APPLICATION OF BACKHAUL STRATEGY FOR POWDER BEVERAGE PRODUCTS

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ABSTRACT

The empty slot or space truck can create the underutilization of transportation for trip. This creates the low capacity of road usage, waste time and resources in transportation. In this research focused on vehicle route management in transferring the products from Khon Kaen to Bangkok. To reduce the transportation cost with high route utilization, the route of transportation needs to redesign to find the opportunity cost-saving with effects price competitiveness of cost of goods sold. Backhaul strategy is one of the tools to increase route utilization. This strategy supported by using As-Is and To-Be to show before and after redesign route of transportation. The method has proven successful elsewhere for created high utilization in transportation and cost-saving. The expenditure report from February- July 2019 (current route) and February- July 2020 (new vehicle routing) are used to compare the result of redesign the route by truck-sharing.

Keywords : *Truck-sharing, vehicle route management, backhaul strategy, utilization, cost-saving*

บทคัดย่อ

พื้นที่ว่างเปล่าหรือพื้นที่ว่างบนรถบรรทุกก่อให้เกิดความไม่คุ้มค่าในการขนส่งแต่ละเที่ยว ซึ่งเป็นการใช้ถนนที่ไม่ได้ประสิทธิภาพ สิ้นเปลืองเวลาและทรัพยากรในการขนส่งสินค้า งานวิจัยนี้มุ่งเน้นการบริหารเส้นทางในการขนส่งสินค้าจากจังหวัดขอนแก่นมายังกรุงเทพฯ เพื่อเป็นการลดค่าใช้จ่ายในการขนส่งสินค้าและเพิ่มประสิทธิภาพในการขนส่ง จึงจำเป็นต้องออกแบบเส้นทางใหม่ในการขนส่งสินค้า เพื่อเพิ่มโอกาสในการลดค่าใช้จ่ายในส่วนของค่าขนส่งและทำให้บริษัทมีกำไรมากขึ้น การขนส่งเที่ยวกลับ (Backhaul) คือ หนึ่งในเครื่องมือที่ช่วยเพิ่มประสิทธิภาพในการขนส่ง งานวิจัยนี้จะใช้การเปรียบเทียบระหว่างเส้นทางที่ใช้ขนส่งสินค้าปัจจุบัน กับ เส้นทางที่ออกแบบใหม่เพื่อทดลองการขนส่งแบบ Backhaul ซึ่งได้รับการยอมรับว่าสามารถเพิ่มประสิทธิภาพในการขนส่งและช่วยประหยัดค่าใช้จ่ายได้ โดยใช้ข้อมูลการขนส่งในเดือนกุมภาพันธ์ ถึง กรกฎาคม พ.ศ. 2562 ซึ่งเป็นการขนส่งสินค้าในเส้นทางเดิมและข้อมูลการขนส่งในเดือนกุมภาพันธ์ ถึง กรกฎาคม พ.ศ. 2563 ซึ่งเป็นการขนส่งสินค้าในเส้นทางที่ออกแบบใหม่ เพื่อเปรียบเทียบค่าใช้จ่ายก่อนและหลังการออกแบบเส้นทางการขนส่งโดยการใช้รถขนส่งร่วม

คำสำคัญ: การใช้รถขนส่งร่วม การบริหารเส้นทางเดินรถ กลยุทธ์การขนส่งเที่ยวกลับ การใช้รถ ประหยัดค่าใช้จ่าย

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INTRODUCTION

The 'Secret of Fresh' Company does business on food industry (FMCG: fast moving consumer goods). This research focused on powder beverages, which currently the largest hub in producing juice powder beverages is in Khon Kaen (Thailand) for export purpose only. The Philippines and China are the main countries where the powder beverages are exported with 80% contribution of sales. Normally, Khon Kaen factory delivers products by truck directly from Khon Kaen to port in Bangkok and exports the products through sea freight to many countries around the world. This was the normal practice until the team found that the company must bear the cost for keeping the products in the warehouse in the Philippines around four weeks before distributing to consumers. The storage cost in the Philippines is very high which affects high inventory cost for keeping the products in the warehouse. Moreover, the company also has limited space in Khon Kaen factory to keep the products in Thailand. This was the reason for using push strategy to export the products to the Philippines immediately after the production. High storage cost in the Philippines has created unnecessary cost for the company to bear.

