once they place an order, while confirmed lead time is finalized after an agreement on details of the delivery is made. Before the real delivery is conducted, any changes in the confirmed lead time in order to better serve the wish of customers will bring about the adapted lead time. Actual lead time is the real lead time that is recorded once the order reaches its order-maker. The authors then introduce four different dimensions of lead time which can be assessed through the lead time length measurement. The descriptions and available metrics to these dimensions are presented in Appendix 2.

As shown above, most of the performance indicators are created to measure the cost, time, quality and productivity aspects. This opinion is approved by Kallio, Saarinen, Tinnilä and Vepsäläinen (2000, 76-78). Taking a closer look to the outbound delivery process, they links the performance measurement and the divergence of delivery processes. The authors define delivery process as “the process of delivering the consignment to the consignee at the agreed time and place”. In reality, a wide range of products are normally manufactured to serve different customer requirements hence different customer segments. As a result, different delivery processes should be developed for various groups of product. These delivery processes obviously have distinct goals and expectations due to the divergence of customer requirements that they are serving. This leads to potential difference in the usage of indicators and target values of delivery processes. In specific, delivery processes can be seen in three designs: routine process, normal process and custom process. Details of these delivery processes are shown in Appendix 3.
4.4 Transportation outsourcing

Firms tend to grant the permission of implementing and managing non-core activities to service providers who are more specialized in those activities. (Rushton and Walker 2007, 4).

In the context of heavy global competition, companies can only stand out from the crowd through the value they can add to their products. As a result, a strong focus must be placed on the business’ core activities in order to best utilize its resources. Although this is true, non-core activities are still significantly contributing to the success of the overall business performance. This scenario brings about an option of outsourcing these activities to service providers who are able to offer outstanding services. (May 1998, 136)

In relation to delivery process, companies usually can choose among 3 alternative ways to carry out the delivery. These are operating with home fleet, outsourcing delivery process or operating with a mix of home-outsourced fleet. The most typical advantages of having an own fleet are the full control of the fleet which then gives the quick-responsiveness to customer orders, and a marketing opportunity with company’s identity on the vehicles. These advantages require a trade-off to the complexity of transportation management. By outsourcing transportation to service providers, the latter issue no longer bothers companies as they are set free from the complicated management. They are, however, not able to boost the service level to a high level due to the outsourced control. Using both own fleet and outsourced vehicles, on the other hand, seems to reconcile the mentioned advantages and disadvantages of the previous 2 options. (Glenn 2001, 22).

The next coming up action should address the issue of establishing needed steps of outsourcing process. May (1998, 137) introduces specifying the outsourced activities as an extremely important step in outsourcing. It determines whether a specific operation should be outsourced or not. In order to do so, a review on that activity should be based on 2 dimensions, its cost and value-added potential. Outsourcing option should be considered if an operation is carried out at high cost, while low value is added to the output given to customers.
If companies are operating at an unwanted cost or quality of service, it is recommended to start solving the problems internally. A clear understanding of the true cost assigned to the considering activity has to be achieved. Not only so, a well-defined target of quality is also necessary. These requirements are very helpful in reviewing and understanding the current situation, hence supporting the decision process of outsourcing. Besides, they form a base for negotiating and choosing service providers as well. Furthermore, firms need to determine to what extent its operations will be outsourced, either fully outsourced or partly outsourced. In the case of partly outsourcing, a clear boundary between internal responsibility and external responsibility is required. (Rushton & Walker 2007, 269-273)

5 Research findings

5.1 Performance measurement of outbound delivery

In performance assessment, it is very essential to develop a collection of performance indicators. Without them, the performance cannot be measured hence cannot be controlled. The size of the collection has to be appropriate to the size of the company. According to Kumar (2013), excessive amount of indicators will result in ineffective performance control, or abundant resources have to be allocated to maintain performance control effective.

It was a surprise to find out that the outbound delivery at Hilti is currently controlled with only one performance indicator. The company has been recording and measuring on-time delivery rate since its establishment in 2011. A shipment has to be completed within its corresponding time window in order to be considered on-time delivery. A double check from both the driver and the customer is carried out to ensure products are delivered to customers on time. This is done through a process of recording number of on-time delivery on the daily basis by the drivers. The record is then reported to the Customer Service team, and the customers are directly contacted to justify the validity of the record.

The indicator is presented in percentage of the number of on-time delivery and the total number of delivery, and it is recorded on the daily basis. Not only
deliveries carried out by Hilti are measured, this indicator is also applied to shipments conducted by other service providers as a part of 3rd party performance measurement.

