South Korea's Domestic Cold Chain Logistics Optimization

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Subject Area: Logistics

Title: South Korea Cold Chain Logistics Optimization

Research Question: To what extent would growth of e – commerce business risk cold chain logistics operation?

Acknowledgments

I would like to express sincere gratitude to Amanda Brondy and Richard Tracey from Global Cold Chain Alliance (GCCA) who have helped my team members and I in planning visits to outstanding cold chain service related companies in the United States. It was really an invaluable experience for all of us where we gained a lot of insights and learned so many valuable lessons.

I would also like to offer special thanks to:

- Dylan Massave, vice president of merchandising and wholesale of Freshpoint Atalanta
- Karen Reece, vice president of Eskimo Cold Storage
- Cristina Soto, customer service supervisor of United States Cold Storage Inc.
- Mike Shorkey, operations manager of United States Cold Storage Inc.
- Joe Bove, vice president of design engineering for distribution facility service, Stellar
- Jonathan Turner, general manager of Lineage Logistics
- James Myers, operations manager of Lineage Logistics
- Jason Wagner, assisitant general manager of Lineage Logistics
- Lamont Nelson, human resources manager II of Lineage Logistics
- Henry B. Bonar II, CEO of Bonar Engineering
- Richard Dowdell, cold storage consultant
- Don Durm, vice president of PLM Trailer Leasing
- Kevin Maguire, regional sales manager of Kingspan

for sharing with us your precious time to teach us what cold chain service is, answer our questions, and share with us your insights during the entire visit. We were very delighted to actually visit cold storages and learn about them more in detail. Thank you again for kindly showing us around and giving us the opportunity to visit.

Everything that we learned from this two week visit was very helpful for me in writing this report and I would like to thank everyone for all the help that you have provided us.

Abstract

According to "The Seven R's" concept of Roy D. Shapiro and James L. Heskett (1985) who taught supply chain management and operations strategy at Harvard Business School, logistics is all about delivering right product, in right quantity and quality, at right time, to right location, using right cost to the right customer. This refers to the fact that logistics has a complex and integrative nature, meaning it is greatly influenced by several existing variables such as those related to customer demand, transportation, warehousing (shelf life management), and packaging.

Therefore, small changes in how customers want products can bring big difference in logistics. Nowadays, due to quick transition to e – commerce in retail market, how customers order products and communicate their needs changed, leading to alteration in operation that could risk efficiency.

As a result, this paper aims to investigate changes that e – commerce business would bring to logistics, especially cold chain business in terms of warehousing and transportation, and whether current status of logistics operation and infrastructure can support these changes. This will eventually give answers to the following research question: To what extent would the growth of e – commerce business risk cold chain logistics operation?

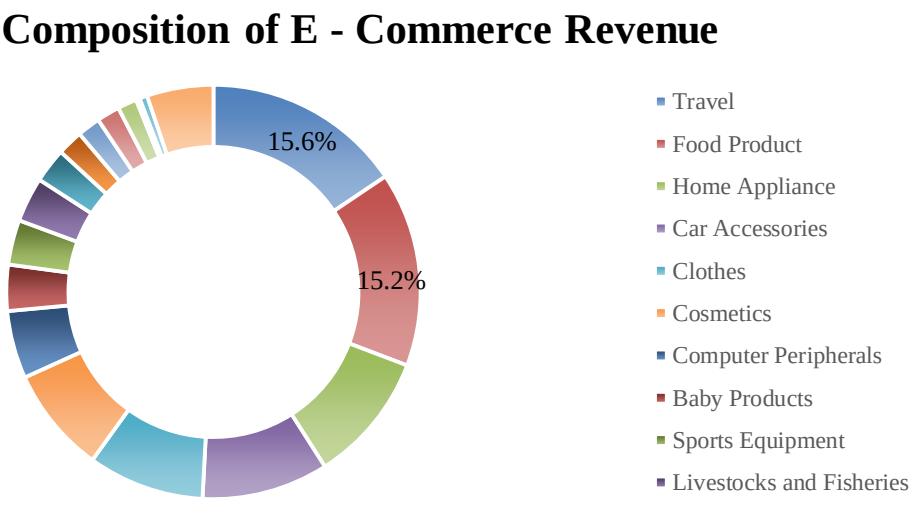
Table of Contents

Introduction

People, nowadays, want to live in a world where they can pursue a great level of convenience. Therefore, the world is now getting more and more connected that offers consumers a brand new way of purchasing what they need. From 78.4% in 2006, domestic internet penetration rate increased to 87.6% in 2017. In addition, 91% of the population now owns smartphones, bringing more convenience to our lives through technology and internet. The era where internet does everything for humans has arrived.