Finally, the Finance and Logistics team studied and analyzed the problem until agreed to use the central distribution center in Bangkok to place the products from Khon Kaen factory as the storage space. Bangkok was chosen as the distribution center because it is near the port to load the products exported to the Philippines. In January 2019, Thailand team started transferring the products from Khon Kaen factory to the distribution center in Bangkok. Once the order is placed, the products are split following the sales order to be exported to the Philippines. The rest of the products are kept in the distribution center in Bangkok waiting for the next order.

After transferring the products, the researcher found that the cost of transportation from Khon Kaen factory to the distribution center in Bangkok was very high. Therefore, the aim is to reduce the transportation cost by proposing a new transportation route with the question, **"How can the company reduce transportation cost for transferring the products from Khon Kaen factory to the distribution center in Bangkok by applying backhaul strategy?"**

REVIEW OF RELATED LITERATURE

Vehicle Routing Management

The problem of vehicle routing such as the empty slot or truck space can create the underutilization of transportation for trip. This creates the low capacity of road usage, waste time and resources in transportation (Islam, 2017).

As-Is and To-Be

Islam and associates (2013) applied As-Is to identify the weakness in current business process of long-time booking slot for backhauling trip as slot booking takes more than fifteen hours before truck arrival for return trip. Then, using To-Be to draw the proposed model to solve the problem by using the transportation sharing application to reduce the amount of empty truck by matching similar origin with the destination to share the empty slot. The objective of the application is short

notice of empty slot for truckers to increase the number of truck-sharing. So, this helps truckers to increase the backhaul trip and transportation capacity.

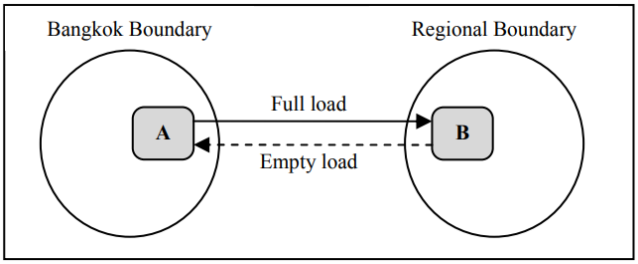
Transportation Cost

Kayvanfar and associates (2019) revealed that the connection of the interrelated firms can enjoy the cost-sharing to achieve the same goals. The most important concerned is to improve the coordination and cooperation of different firms towards the same requirements. It was found that logistics operation was performed through outsourcing specialized company such as third-party logistics provider (3PL). The 3PL can reduce expenditures by optimizing the usage of resources with better service quality and knowledge as specialists, such as distribution planning and delivery process. The researcher allowed a third-party logistics provider to manage the transportation activities to utilize the truck capacity. The specialized capability reduces inefficiency in doing the tasks, and the company can enjoy cost reduction by working together with 3PL for route management.