A discussion with the Logistics Supervisor at Hilti Vietnam was done to point out difficulties in measuring performance of the delivery process at Hilti. The limitation remains in the information system that is being used. All data input is completed manually, which is very time consuming. Together with the lack of human power of the logistics team, it hinders any efforts of developing more performance indicators. However, it is clear to the company that a set of suitable performance indicators has to be determined in the near future. Specific details on which indicators should be measured have to be determined because the company has no preference to any particular performance measure at the moment.

5.2 On-time delivery

The next step in data collection and analysis involves figures of on-time delivery. A period of six months, from September 2015 till February 2016, is considered for the analysis. As shown in Figure 5, on-time delivery rate within this period stays above 95%. By discussing with the Logistics Supervisor, the figures on punctuality of deliveries meet the company’ expectations.

Figure 5. Amount of on-time and late deliveries.
5.3 Vehicle utilization and availability

The aim of this research is to have a review that reflects the delivery performance from different angles of view. Having this in mind, the question of how the fleet is utilized definitely plays a key role. Two dimensions will be investigated: vehicle utilization and vehicle availability. Under the current setting of the company, vehicle availability nor vehicle utilization are recorded and tracked down for performance assessment.

It should be noticed that the evaluation of these two dimension is implemented regarding the task of outbound delivery which is the major function of Hilti’s fleet. They do not reflect the utilization and availability of vehicles when they are appointed to other tasks which are introduced in the sub-chapter below.

5.3.1 Vehicle availability

The availability of the fleet is calculated in ratio of the number of available vehicles for delivery function and the total number of vehicles in the fleet and expressed in percentage. Due to the fact that a vehicle cannot be functioned without a driver, vehicle availability measures the degree to which both the drivers and the vehicles are available for making delivery. For instance, considering Hilti’ fleet with 2 vehicles, one available vehicle with an available driver and one available vehicle without a driver will result in a 50% availability.

As mentioned above, Hilti’s fleet consists of two vehicles that are accompanied by two drivers. These are the resources that are directly used in delivery process at Hilti Vietnam. Unfortunately, one of these two drivers cannot be fully committed to his job of hauling shipments to customers. Beside the task of outbound delivery, this driver is also responsible for the product testing which is a value-added service to support the customers. Additionally, both the drivers are in charge of staff travel whenever business trip is needed. Consequently, the vehicle availability has been prevented from reaching its maximum value, 100%. In conclusion, the allocated staff to outbound delivery are carrying out many other tasks and not only its core function of delivery.

Furthermore, if a vehicle cannot be used for delivery, it is mainly because the drivers have to perform other tasks. In fact, Hilti’ vehicles themselves are
almost available all the time since the vehicle maintenance only takes approximately four hours throughout the considered three months. Thus, the possibility of the vehicles themselves being physically unavailable can be neglected.

Vehicle availability analysis is conducted based on the data of the latest three months, from January 2016 to March 2016. The analysis takes account of the two time windows of delivery (morning delivery and afternoon delivery) separately. It is possible that a certain minor task tends to be assigned to the drivers only within one delivery time window and not within the other. Therefore, this separation prevents generalizing any trend in assigning driver’ tasks among the mentioned time windows, and it makes the comparison of vehicle availability between them possible. Data on vehicles availability are extracted from the driver’s working schedule which is recorded by the company. The analysis finding is then taken place and presented in Figure 6.

![Average fleet availability](image)

Figure 6. Average fleet availability for outbound delivery

From the figure above, it is quite a concern that the vehicles have not mostly been available for outbound delivery. Within the first three months of 2016, the
figures are relatively low. Hilti Vietnam currently has no target value for the vehicle availability, however according to the Logistics Supervisor a value of 75% is expected. Keeping that in mind, all the three months fail to achieve the expected result.

The analysis used to bring up findings in Figure 6, however, takes into account of cases in which the drivers take their annual leave. Annual leave represents a fixed number of days in a year that employees are eligible to be excused from their work while being fully paid, hence it is considered as a valid reason for the driver not to be available for his service. On the other hand, the meaning of taking account of annual leave in analyzing the vehicle availability is that it is possible to avoid the impact of annual leave on the fleet availability by having more drivers. Figure 7 indicates the vehicle availability that does not consider the annual leave of drivers, meaning a driver who is on his annual leave is still considered as being available for his delivery service.