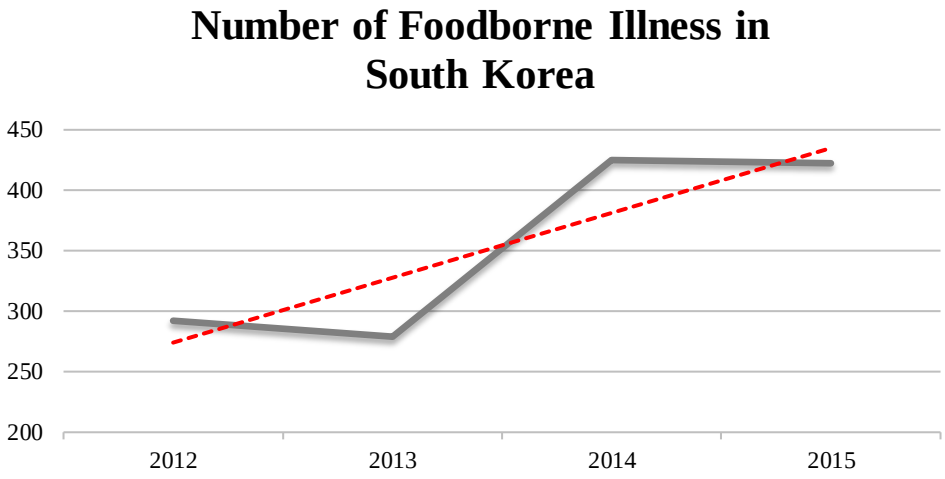
Internet became indispensable to South Korea, where people live and work in a very fast paced environment. Saving time became essential aspect for them and therefore people are finding ways to gather massive amount of data within short period of time. These people who find convenience and efficiency through internet are called the "flex shoppers". As a result, those who shop online to save time have increased up to 65% of the total population of 52 million.

On the 2nd of August, 2018, South Korean National Statistics Office posted a report that accurately demonstrates this current trend. E – commerce market increased its revenue by 3.94% just in 2018 and South Korea is expecting higher growth by the end of 2018. Moreover, this data showed that food products were second most purchased item online, solely comprising 15.2% of the total market revenue (Graph 1), which is quite large considering several other existing product categories.



Graph 01. E – Commerce Revenue Composition

Among several product categories to choose from, why is food product so popular with us, flex shoppers? First of all, four out of ten people in South Korea have food safety anxiety since the number of foodborne disease is increasing annually (Graph 2). As a result, 35.2% of the population increased purchase of organic ingredients despite the high cost. Also, there has been 37.8% increase in processed food consumption because it is convenient (61.9%), time saving (37.6%), and cheaper than fresh ingredients (25.4%).