Backhaul Strategy

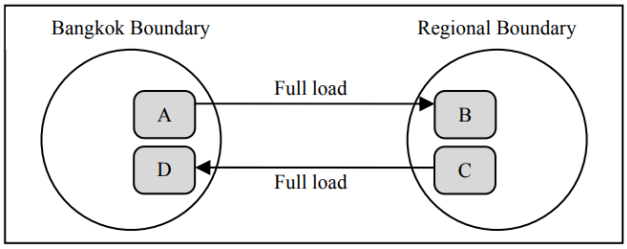
Backhaul trip is one type of transportation movement that utilizes the truck vehicle routing. It is re-routing the vehicle in the return trip to load the product from the first destination to the second destination with fully-loaded capacity truck or less than for the benefit of route-sharing (Theissen, 2015). Islam and Olsen (2013) studied the truck sharing service (TSS) by using As-Is and To-Be as the proposed model to review the route of transportation. At the beginning, there was a problem of empty trip truck of at least 70%, which created low utilization of transportation. After adopting the TSS as decentralized perspective by using matching facility system as if the two parties have same origin and destination, they can share the truck together. The TSS has conditions such as the origin and destination of two parties must be near each other. The appointment time to pick up the products should be matched with the goods at the return trip. The result of the truck sharing was reduction in the number of empty trucks. Peetijade and Bangviwat (2012) stated that empty run is a basic problem in transportation with high demand of transporting the products but results in empty trip or less than truck load trip. The matching truck can reduce inefficiency of truck run for the company. The fronthaul determines the first leg of the truck trip that carries the products to target destination while backhaul is the return leg from the target destination to the point of origin. The logistics survey in Bangkok found that the total truck run per week was 245,118 trips, and out of which 210,193 were empty trips and 34,925 were backhaul trips.

Figure 1: Truck Run without Matching Process



Source: Peetijade and Bangviwat (2012)

Figure 2: Truck Run with Matching Process



Source: Peetijade and Bangviwat (2012)

Figure 1 shows the truck run without matching process that has created empty trip. On the other hand, Figure 2 shows the truck run with matching process. The truck is loaded from point A carrying the products to point B and return the truck run as loaded from point C to point D. The matching process is based on several parameters, such as size of load and type of goods. The results of matching can reduce transportation cost. The key concern is information sharing with each party in terms of point of origin and destination, type of truck, and time window for delivery of the products.

Sutton (2013) stated that the success of backhaul collaboration has seven steps to organize.

1) The summary of lane and volume. The company who wants to implement backhaul strategy for vehicle utilization has to provide lane of transportation to see the opportunity of route-sharing with the other companies. Also, the company has to calculate the volume of loading, which is the number of trips per week and month to estimate the amount of the container load to match with the load of the other companies.
2) To identify the potential parties for lane sharing. This step needs to find other parties that have the same problem to discuss the route sharing and collaborate with each other. The best collaboration should be that one party will use the truck in the first depot as the origin (point A) to destination (point B). Then, the second party will use the return the destination (point B) to the origin (point C), which is the basic of backhaul trip.
3) To agree on the charge rate lane by lane. Each party has to agree on the charge rate for sharing the truck and charge route with others. The rate should be fair to both sides and can meet the target to save the transportation charge.
4) To agree on key performance indicators of each party. In general, each party has a key performance to indicate the transportation activity. But, the agreement of route sharing needs both parties to share their concerns and find the middle performance indicators that both can accept, such as time agreement and container condition to pick up the goods.
5) Run the trial. After the agreement of all parties, the trial of backhaul will begin as a test to see and foresee the problem during route-sharing.
6) Review and solve the problem. After the first trial, each party will have the result of route-sharing. Each party has to review the problems and foresee the potential problems. The parties have to set the procedure/guideline for the operation following the rule. Moreover, each party will see the potential saving cost on the first trial and draw the next trip as the scenario of cost saving.

7) Roll-out. Finally, the problems are solved and the route sharing as backhaul trip can be implemented.

Supply chain collaboration

Supply chain collaboration is the activity in supply chain that starts from the upstream to the downstream activities (purchasing, production, logistics, warehouse and distribution, marketing, sales) that have the same understanding about the tasks and try to manage their tasks efficient by applying collaboration as a core to achieve the goal. The collaboration begins with the problems in daily operation tasks, such as wrong picking order and late loading of goods that can block the efficient use of resources, such as labor and time. The problem will come up with the solution for all functions involved to put the idea, discuss, find the solution, and improve the process of work by supporting all functions. Without the collaboration of all the functions, the work will not achieve the goal (Islam, 2017).

RESEARCH METHODOLOGY

Data Collection

1. Primary Data

The researcher collected the primary data by conducting interview with the warehouse team to review the transportation route and constraints in the operation between 'Secret of Fresh' Company and the warehouse team if there were changes in the route of the transportation. The interviewer has helped to analyze the daily operation part and see the foreseen problem before implementing the backhaul strategy. The research questions asked during the interview and the answers of the respondents are as follows.