![Average fleet availability-without annual leave](image)

Figure 7. Average fleet availability excluding annual leave

Without considering annual leave, the results from Figure 7 are better than that from Figure 6 because the fleet is more available for outbound delivery.
February 2016 and March 2016 successfully meet the expectation of the Logistics Supervisor by acquiring more than 75% of fleet availability, while January 2016 remains underperforming.

It is worth to take a look at the gap between the morning time window and the afternoon time window. From both Figure 6 and Figure 7, the gap is relatively small with the maximum difference is 3.57%. This means the vehicles and drivers are equally reserved for outbound delivery in both the two delivery time windows, and there is no preference to any time window in making delivery.

One of the advantage of the current setting at Hilti Vietnam is that the drivers only carry out a single task within a working time window. For example, if a driver is appointed any task other than product delivery within a delivery time window, he is excused from delivery service during that entire time window. Within a single deliver time window, cases in which a driver has to complete product delivery and also other tasks seldom occur. This fact helps to simplify the calculation, otherwise it would be more complicated as calculation has to be done on working hour basis instead of delivery time window basis.

5.3.2 Vehicle utilization

Taking a further step from vehicle availability analysis, vehicle utilization rate measures the degree to which the maximum vehicle capacity has been capitalized. Vehicle utilization rate is the ratio of the utilized net weight and the maximum available net weight of a vehicle, expressed in percentage. Due to insignificant size of Hilti’ products, the utilization rate will be measured as weight utilization instead of cube utilization. The calculation of vehicle utilization should only cover the situations in which vehicles are available to carry out the task of delivery, as it makes no sense to come up with utilization rate of unavailable vehicles.

Similarly to the vehicle availability analysis, data are collected for the first three months of the year 2016 for computing the vehicle utilization. Raw data regarding the total net weight of each delivery are recorded by the company, hence vehicle utilization can be analyzed by comparing that figure and the maximum vehicle capacity. Unfortunately, it is not possible to present the findings regarding vehicle utilization under two separate delivery time
windows. Due to the fact that this measurement is not being applied in the system at Hilti Vietnam, the delivered net weight of products has not been recorded based on its delivery time window but on a whole working day instead. Accordingly, it is presently not practical to pinpoint any correlation or trend that exist between delivered net weight and the two delivery time windows. However, the purpose of investigating vehicle utilization rate can still be fulfilled as it is possible to identify the daily delivered net weight and the maximum daily vehicle capacity. This maximum daily vehicle capacity can be determined by considering both the number of available drivers and the maximum vehicle capacity of a specific working day. For example, with one vehicle that allows a maximum net weight of 300 kg and one of 500 kg, two drivers are able to deliver a maximum load of 1600 kg during the two delivery shifts (morning time window and afternoon time window). In the situation in which products are delivered by two drivers in the morning shift but only one driver in the afternoon, the vehicle whose payload of 500 kg is used twice while the 300 kg vehicle is used only in the morning, resulting in a maximum fleet capacity of that day is 1300 kg.

Again, the data from January 2016 to March 2016 are collected for comparison. The average vehicle utilization rates of the three months are shown in Figure 8. It is found out that the usage capacity is no way close to its maximum value. During the first three months of 2016, the utilization rate of Hilti’ vehicles could not achieve a rate of 50%.
From Figure 8, it is a necessary step to compare the capacity that has not been used, so called leftover capacity, and the net weight of products delivered by party A. Party A is a third-party service provider that has been introduced in Table 1. It offers the same type of delivery service with Hilti’s fleet, hence its service can be rationally compared to that of Hilti. It is such a waste if an outsourced service is used while the own fleet has not been fully utilized.

From January 2016 to March 2016, the number of deliveries completed by party A is 31, observing an increasing rate from January onwards. Among these 31 deliveries, majority of them can be handled by Hilti’s fleet while the rest were done by party A because Hilti’s fleet is either not available or the leftover capacity is not sufficient to conduct the delivery. The detailed values are in Figure 9.
Additionally, in many cases, service from 3rd-party is used even though company’s vehicles are not fully utilized. Under these circumstances, it questions the reasonability of decision of purchasing external delivery service. Figure 10 depicts the ratio of the total product weight delivered by party A and Hilti’s unused fleet capacity. The higher this ratio is, outsourcing decision is more acceptable. Among those delivery completed by party A, 80% of them deliver the total net weight that occupies less than 10% of the leftover capacity.