Graph 02. Foodborne Illness Outbreak Pattern

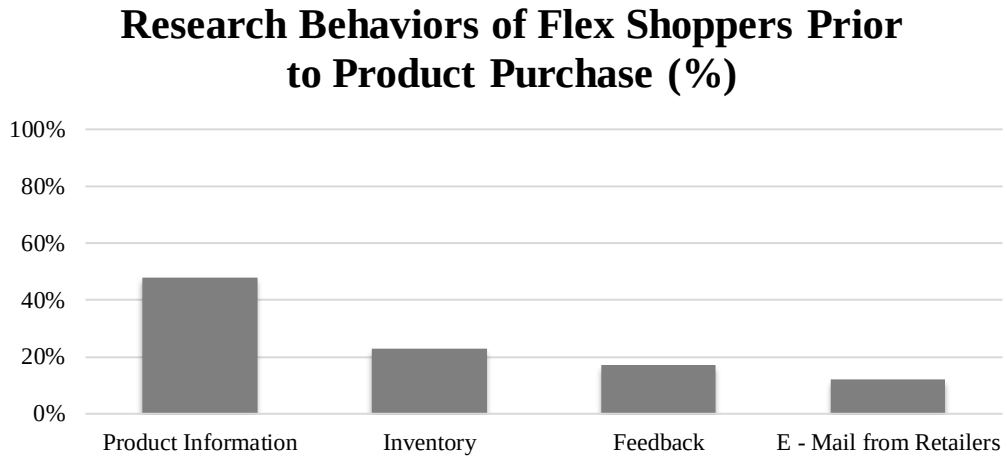
As diverse food products are being purchased online in high numbers and frequency, companies feel much higher need for systematic cold chain logistics operation to serve the customers with right quality. However, cold chain is a more complicate operation where temperature control in both transportation and warehousing plays a very important role.

Prior to analyzing status quo of domestic logistics operation, I am going to look at customer influence on logistics trend and how it is transforming traditional logistics operation to adapt to changing customer demand in e – commerce retail market.

Effects of Flex Shoppers on Cold Chain Logistics

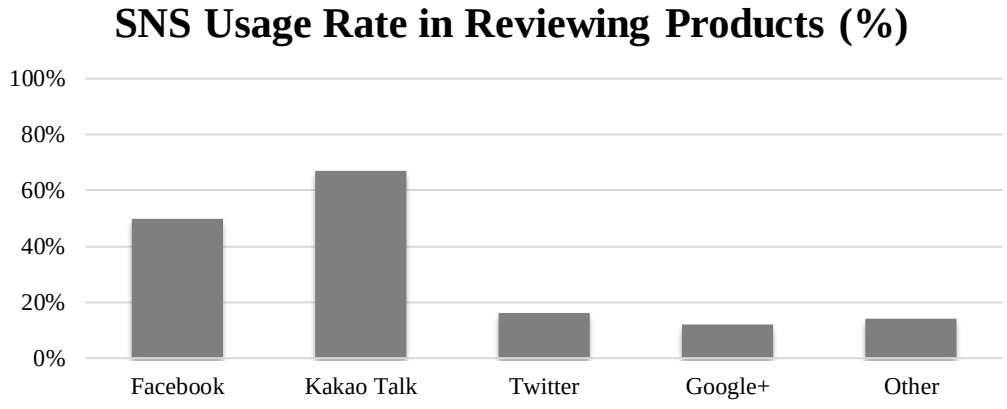
According to the Mangyakazmi, CEO of ANBI Communications, Attention Interest Search Comparison Examination Action Share (AISCEAS) is one of four consumer's purchasing behavior theories that define flex shoppers where convenience and efficiency drives purchase.

To explain, people first need to be aware of the sold products. Once they develop interest, they go online to look for the products. These can be websites or Social Networking Service (SNS). Actually, about 70% of online shoppers have searched online to gather information on the products (Graph 1).



Graph 01. Flex Shoppers Behavior

After people decide to purchase the products, they compare and examine quality and price using different channels. Finally, when consumers purchase products, they share reviews online for others to look at. They can even gather product reviews with just few clicks (Graph 2).



Graph 02. Media Use in Finding Product Reviews

Unlike in the past where markets had more power than customers, nowadays, customers possess more power, transforming the market from push system to pull system because now,

customers decide what they are going to buy rather than markets giving them choices to choose from. Therefore, consumer satisfaction is prioritized more than anything, and these flex shoppers are now driving changes in logistics operation in retail section in terms of warehousing and transportation.

We are specifically dealing with food products that require cold chain service. Looking at their characteristics, they are very sensitive to time, temperature, and where they get to be stored with what. Traditionally in South Korea, the products purchased online did not include food products, and items were being dealt with by pallets. Also, the number of products being handled was pretty minimal. However, with the introduction of e – commerce business, logistics operators are burdened with massive amount of products that come in various Stock Keeping Units (SKUs) that require special handling process, cold chain service.