The researcher interviewed five people which are the logistics supervisor, logistics specialists, warehouse supervisor, inventory control officer, and fleet and transportation officer to gather information about the trial backload trip.

Question 1: What is the current concerned of transferring the products from Khon Kaen to Bangkok?

The summary of the first answer in the interview with the logistics supervisor and logistics specialists is concerned with the transportation cost that is still high as compared to the cost of the proposed logistics cost at the beginning. Moreover, the operation cost is also high, but it depends on the quantity of the products loaded at Khon Kaen factory and unloading at the distribution center in Bangkok. So, it should be focused on the cost that has opportunity to improve the most, which is transportation cost. This helps the company to reduce cost of goods sold and gain more profit.

Question 2: What are the concerned points if backload trip is proposed?

The summary of the second answer in the interview with the warehouse supervisor, inventory control officer, and fleet and transportation officer is concerned with the amount of truck to receive the products at Khon Kaen factory as the quantity of trucks should match with the quantity of

products to be transferred to Bangkok. On the return trip, the container should be loaded with food grade. The truck company and truck driver should align their schedule of the return trip to pick up the products on time. Also, the warehouse officer needs to change his or her working schedule to match with the truck's arrival time in Bangkok. So, the company needs good alignment with the third party logistics provider to process all the activities smoothly.

2. Secondary Data
    1) Production Volume: The data were from the Production Department as part of the total volume of the finished good and split the volume weekly in transferring from Khon Kaen factory to the distribution center in Bangkok. These data were used to analyze the possibility to save transportation cost by applying the backhaul strategy.
    2) Logistics Cost: The data were gathered for the logistics cost in daily operation. The data showed the loading cost from Khon Kaen factory, overtime cost for loading the products, transportation charge, unloading cost to unload the products from container to warehouse, and storage charge. These data were used to review the operation cost (loading cost from Khon Kaen factory, overtime loading cost, and unloading cost at the distribution center in Bangkok) and transportation cost. The storage cost was not within the scope of the research.
    3) The contact and agreement between the company and third-party logistics: The terms of agreement include transportation, warehouse management, and freight forwarding. These data have helped in looking at the potential cost saving in terms of transportation with backhaul strategy.
    4) The daily transportation record: The data for the single trip consist of arrival time of the truck in Khon Kaen, loading time, departure time of the truck to Bangkok, and the problems in daily operation. These data were used to analyze the potential change in the operation by conducting a trial on the backhaul trip and to foresee obstacle during the change.

Data Analysis

The current route (As-Is) of the transportation to transfer the products from Khon Kaen to Bangkok. The truck is driven from Bangkok directly to Khon Kaen with alignment time to pick up the products to eliminate delay. The container is a 40 foot-standard container with 4,500 cartons capacity load and a 20 foot-standard container with 2,250 cartons capacity load. The condition inside the container is dry, clean, and normal smell for food grade products with ambient temperature in container. Normally, the team loads more than 85% of the container utilization to save cost of transportation, but it also depends on the quantity of products from the production line regarding push strategy.

As As-Is route of transportation, the researcher has foreseen the opportunity for route utilization. The first trip of transportation that is an empty container truck transported from Bangkok directly to Khon Kaen. The first trip is the focused point as if the first trip is with full container, there will be a potential cost-saving for the company.

Potential Opportunity

In this part, the researcher analyzed the trip of transportation and found that there is a potential to reduce the cost of transportation.