Figure 9. Number of delivery orders outsourced to 3rd party
Figure 10. Breakdown structure of outsourced deliveries by ratio of the total delivered weight by party A and Hilti’s fleet unused capacity

5.4 Freight cost

By offering a delivery service to its customers, the company definitely has to carry the cost generated from its freight transportation. A check on the actual freight cost will give an insight into financial effectiveness of the outbound delivery at Hilti Vietnam. The actual freight cost which includes all the cost generated from the delivery service, such as personnel cost (including salary, daily allowance, insurance, annual bonus), vehicle repair and maintenance cost, tolls fee and fuel cost. Freight cost is calculated and recorded on the monthly basis by the company. In addition, the company has been carrying out a forecast of freight cost throughout the year. A comparison between the forecasted and the actual freight cost is conducted and presented in Appendix 4.

It can be seen that the freight cost does not really match its corresponding forecasted value over the period of six months (from September 2015 till
February 2016). Three out of these six months gets a higher actual freight cost than expected. This is possibly due to the growth in sales figures, which results in an expansion of delivery volume. Thus, a crosscheck with the sales figures is necessary in order to determine whether the freight cost has been under control or not. According to the Finance Manager of the company, freight cost of a single month should only compose of approximately 1% of the sales revenue of that entire month. Unfortunately, due to the importance of keeping the sales figures confidential, details on the ratio of freight cost and sales revenue will not be available for viewing. However, during the period of those six months, the freight cost always remains under 1% of the sales even though there is a sign of it acting unexpectedly. Therefore, the freight cost is claimed to be under control.

It is good to notice that this ratio is getting higher recently, and this trend matches the finding in Figure 9. As the number of delivery conducted by service providers increases, the freight cost rises as the cost of using service from outsiders is higher than the cost generated by Hilti’s fleet. Within a period of time from January 2016 till March 2016, the average freight cost per delivered kilogram by Hilti is approximately 70% of the freight charge per kilogram by party A, meaning Hilti’s fleet has been operating its service with a lower cost of 30% compared to the cost of purchasing external delivery service.

5.5 Vehicles idling time at distribution center

Understanding the delivery process under points of view of the drivers contributes a significant part in accurately evaluating the process. The interview is designed mainly to uncover the obstacles remaining in process.

From an interview with the two drivers, the current workload is reasonable despite of a few overtime working shifts. The biggest concern would be long idling time in the dockyard of the distribution center, waiting for the items to be picked up from the warehouse. The delivery trip can only be initiated when Hilti’ drivers receive all the required items. The pick-up activity is fully controlled by the third-party who operates the distribution center, and it turns out to be a very time-consuming activity in many occasions. Consequently, the
drivers start their delivery journey later than expected, hence they then have to extend their working shift in order to finish all deliveries.

The issue is then discussed with the warehousing service provider through a meeting in which the researcher is a participant. At the end of the meeting, it is highly recommended by this service provider that Hilti Vietnam should apply a cut-off order time, meaning the service provider only receives item-picking lists from Hilti till a specific point of time. The reason behind is that the lack of human resource does not allow the warehouse operator to fulfill the urgent requirement from Hilti, and in fact it needs a certain amount of time to react accordingly. The service provider proposes a cut-off time which is three hours prior to the start of Hilti’s delivery time window. In other words, the warehouse operator expects Hilti to not receive any purchase orders from the customers within a period of three hours prior to the point of time that Hilti’ drivers start their delivery journeys. All purchase orders from Hilti’ customers which are received before the cut-off time will then be forwarded to the warehouse service provider for order picking-up activity. According to this service provider, in many cases Hilti could not send the picking list at least three hours before the vehicle pick-up, making it impossible for the service provider to urgently organize its order picking-up. The cut-off time proposal from the service provider, however, might not match up with Hilti’ operations, hence Hilti has to be able to identify the most suitable cut-off time on its own.

From the company’s viewpoint, applying a cut-off time is a reasonable requirement, however selection of the cut-off time has to be carefully evaluated in order to ensure Hilti’ benefits. The evaluation is then taken into action by analyzing different time frames during which Hilti receives purchase orders from its customers. By doing so, peak period of purchase order receiving can be identified. As mentioned above, cut-off time needs to be applied to improve on-time delivery rate. On the other hand, the implementation of cut-off time restricts the order-processing time, meaning customers might not be able to place their orders at any time. In order to minimize the negative impact on sales revenue of the company, analyzing the peak hours of purchase order receiving has to be done simultaneously with determining an appropriate order cut-off time. Data used in the analysis cover the first three months of 2016. The analysis results are available in Figure 11.
Performance assessment of the delivery process cannot be completed without gathering opinions of the customers. A questionnaire has been developed to mainly reflect the customer’ viewpoints, and customer’ responses only cover deliveries that are executed by Hilti Vietnam and not by its third-party services. The questionnaire is presented in Appendix 5, and is composed of 10 questions. Among these 10 questions, the last four questions (numbering 6 to 10) serve the main purpose of this questionnaire.