As we are moving on to online market with these perishable products, logistics operators should be ready to handle increased diversity in SKUs within limited warehouse floor space. Also, because these products are being delivered directly to customers, warehouse operators should make enough space for individual picking and packaging. With these increasing number of individually handled products and influencing factors, management becomes ever more important for traceability and visibility that will enable full control over the warehouse. To sum up in short, space management is really needed in cold storage operation.

In e – commerce business, we are not just talking about warehousing but also transportation because these stored products should get to customers in right quality on time. Therefore, how these products get delivered also matters. Transportation operators should always have full control over the temperature management within the trailer through 24 hour monitoring system. Also because transportation takes up large proportion of total logistics cost, operators should also have means to check on trailer condition to determine trailer replacement cycle based on whether the trailer is causing inefficiencies or not, in terms of fuel consumption and environmental friendliness. That way, logistics companies can promise customers not just timely delivery but also quality guaranteed and environmentally friendly service.

Due to customers having more power over market, e – commerce business should always pay

close attention to customer demand for maximum satisfaction and revenue. In order to do that, finding ways to reduce inefficiency and cost is really important, and everything starts from the core of the logistics business, warehousing and transportation.

Domestic Cold Storage Operation Analysis

[General Domestic Warehouse Statistics and Information]

South Korea began with just 307 cold storages in the year 2013. As more customers began to use online grocery markets, cold chain business grew accordingly. As a result, in the year 2018, it is recorded that there are 1,522 cold storages in operation. These facilities are all privately owned and managed. Although the number of cold storages increased by almost 400%, it is still relatively small in number compared to 4,491 existing general warehouses, considering increased customer demand of fresh food products in online market.

Warehouses in operation are separated into three different types of warehouses that all deal with fresh food products: cold storage, fruits and vegetables storage, and marine products storage. What does this division mean? This means that fruits, vegetables, and marine products that are not stored in cold storages, do not receive proper temperature treatment, leading to loss in quality. Actually, it is known that only 7% of fruits and vegetables receive cold storage service from farm to fork.

Also, these warehouses are concentrated in three regions: Gyeonggi – do[1], Gyeongsangnam – do, and Busan (Map 1). This is because these locations offer great geographical advantage. Seoul and Busan are two main, and active cities where most of the population live and show active economic activity. Therefore, most of the products ordered go to these two locations, and so transportation infrastructure is highly developed in these two areas. Therefore, products can easily get to customers which significantly cuts down delivery time.

[1] "do" is Korean meaning province

Map 01. South Korea Map

Placing warehouses in these three locations may seem strategically advantageous because they are in close proximity with customers; however, it is actually not. As these storages are concentrated in limited areas, operators fiercely compete with each other to attract more customers, and they do this by endlessly cutting down service cost. What operators did to survive from competition eventually did harm to themselves, causing deficit due to service offered at much lower cost than prime cost.

This problem does not end here. In order to cut down total logistics cost, it goes onto further reducing financial investment in other areas, such as technological and operational investment, that negatively impacted whole logistics operation.

[Distribution Model]

South Korea uses multi – level distribution model, meaning fresh products go through at least seven stops from farm to fork. To take marine products for example:

This distribution model not only risks product quality but also increases the amount that customers have to pay to buy the product. Therefore, if this model is to be used throughout the future, it is especially important that quality be managed with more special care.

At this point, I would like to ask where should the starting point of warehousing the products be in order to properly control quality? Start point being the local farm or sea seems logical. However, in South Korea, temperature control begins once products reach distribution center that is nearest to the customers. Therefore, about 110kg of harvested food that failed to receive proper treatment gets thrown away during the distribution process.

To improve this problem, logistics companies came up with the idea of expediting delivery up to 2 hours after order placement. As a result, transportation began to take larger proportion of total logistics cost, exacerbating the problem of high logistics cost. More companies began to experience financial difficulties but have no other choice rather than to continue, not to make the problem worse than it already is. Speeding up the delivery time does not seem like a good solution after all.