Table 1: The Transportation Cost from February to July 2019

Month	Type	Total	19,000 Baht/Trip	16,100 Baht/Trip	
			Transportation Cost (Only Truck Cost)		
		(Catons)	No. of 40ft ST Container	No. of 20ft ST Container	THB
Feb 2019	Single Trip	213,441	46	2	906,200.00
Mar 2019	Single Trip	172,083	37	3	751,300.00
Apr 2019	Single Trip	167,535	37	2	735,200.00
May 2019	Single Trip	231,293	50	4	1,014,400.00
Jun 2019	Single Trip	171,249	37	4	767,400.00
Jul 2019	Single Trip	230,431	52	2	1,020,200.00
TOTAL		1,186,032	259	17	5,194,700.00

Table 1 shows the transportation cost for six months from February to July 2019. The truck cost is 5,194,700 baht for both 20-foot standard and 40-foot standard containers without cancellation and waiting time charges. The researcher reviewed the data and found the opportunity to save cost 100% for single trip. The total number of trips is 276 trips separated as 259 trips (40 foot-standard containers) and 17 trips (20 foot-standard containers). It means that 100% of the trip is imbalance for the first trip as low utilization of transportation. Finally, the researcher thought that the first loaded trip from Bangkok to Khon Kaen would be used for the return trip to transfer the products from Khon Kaen to Bangkok. This would reduce the imbalance of transportation trip with cost-saving by sharing the route with other parties.

Proposed Model

For this part, the researcher used the data from February to July 2020 as a trial for backhaul strategy. The route of transportation starts from Bangkok to transport the products of the other company to Khon Kaen. After unloading the other company's products at their warehouse, the truck is re-routed to pick up the products at Khon Kaen factory to be transferred to the distribution center in Bangkok.

FINDINGS AND RESULTS

Trial backhaul technique

1. Implement in operation

Backhaul technique is quite challenging in terms of limitation of time schedule, container supplement, and condition of container. Before trying the backhaul strategy, the researcher discussed with the third-party logistics provider to manage the backhaul trip. The first concern was the time schedule to pick up the goods at Khon Kaen factory to transfer the products to the distribution center in Bangkok. The third-party logistics matched the route and trip with another company as the first trip, the third-party logistics loaded another company's product from Bangkok transfer to Khon Kaen. After unloading another company's product, the return trip loaded the products from Khon Kaen factory and transferred to Bangkok. The time schedule was fixed at 8:00, 18:00, and 24:00 with three return container trips per day.

The second concern was the container supplement. The third-party logistics was able to provide only three return trips per day. Therefore, there was a shortage because some SKUs needed to expedite due to the export demand to the Philippines. So, there were some single trips to transfer the products to Bangkok.

The third concern was the condition of container that should be dry and suitable for food grade products as the container must not have contained toxic or contaminated products. Fortunately, most of the other companies were also in food industry, so the third-party logistics was able to match the container grade supplied to the three containers per day.

The limitation from the third-party logistics provider is quite challenging to manage both internal operation in Khon Kaen factory and the company with external operation as a third-party logistics company in part of trucking and warehouse to receive products. This needs good coordination and collaboration in cross-functional team for both internal and external operations.