Question 6, 7 and 8 are created to understand opinion of the customers regarding the possibility of setting up scheduled delivery. Starting with an idea of utilizing the materials planning in construction industry, a good collaboration between Hilti Vietnam and its customers will result in improved quality of Hilti’s delivery service as product delivery can be planned in advance based on the customer’ needs. Materials planning of the customers which give information about the usage of materials can be closely connected to the delivery planning of Hilti, since it provides Hilti the information of needed products in advance.
Accordingly, delivery planning can be conducted much easier and more accurate, hence ensuring a high quality of delivery service.

Question 9 and 10 are used to directly point out the major concerns of the customers and also an overall level of satisfaction regarding delivery service of Hilti Vietnam.

In a large customer pool, only certain customers are chosen for this survey. These customers have to fulfill all these criteria:

- Frequent buyers with more than 40 orders over the last 2 years. This criteria ensures the customers are familiar with Hilti’s delivery process, hence gather opinions can truly reflect the reality.

- Recent purchaser with at least one order over the last 2 months. This criteria helps to verify the connection between the customers and the performance of current deliver process, not the obsolescent one.

From these criteria, a list of 13 customers has been established. Unfortunately, only eight of them made their responses to the questions.

To all eight customers, the demand for Hilti’s products is not consistent during a year. They all give the same reason for that, as their construction projects normally do not last over the whole year. There are breaks in between the projects, and the demand is still not consistent even for those projects that last for a few months. The answers for question 7, 8 and 10 presented in Table 3 give further insights into the possibility of implementing scheduled delivery as well as the overall performance of Hilti’s delivery service.

All the contacted customers confirm that the implementation of scheduled delivery will not be practical, due to the fact that none of the customers currently is executing materials planning. Therefore, they prefer the current method of delivery which allows products to be delivered whenever they request.

Considering the satisfaction regarding delivery service, all the respondents are satisfied with all deliveries from Hilti. Related to question 9 which is about the customer’ concerns regarding the service, none of the respondents has any
additional concerns other than the punctuality of deliveries. In another way of expression, according to the customers the delivery service of Hilti provides a good service quality as long as products are delivered on time. Furthermore, the three customers who are not highly satisfied with the delivery service all mentioned that there are still a minor number of late deliveries.

Table 3. Key answers from the questionnaire

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>No opinion</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implementing scheduled delivery will bring about a higher quality of delivery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Willingness in collaborating with Hilti, including careful usage planning for Hilti products</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Satisfied with the delivery service of Hilti</td>
<td>5</td>
<td>3</td>
<td></td>
<td></td>
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</table>
6 Conclusions

6.1 Reviews on the current delivery process and problem identification

To answer the main research question, assessment of outbound delivery process is a sophisticated topic that covers different perspectives of the process. Accordingly, improvements have to be proposed and discussed separately and correspondingly.

Part of the research has been done in order to understand the performance of fleet vehicles, focusing on its availability and weight utilization rate for delivery service. Based on the research findings, Hilti’s fleet has not been operated at its full capability. There are a lot of rooms for improvement both on its availability and utilization rate. The fleet availability can be enhanced by fully committing the driver’s working hours on delivery task, instead of assigning multiple tasks to them. However, it requires further analysis and researches to evaluate the tradeoffs between obtaining better fleet availability and increasing number of staffs. By accepting a target value of 75% for the fleet availability, the company understands that external delivery service is needed. The lower the availability is, the higher level of external service has to be purchased. As a result, Hilti Vietnam has to finish settling this issue in the near future, as the research findings show that the freight cost is increasing along with more deliveries being outsourced to service providers. The cost to enlarge the staff pool can be compared with the increased cost of hiring external delivery services.

The findings on vehicle weight utilization in this research indicates an inefficient utilization of the fleet vehicles. When the vehicles are available for outbound delivery, only a small portion of its maximum weight capacity is capitalized. Furthermore, some deliveries have been executed using service from a third-party which results in an additional cost to the company, even when the fleet capacity has not been fully used.