[Product Handling Means]

Previously, we have looked at few reasons to why logistics companies are reducing financial investment in logistics operation. This can bring severe problems that could risk the whole business.

On April, 2018, South Korea's one of the major logistics company became a hot issue due to the news that reported on truth behind "The Great CJ Logistics[2]". This company promised customers that products will always be handled with temperature controlled equipment; however, absence of refrigerated docks in the warehouse caused temperature sensitive products to sit on the open dirty floor during the loading hours.

On June, 2018, a reporter wrote an article about a story that a customer, a CEO of small, offline grocery store, had to tell. As usual, he was waiting for fresh ingredients to arrive for

[2] CJ Logistics is one of major logistics company in South Korea.

sale but products did not arrive without a word from logistics company. What this company told the customer after he made a call made him lost in words. He was told that the ordered products got lost, and that it is impossible to track down where the products went. From these two incidents, we can assume that South Korea's logistics companies are far behind in equipped facility operation, causing inventory tracking problems and quality issues.

This is due to lack of financial investment in core business of logistics. On the other hand, it could be due to all of the facilities being privately owned. When these warehouses are privately owned, regulations and operation are managed within the company. Then, the company turns into a very closed and secluded place, where only companies know what they are doing. Since there is no third party to monitor how is logistics being performed and companies are very reluctant to opening up to the public, it is very difficult to bring changes. This is very dangerous in that logistics companies will continue its way of doing business as long as they earn profits and no one complains about it.

However, logistics companies should now work on improving their core business and bringing changes. Fixing problems may cost some fortune at the beginning, but it will definitely pay off those expenditures later on. It is now time to change the business philosophy from "keeping everything to ourselves" to "admitting what we did wrong and focusing on ways to solve problems".

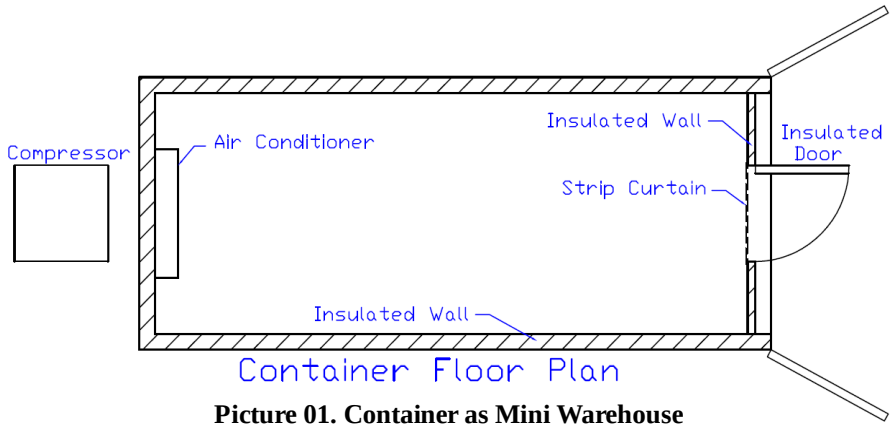
Domestic Cold Storage Operation Solutions

Before moving on to giving plausible solutions to previously analyzed problems, I am going to list existing problems in current domestic logistics company that could be solved:

- lack of regulations and manuals in warehouse operation
- great loss of food products during multi – level distribution model
- limited space causing inflexibility
- lack of financial investment, leading to improperly equipped warehouse
- zero traceability and visibility

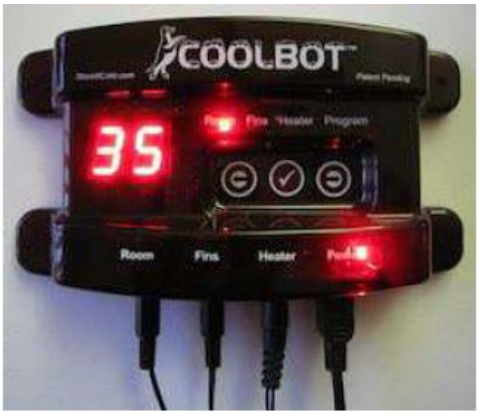
The moment we are born, we abide by the given rules and instructions so that we can do things right. I believe that it is the same for the business. Establishing ground for the business is the foremost important. Warehouse operators should work on establishing regulations and operation manuals for every possible situations that could occur in the warehouse. This will be a excellent guide for employees to follow and will aid standardization of the operation.