2. New vehicle route management

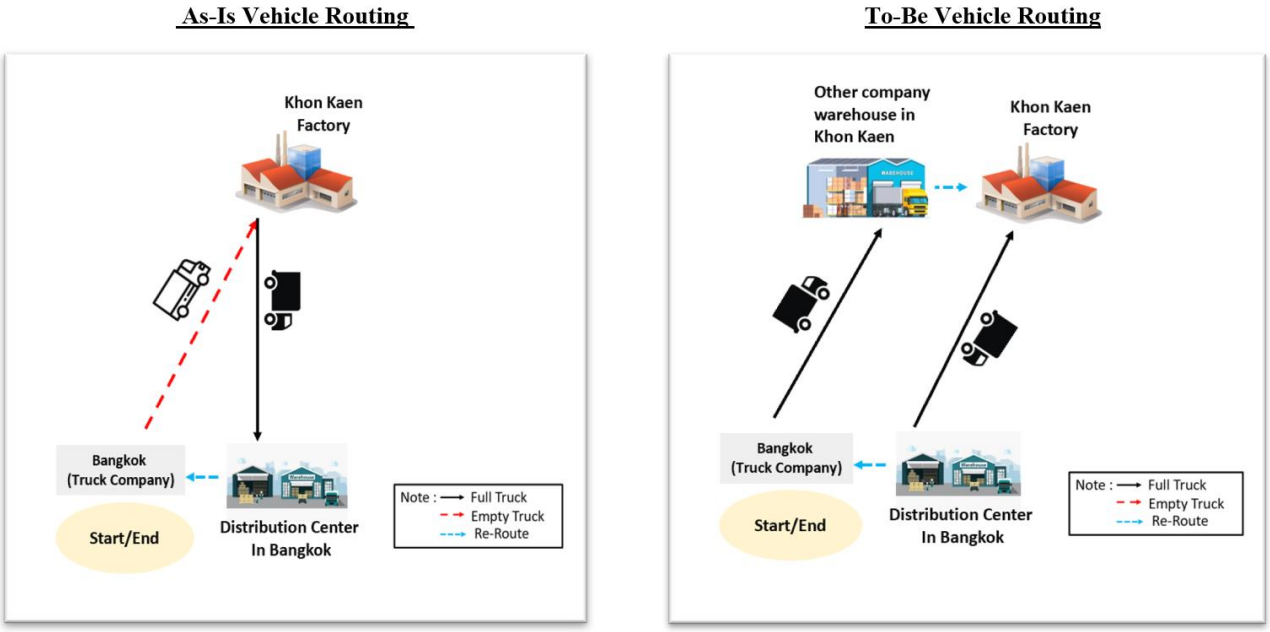
After researching and studying the backhaul strategy, the researcher came up with a new vehicle route management as shown in Figure 3 as the current vehicle route. It begins with the truck trip directly to Khon Kaen to pick up the products at the factory on the appointed time. Then, the truck transfers the products to Bangkok. After managing the new vehicle route, the third-party logistics will match the company and the other company's vehicle route together. The route begins as the truck picks up the other company's products transported to Khon Kaen. Next, unload the other company's products in Khon Kaen and re-route the truck to pick up the products at 'Secret of Fresh' Company with the supplied three containers per day at 8:00, 18:00, and 24:00 for the return trip. Then, the truck transfers the products to Bangkok and store the products at the distribution center. This new route management is beneficial in terms of cost-saving because of the shared cost of transportation between the other company using the first trip and the 'Secret of Fresh' Company using the return trip.

3. The control sheet for backhaul trip

As backhaul trip has a lot of conditions to be concerned about, the researcher and the team created two control excel sheets to monitor the backhaul transportation. One control sheet shows the logistics and transportation activity in Khon Kaen. The details of the excel sheet consist of truck number, date, type of truck for 20 foot-standard container or 40 foot-standard container, appointment time of the truck's arrival at the factory as requested by the customer service team, tally number as the transfer documents (SKU of product, batch code, quantity of the products convenient for the warehouse team in the distribution center to track and receive products in the system), truck arrival time, start loading time, finish loading time at Khon Kaen factory, truck departure time, travel time of transportation from Khon Kaen to Bangkok, and the remark (any activities with additional cost -delay or problem of loading in the production line).

Another control sheet shows the logistics and transportation activity in Bangkok. The details of this part consist of the total quantity of products by carton, total number of pallet, time of truck's arrival at the distribution center in Bangkok, time of warehouse team to unload the products from the truck, and time to finish unloading the products at distribution center in Bangkok.

Figure 3: As-Is for Current Route of Transportation and To-Be for New Vehicle Route Management



The control sheet has helped the researcher and the team to validate cost-saving in transportation. Moreover, the control sheet has shown the error and unforeseen problems while trying the backhaul strategy to find a corrective action in the next backhaul trip.