In addition to the performance indicator of on-time delivery, developing more indicators is a very crucial task in reviewing and managing delivery process at
Hilti Vietnam. Vehicle availability and vehicle weight utilization are recommended to be continuously checked by the company after the end of this research, and vehicle cube utilization should be controlled as well. Furthermore, recording actual delivery lead time will enable the company to analyze the four dimensions of lead time (lead time variability, lead time adaptability, lead time flexibility and lead time accuracy) that have been mentioned in the literature review. These four dimensions give an overview on the extent to which the company can make improvements on the lead time of its service, hence reinforcing its service level. In fact, the record of actual delivery lead time does not take many efforts from the drivers to note down the actual delivery time for each shipment as they can easily make a personal note once the shipment is handed to its purchaser. In order to facilitate the creation and management of performance indicators, an update on information system might be required, otherwise it is very time-consuming for the personnel to handle these tasks manually. Moreover, a target value for each indicator should be determined unless the top managers feel it more comfortable to evaluate indicator case by case. If target values are computed, they have to be continuously reviewed over time in order to match the situational changes.

Regarding the quality of delivery service, the service has been conveying a relatively good quality according to main customer’s reflections, thanks to a high on-time delivery rate which is the supreme concern under customer’s point of view. However, a higher rate of on-time delivery can still be obtained by reinforcing the order cut-off time. This step will partially eliminate delays in outbound delivery, helping the drivers to secure even more on-time shipments. The challenging part remains in determining the most appropriate cut-off time. The decision has to be discussed among different departments of the company, such as logistics, order processing, customer service and finance. The finding on peak hours for receiving customer orders can be used as a hint in the decision-making process. Equally important, Chapman, Bernon and Haggett (2011) points out that different management techniques such as Process chart, Histogram and Cause and Effect Analysis can be used to identify the roots of delivery time variability. Therefore, on-time delivery rate can be improved to even a higher level.
From the research findings, the possibility of developing scheduled delivery is also made clear to the company. It was pointed out by the customers that they were not willing to take part in this development. Thus, scheduled delivery is irrelevant and unfeasible to the current operations.

In conclusion, based on the results in this research, the current delivery process of Hilti Vietnam is not being executed efficiently. After reviewing the process under different angles of view, the outlined factors that hinder the process from being efficient are:

1. Lack of KPIs and pre-determined target values
2. Fleet vehicles are not fully utilized at their maximum capacity when they are available for product delivery
3. Fleet availability for delivery service is relatively low
4. Late delivery often arises from long idling time of vehicles at distribution center

To tackle those obstacles, improvement proposals are created accordingly:

- Implement new KIPs and their target values. Highly recommended: vehicle availability, vehicle weight utilization and four dimensions of delivery lead time (lead time variability, lead time adaptability, lead time flexibility and lead time accuracy).
- Make changes on the current information system in order to facilitate measurement of new KPIs. Input of real-time operational records into the system has to be feasible, together with data extraction for analysis.
- Improve vehicle availability rate by enhancing driver’s commitment to delivery service. Financial comparison has to be made to point out the cost difference of hiring additional drivers and charges from 3rd-parties by using their services.
- Set up cut-off time for purchase order from customers, and make sure cut-off time is followed by all parties. As a result, delivery journey can
be started according to schedule with vehicle idling time at distribution center being minimized.

### 6.2 Indispensability of purchase of external delivery service

Despite there are many issues that hinder the efficiency of outbound delivery at Hilti Vietnam, Fully outsourcing its delivery service seems not neccessary. The current strategy of exploiting a combination of own fleet vehicles and for-hire delivery service only when needed should be more preferable. From the research findings, the fleet vehicles being used have the potential of handling the total ordered volume from customers. In order to capitalize this potential, actions have to be made to improve the vehicle availability and vehicle utilization rate. In a long term, depending on the real growth rate of the business, this fleet might still meet the customer’s requirement as there is currently a big proportion of its capacity left unused.

Any obstacles remained in the process should be addressed and resolved internally, instead of purchasing external services. Bearing in mind the fact that Hilti Vietnam used to fully outsource its delivery service to a third-party in the past, the company clearly understands the high cost exerted on its business if external services are used.

Nonetheless, it is worth stressing that this research serves as a recommendation rather than a confirmation on whether the company should outsource its delivery service or not. This research itself has limits on its scope, as mentioned before. The more researches being done will bring about a more reliable answer to this matter.

### 7 Discussion

First of all, it was a pleasure for me to receive a powerful support from Hilti Vietnam and my thesis instructor. By this time, the completion of this thesis was a real challenge, and the tough part lies on the research design in which I have to answer “what” to research and “how” to research.