Moving on to actual operation, one of the major problems was large amount of food being wasted during the long distribution model. If it is difficult to reduce the steps, one way to prolong the shelf life of the products is to start temperature control from the local farm. In order to do this, we do not necessarily have to build a new warehouse. Let's take a look at the following.



Picture 01. Container as Mini Warehouse

A solution suggested by cold storage consultant, Richard Dowdell, was to use retired, but well insulated refrigerated container as a small cold storage at local farm. Optimum temperature and humidity can be maintained by using just the air conditioner and household humidifier, as long as the container is located under shade.



Picture 02. CoolBots for Temperature Control

Above tool that you are seeing, is called CoolBot. This will aid local farmers to control temperatures and monitor any temperature variations, which will be a great device to control air conditioning and humidifier operation to manage products in good condition until the next step in the distribution model. This is a very economical and efficient way of utilizing cheap and retired equipment to better control product quality. Estimated cost would be:

20 ft container (insulated)	$4,000
12,000 BTU air conditioner	$1,200
Coolbot Controller	$400
Insulated Wall, Door, Strip Curtain	$1,500
Electrical Installation (LED Lighting)	$1,200
Installation	$1,700
Total	$10,000

Considering the amount of money that we throw away due to food wastes, I think that this amount is worth investing, as more products will begin to reach more customers.

Once food products have arrived in good condition from the local farm to distribution center, it is really important to well operate the cold storage because this is where products will sit for quite a long time. Existing storages cause problems if not properly managed, such as condensation issues leading to frost problems. In order to solve this issue, warehouses should be properly equipped with refrigerated docks, temperature rooms, air barrier doors, etc. which require quite a lot of space. However, warehouses in South Korea is still quite small due to financial difficulties, but companies can no longer put off warehouse expansion in order to survive in a more competitive e – commerce market. To survive, companies should serve the customers with right quality. Moreover, expansion will allow better space management efficiency to handle various SKUs, which was one of the changes that e – commerce business brought to logistics.

As a cold storage, refrigerated docks with dock doors, and temperature rooms are necessary. Well managing these facilities is as important as building these structures as warehouses expand to solve operative problems as business continues onward. Frost is still an ongoing

problem worldwide in warehouse sector. Frost falls as doors open and close, making working environment dangerous for fork lift drivers, and if it falls on the food products, it will cause quality issues. In order to solve this condensation problem, warehouse operators should find ways to limit heat transfer into the warehouse to minimum.

Picture 03. Frost Due to Condensation Problems

Heat enters the warehouse through the gaps between trailers and dock doors while loading and unloading. The heat entered to the dock space transfers to the temperature rooms, causing frosts within. Therefore, designing dock doors in a ways that reduces the gap between, and designing temperature room doors that limits the heat entrance to minimum are really important.

Picture 04. Metal Levelers

According to Stellar, a cold storage construction and engineering company, this metal leveler can be one good solution to reducing the gaps between dock doors and trailers, compared to trailers and dock doors being directly connected. Without it, as people load and unload, the weight of fork lifts alters the height of the trailer that is connected to the dock doors, increasing the gaps. With its application, it will automatically adjust to the varying height of the trailers as people load and unload, bringing minimum gap in between.

Picture 05. HCR Doors

In order to keep the heat just within the refrigerated docks and not into the temperature rooms, heat barrier is needed. A HCR Door is one good solution suggested by the vice president of Eskimo Cold Storage, Karen Reece. This was especially designed for Eskimo Cold Storage with two cold air bursts that act as heat barrier. Facilities with and without these special doors showed significant difference in frost condition within the warehouse. By paying close attention to designing and building these structures, temperature rooms can remain stable and will safely maintain product quality.