The collection of the transportation data from February 2020 to July 2020

Table 2: The Volume of Load and Number of Trips from February to July 2019 and February to July 2020

Year 2019				Year 2020					
Month / Year	Total Catons	No. of Single Trip 40' ft	No. of Single Trip 20' ft	Month / Year	Total Catons	No. of Backhaul Trip 40' ft	No. of Backhaul Trip 20' ft	No. of Single Trip 40' ft	No. of Single Trip 20' ft
Feb 2019	213,441	46	2	Feb 2020	160,260	35	1	1	1
Mar 2019	172,083	37	3	Mar 2020	178,837	38	4	2	-
Apr 2019	167,535	46	4	Apr 2020	167,846	37	-	1	-
May 2019	231,293	41	2	May 2020	155,064	32	4	1	-
Jun 2019	171,249	37	4	Jun 2020	193,055	41	2	2	2
Jul 2019	230,431	52	2	Jul 2020	171,823	34	3	2	2
TOTAL	1,186,032	259	17	TOTAL	1,026,885	217	14	9	5

Table 2 shows the volume of products loaded to transfer from Khon Kaen factory to the distribution center in Bangkok from February to July 2019 and February to July 2020. The volume of load in 2020 was reduced because of Covid-19 that customers reduced their order volume. Therefore, the researcher has calculated the reduction of cost per carton to compare between 2019 and 2020.

In 2019, the company was still using 100% of single trip to transfer the products from Khon Kaen to Bangkok. After analyzing, the transportation cost was very high and without any benefit to the

company. So, the researcher began to study and discuss with the third-party logistics to service the company and for the transportation charge to come up with the advantages and disadvantages of both single and backhaul trips.

There are advantages of single trip. The company can manage the time to pick up the products. Also, the company can specify the condition of the container such as dry container for good grade products to fill the products inside. Moreover, the company can make sure that there will be enough supply of container to transfer the products from Khon Kaen to Bangkok. However, the disadvantage of single trip is high cost of transportation as there is no-sharing of vehicle with another route.

The advantage of backhaul trip is that the company can share the route of transportation with another trip to save cost. There are disadvantages of backhaul trip. The company cannot manage the pickup schedule. The company cannot make sure that there will be enough trips to transfer the products from Khon Kaen to Bangkok. Furthermore, there is no guarantee for enough supply of dry container with good grade condition for each day of transferring the products.

As the researcher had reviewed the advantages and disadvantages of both single and backhaul trips, it came up that the single trip is more advantageous than the backhaul trip. But in the world of business, the cost is very important in terms of profit margin. If the company is concerned with only the time management and quality of products by using single trip, the transportation cost will be high to reduce the profit margin. If the company wants to improve and find the opportunity for cost-saving to increase the profit margin, the backhaul strategy is quite challenging in terms of time management, trip, and daily operation. If the trial is in positive direction with cost-saving, there will be a lot of benefits in terms of reducing the cost of goods sold.

Cost-saving of transportation cost per carton

After getting the quotation for backhaul trip, the transportation cost is lower. For a 20-foot container, the price is 5,450 baht per trip, which saves 10,650 baht per trip. For a 40-foot container, the price is 10,900 baht per trip, which saves 8,100 baht per trip.

As discussed in the beginning of this chapter, the ordered volume from the Philippines was fluctuating due to the spread of Covid-19, so the transportation cost in 2020 was also reduced to the lower volume of products transferred from Khon Kaen to Bangkok. Therefore, the researcher compared the transportation cost between February to July 2019 and February to July 2020 by calculating the transportation cost per carton from Khon Kaen factory to the distribution center in Bangkok as shown in Table 3.

Table 3 shows the comparison of the transportation cost per carton. The total transportation cost on February to July 2019 is 5,194,700 baht with 1,186,032 cartons transferred from Khon Kaen to Bangkok, so the average cost per carton is 4.38 baht. On February to July 2020, the total transportation cost is 2,693,100 baht with 1,026,885 cartons transferred to Bangkok, so the average cost per carton is 2.62 baht. Therefore, the backhaul trip has reduced the cost of goods by 1.76 baht, which the company has benefited in terms of cost-saving to gain more profit.