Fortunately, discussions with the Logistics Supervisor and the Finance Manager at Hilti Vietnam together with guidance from my teachers at JAMK
University of Applied Sciences gradually shape the backbone of this research. By working closely with the people at Hilti Vietnam, insights into its delivery process, the existing and potential problems and the company’ expectations are obtained.

From the very first discussion with Hilti Vietnam, the drive for better performance has always been critical to Hilti. The researcher is motivated in completing my thesis as the research is an opportunity to practice and apply theoretical knowledge. At the same time, this thesis cooperation is a mutual benefit in which not only Hilti Vietnam gains its objectives but such experience will also allow the researcher to get insights into real-life operations.

Gathered information from interviews with the Finance Manager and the Logistics Supervisor increased the reliability of this research, and data analysis was also facilitated. For those measurement that have never completed by the company, the interviews provide acceptable target values from the company’ points of view, hence making the assessment of research findings feasible.

Ideas are then further generated through the literature review. I tried to cover a broad theoretical background because I believe more solutions could be generated once I fully identify the problems in the delivery process. The reality turned out to be exactly what I expected, directions on designing the research were easily formed as more problems discovered.

It was a big surprise to me to figure out there was only one performance indicator being used to evaluate the delivery process at Hilti. The scale of logistics management, in overall, was much smaller than what was expected. This fact was both a challenge and an opportunity to me. It was a demanding task because it consumed lots of time to extract the right information out of the raw data. On the other hand, the lack of pre-analyzed data encourages me to exploit my background knowledge and creativity in order to get the research completed.

The customers who responded to the questionnaire gave very informative answers even though receiving answers from all the selected customers was
expected. Despite that, customers who supported my research are the most important customers of Hilti, assuring the reliability of research findings.

Once all the research findings are available, the result was a surprise. Initially, in my opinion, a complete purchase of delivery service from an operator seems to be the most suitable solution for Hilti Vietnam as the management system of outbound delivery is pretty basic. A fear that the present system cannot match the business expansion rate was real. Unexpectedly, my final recommendation was to stick with this system and try to improve it.

Importantly, the research findings are considered reliable. All the evaluation of measurement results in this research has taken into account the target values of the company. Any measure without a predetermined target value led to discussion with by the company representatives to find out the company's opinions regarding the research results, only then further step on evaluation of the results is completed. Equally important, data was extracted from real-time operational records that are available in the information system. Customers participated in the questionnaire are main customers chosen from the company’s customer pool.

Bearing in mind that fact that delivery time window is restricted in terms of unit of time, inefficient transportation planning may make the completion of deliveries within a delivery time window impossible. Consequently, maximizing vehicle utilization becomes a minor concern because completion of deliveries is always the first priority. Inefficient transportation routing may also be the cause of using external delivery services when the fleet capacity is, however, available. For instance, a delivery order which consists of relatively light products but various distant delivery destinations will most likely result in products being not delivered at the end of the day. Unfortunately, developing a mechanism that can investigate this issue could not be covered within this research, nevertheless the company should work on it as soon as possible.

Consequently, the next step the company should work on is to develop a mechanism which can monitor the delivery time. Being emphasized for many times, the phenomenon of purchasing delivery service from outsiders in the context of high unused fleet capacity should be seen as a serious problem. If it is not properly addressed, negative impacts will exert on the credit of logistics
personnel. Numerous points of delivery possibly result in the need of external delivery services regardless of utilization of fleet capacity.

A possible design of this mechanism is to have a ranking system which is based on the transit time. Data on transit time taken to reach different areas of Ho Chi Minh City will be collected over a considerably long period of time. Each area is then appointed a rank. The ranking of a delivery trip is the sum of the ranks of all area included in the trip. By using this mechanism, it only takes a moment to have a general picture on the total transit time of a delivery journey by checking its ranking.

In addition, this mechanism is a good starting point of the establishment of transportation routing. The more volume is delivered, the more important role transportation routing plays. Although it is considered as a complex planning, being able to execute transportation routing is definitely the core target in the future.