As warehouse expand and is being properly equipped, it is important to bring flexibility within the floor space which will facilitate adaptation to quickly changing environment in e – commerce market, allowing more rooms for individual picking and packaging for several SKUs. Since the general trend is that going up is much cheaper than going wide, excellent cold storage operators all think that adjusting rack size is the best option.

Picture 06. Unique Aisle Design

Above picture shows how Eskimo Cold Storage brought space flexibility by uniquely designing the aisle, using new rack design with carefully calculated the space in between. Tall racks with enough space for just the fork lift trucks to pass through enabled the operators to store same volume of products, but instead reduce use of floor space to minimum, giving rooms for individual picking and packaging.

Through proper design, equipment, and operation, the warehouses will begin to look neat and efficient, which signals that it is now time to bring maximum level of traceability and visibility of the inventory to the warehouse. Excellent facilities use bar code to provide license plate numbers for inbound and outbound stocks, that gave operators full control over the entire warehouse in every situation. One reason South Korean industries are reluctant to using bar code is because of its high cost. However, considering all the cost coming from lost item, and time used in locating products, it is now time to invest money to remove all the inefficiencies that is costing money.

Of course, facilities in the United States also didn't start with fancy bar codes from the beginning. Traditionally, they all started out manually on a daily basis by conducting blind inventory count to keep track of updated inbound and outbound inventory. They trusted the lift drivers and trailer drivers to physically write down customer name, material code, lot number, and number of cases. This paper would then be entered into the computer system by the inventory managing office. This works but what made them change? Time taken in writing down, deciphering the handwriting, and typing in the information were all considered inefficient.

The license plate themselves do not cost a lot, averaging around $0.03 per label. Considering the labor and scanner ($1,200), it will cost some money but it will definitely remove bottleneck and inefficiency in keeping track of inventory level by speeding up the inbound and outbound operation through quick scan.

Picture 07. License Plate

Picture 08. Scanning Machine

Collaboration with scanning technology, workers can even receive picking instructions, as you can see in the picture, to show the workers what is left to pick and where to pick.

Finally, managing all these established facility is important but what is more important is to receive regular audits by third party, whether it be government or be food safety organization. Key point is that companies should never be afraid to open up, then it will be easier to locate problems and fix them through regular check – up. Being honest with limitations can be a new way of building trust with customers that will attract more customers.

Domestic Refrigerated Trailer Operation Analysis

As mentioned before, warehousing and transportation is all included in one logistics sector, in a single company, and are privately managed. Therefore, vehicles are purchased with company's assets that cost a fortune. Customers exacerbates this finance problem because we want high quality service at lowest price. According to the research, 58% of flex shoppers are

willing to wait for average three more days, if the delivery is free.

Due to increasing financial burden, logistics companies find it harder to invest in temperature control technology for cargo trailers. Therefore, most of the trailers are not equipped with temperature monitoring and controlling machine, instead companies work to deliver fresh products in Styrofoam box via general trailer within short delivery time (up to two hours) to deliver them in right quality. This, however, risks product quality in e – commerce business because last mile delivery has several stops and opening of the vehicle, letting more heat to enter and increasing delivery time.

Some companies that suffer from purchasing even the general trailers have gone so far as to operating illegal vehicles; vehicles that are not reported, vehicles that are not for cargo delivery (normal car), and vehicles that are not equipped with temperature control equipment.

Moreover, already purchased vehicles cause problems in operation because the vehicles are purchased all at once. This becomes a problem because it becomes obstacle to efficient and cost efficient trailer replacement cycle. Trailers should be purchased quarterly so that operators can plan efficient replacement cycle for those trailers that are causing inefficiency in terms of fuel consumption and environmental friendliness. When trailers are purchased all at once, operators should replace them all at once, costing a lot of money.

To sum up, trailers that have no idea at which temperature it is being operated, and how much fuel are being consumed are being operated around South Korea that is inefficient for both the company and the environment. When this problem meets with congestion, the problem gets worse.