Table 3: The Calculation of Transportation Cost per Carton between February to July 2019 and February to July 2020

Transportation Cost per Carton (Year 2019)				Transportation Cost per Carton (Year 2020)			
Month / Year	Total (Catons)	Transportation cost	Cost/Carton (THB)	Month / Year	Total (Catons)	Transportation cost	Cost/Carton (THB)
Feb 2019	213,441	906,200	4.25	Feb 2020	160,260	422,050	2.63
Mar 2019	172,083	751,300	4.37	Mar 2020	178,837	474,000	2.65
Apr 2019	167,535	735,200	4.39	Apr 2020	167,846	422,300	2.52
May 2019	231,293	1,014,400	4.39	May 2020	155,064	389,600	2.51
Jun 2019	171,249	767,400	4.48	Jun 2020	193,055	528,000	2.73
Jul 2019	230,431	1,020,200	4.43	Jul 2020	171,823	457,150	2.66
TOTAL	1,186,032	5,194,700	4.38	TOTAL	1,026,885	2,693,100	2.62

SUMMARY AND CONCLUSIONS

Referring to the result of data analysis, 'Secret of Fresh' Company used single trip to transfer the products from Khon Kaen factory to the distribution center in Bangkok from February to July 2019, which incurred high transportation cost for the company paying empty first trip. After studying the backhaul strategy, the researcher proposed backhaul trip to design a new route of transportation from February to July 2020 using vehicle route sharing with another company for the return trip. The new route starts from the truck loading the other company's products transported from Bangkok to Khon Kaen and unloading the products at their company's warehouse. After that, the truck is re-routed to 'Secret of Fresh' Company on the appointed time. Then, loading the products and transferring to the distribution center in Bangkok. The new route was implemented or six months. The researcher found that the empty trips were reduced with three containers trip supplied per day for backhaul trip, saving 1.76 baht per carton of product. Hence, based on the finding of the study, the researcher proposed backhaul by vehicle route sharing with the other company to reduce the transportation cost by reducing single trip. The backhaul trip can be applied as a continuous improvement in the route of transportation with incremental cost-saving.

Theoretical Implications

The researcher collected the transportation data and discussed with the internal and external parties about the high transportation cost problem. The researcher found that the single trip truck was the cause of this issue. Therefore, the researcher focused on the management of the vehicle routing to achieve cost-saving in transportation by truck-sharing using the backhaul concept (Islam & Olsen, 2013) and matched the process to reduce empty trip (Peetijade & Bangviwat, 2012). This research shows the importance of backhaul strategy, which is the guideline in designing the new route of transportation and in increasing the utilization of vehicle routing.

Limitations and Recommendations for Future Research

The data collection and cost of transportation are the result to insist that the route-sharing can increase route utilization and reduce the cost of transportation using the first trip by the other company and the return trip by our company. However, there are some limitations in applying the backhaul trip for this case study as follows:

1. The uncontrollable factor increases the transportation cost, such as the delay in production due to shortage of raw material supply; the overproduction that exceeds three containers per day and still needs to use single trip; to expedite some SKUs to export to the Philippines that needs

the company to expedite the transfer of the products from Khon Kaen to Bangkok creating additional single trip with low container utilization, holiday period that needs to increase single trip to transfer the products to Bangkok.

2. There will be a guaranteed transportation trip of no less than 30 trips per month for the backhaul trip. If the trip is less than 30 trips per month, it will increase transportation cost per trip. So, this condition is out of scope in this study.

3. This research is the result for only six months from February-July 2020, which supports the reduction of the transportation cost of the agreement rate between the company and the third-party logistics provider for only two years. So, the cost of transportation will be lower in the next bidding.

The recommendation for this research is underutilization in vehicle routing can occur as the common problem in logistics field, which results in high transportation cost. The backhaul strategy is one of the tools to reduce transportation cost with higher route utilization. But, to implement the backhaul strategy is not easy. It needs all involved functions to work together to coordinate, avoid errors and find the corrective action to close the gap because without a good plan, it creates a lot of additional cost for company.

For future research, the research will focus on the problem of production because it is related with transportation cost as well. After the 2019 and 2020 data were collected, the researcher found that the problem of production shortage and expedite some SKUs transferred to Bangkok have increased the cancellation of truck and urgent request for single trip. The further step for the research is to create more collaboration in cross-functional team with preventive action to close the gap of additional cost.

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