After all, I strongly believe this research trained me into a more determined person. Additionally, the practical experiences and knowledge I have learned along the research execution are invaluable assets to my future career.
8 References


9 Appendices

Appendix 1. Confidential
### Lead time dimensions

<table>
<thead>
<tr>
<th>Lead time dimension</th>
<th>Description</th>
<th>Metrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead time variability</td>
<td>Relates to the degree of difference between the anticipated lead time and the offered lead time.</td>
<td>$(\text{Max(anticipated lead time, confirmed lead time)} - \text{Min(anticipated lead time, confirmed lead time)})/\text{(Average anticipated lead time)}$</td>
</tr>
<tr>
<td>Lead time adaptability</td>
<td>Relates to the degree of difference between the offered lead time and the confirmed lead time.</td>
<td>$\frac{\text{Offered lead time} - \text{Confirmed lead time}}{\text{Offered lead time}}$</td>
</tr>
<tr>
<td>Lead time flexibility</td>
<td>Relates to the degree of difference between the confirmed lead time and the adapted lead time.</td>
<td>$\frac{\text{Confirmed lead time} - \text{Adapted lead time}}{\text{Confirmed lead time}}$</td>
</tr>
<tr>
<td>Lead time accuracy</td>
<td>Relates to the degree of difference between the confirmed lead time and the actual lead time.</td>
<td>$\frac{\text{Number of on-time deliveries}}{\text{Total number of deliveries}}$</td>
</tr>
</tbody>
</table>
Appendix 3. Delivery processes. (adapted from Kallio, Saarinen, Tinnilä and Vepsäläinen 2000)

<table>
<thead>
<tr>
<th>Delivery process</th>
<th>Performance emphasis</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routine process</td>
<td>Low cost</td>
<td>Delivery of standardized and finished products. Products are made available in stock before orders are received. There is no room for product customization according to special customer requirements.</td>
</tr>
<tr>
<td>Normal process</td>
<td>Minimum delivery time</td>
<td>Delivery of module-based finished products which are assembled from stocked standardized components and parts. Room for customization is constrained to a limited set of modular combination of standard components after orders are received.</td>
</tr>
<tr>
<td>Custom process</td>
<td>High cost</td>
<td>Delivery of highly-customized products which match special customer requirements. Products are neither standardized nor assembled from standardized components, but are rather made through projects that closely involve the manufacturers and customers.</td>
</tr>
</tbody>
</table>

- **Low cost**
- **Minimum delivery time**
- **Standardized quality**
- **Standardized cost**
- **Short delivery time**
- **Standardized quality**
- **High cost**
- **Long delivery time**
- **Highest possible quality**
Appendix 4. Confidential
Appendix 5. Questionnaire for main customers

1. Tên và địa chỉ khách hàng
   (Name and customer’s address)
   ………………………………………………………………………………………………………

2. Số lần giao hàng theo đơn quý khách hàng đã nhận từ Hilti trong quá khứ (nếu có thể)?
   (From the history, how many deliveries have you already received from Hilti? If applicable)
   ………………………………………………………………………………………………………

3. Số lần giao hàng trung bình quý khách hàng nhận từ Hilti trong 1 tháng (nếu có thể)?
   (On average, how many deliveries have you received from Hilti on the monthly basis? If applicable)
   ………………………………………………………………………………………………………

   (Number of deliveries that could not meet your satisfaction? Any reason for that? If applicable)
   ………………………………………………………………………………………………………

5. Trong tổng số những lần giao hàng không hài lòng ở trên, số lần quý khách hàng thể hiện ý kiến của mình với đại diện Hilti? (nếu có thể)
   (Among those unsatisfied deliveries, number of deliveries have you officially made your claims on? If applicable)
   ………………………………………………………………………………………………………

6. Nhu cầu sử dụng của quý khách hàng đối với những sản phẩm từ Hilti có đều đặn trong một thời gian dài (từ 1 tháng trở lên)?
   (Is your demand for Hilti products relatively consistent within a time frame of 1 month and above?)
   ………………………………………………………………………………………………………

7. Việc áp dụng giao hàng định kỳ đối với những sản phẩm có nhu cầu sử dụng ổn định sẽ tăng chất lượng hoạt động giao hàng? Lý do?
To what extent do you agree that applying scheduled delivery will bring about a higher quality of delivery? Reasons for your choice?

8. Quý khách hàng sẽ tích cực tham gia để giúp việc giao hàng định kỳ đạt hiệu quả, bao gồm việc lên kế hoạch sử dụng cho sản phẩm từ Hilti? (To what extent are you willing to participate in order to make scheduled delivery successful, including careful usage planning for Hilti products?)

9. Vấn đề nào được quý khách hàng quan tâm nhất trong dịch vụ giao hàng của Hilti bên cạnh việc giao hàng đúng giờ? (What is your biggest concern regarding delivery service from Hilti apart from on-time delivery?)

10. Đánh giá chung về mức độ hài lòng của khách hàng về khả năng giao hàng đúng giờ từ Hilti? Lý do lựa chọn (Your overall level of satisfaction regarding delivery service from Hilti? Reasons for your choice?)