Domestic Refrigerated Trailer Operation Solutions

Before we move onto giving solutions that could possible improve transport operation, let's first of all list the problems that have been detected:

- absence of trailer replacement cycle
- temperature control difficulty
- congestion problems

Assuming that it is impossible for the company to invest money into temperature control equipment, so the only way to maintain the product quality using the general vehicle is to reduce delivery time, it might be more economical to think of new ways to deliver products to avoid congestion.

According to McLANE, a last mile delivery company for food products, one solution could be "key drop" service. Traditionally, customers all had different times of when they would like to receive products. However, through research, this behavior was known to be more like habit. Since customers got used to receiving products at a certain time, they feel psychologically comfortable receiving future products at that time without no tangible reason. If the companies could persuade customers into changing product receiving time, key drop solution can be applied.

Key drop solution is delivering products during early in the morning before people begin to work. In order to do this, customers should have temperature controlled key drop garage. One garage per condominium for the residents, and one garage per retail store will be enough. Drivers, then can deliver products early in the morning to this key drop garage to avoid congestion and heat exposure of the products. According to McLANE, this solution significantly cut down operation cost.

If the company is ready to invest more money into actually operating properly temperature controlled vehicles, it is important to establish replacement cycle plan. Old vehicles that were operated in high speed for long time tend to use up more fuels compared to new vehicles; when healthy oil usage rate is 0.5 gallons per hour, old trailers are known to use up 3 gallons per hour. Therefore, it is really important to replace old trailers to remove cost inefficiency. Healthy life cycle is estimated to be 6 years. Companies should come up with 6 year gap replacement cycle for the trailers that they have, which is economical since they do not have to replace all trailers at once.

Once vehicles are ready to be operated, it is time to pay attention to temperature control. It is important to define what is the cause of that difficulty. If the difficulty is due to lack of technological equipment, simply, companies could invest some assets to installing

Thermoking, a temperature controlling and monitoring machine. This is used to maintain certain temperature, track and monitor all the temperature variations during delivery for the operator to take action when needed, which helps drivers to better maintain product quality.

Picture 01. Thermoking

However, if the problem is occurring in those trailers that have Thermoking installed, we should look at operational reason. There are two modes in using Thermoking: continuous run, and cycle centric stops.

In continuous run mode, the device continuously works to maintain the set temperature without stop. Drivers think that this will keep products at desired temperatures even with multiple opening of the trailers during the last mile delivery. However, it is not because trailers are operated with open doors at each stop. When the doors remain open, push and pull system of air circulation breaks, causing continuous pull of cold air from the trailer and pushing in heat and moisture. As a result, when the driver expects -17.8°C, it could actually be 2.8°C, risking product quality even with Thermoking. Therefore, it is more efficient to operate using cycle centric stops mode. This is just like air conditioning, once the trailer reaches the desired temperature, then the operation stops which saves fuel, and reduces carbon footprint.

If this does not solve the problem, then lastly, operators should think of amount of load. If the trailers are fully loaded, without leaving space for air circulation, hot spot is created within trailer, causing temperature control failure. Therefore, it is always important to load, leaving enough space for air circulation.

What is more important than actually applying these solutions is to stop thinking about costs. We are living in a world where customer satisfaction comes first. They should be satisfied for business to reduce efficiency and earn money. It is time to think about change.

Conclusion

In conclusion, customers in e – commerce business sector are now driving changes in how logistics should be operated. Customers are exposed to massive amount of information, meaning people look at more things when using the service. Companies keeping everything to themselves and operating in secluded environment is now past. Today's trend is to open up to customers to build trust, and making them want to use the service by being honest with them. If there is a problem, companies can always fix it. Admitting what we did wrong is the most important part, because without that business philosophy, change will never happen.

Also, if companies decided to invest some assets into bringing innovation to operation, do not forget to continuously check on operation to see if people are doing things right. Without proper management and regulations, things will go back to as it was pretty soon. How people use it and manage it to adapt to changing environment and customer trend is much more important than installation because simply any companies can buy facilities, but not all companies can do it right.

Step by step improvement and innovation is needed in South Korean industries as suggested in previous solutions. Starting small will eventually make the business be the leader in the future. As new market trends are being introduced, now is a great time to attempt change and take one step further. It is better late than never.

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