



# Proposing an Automation Concept for a Logistics Company

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## Proposing an Automation Concept for a Logistics Company

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This thesis project concentrates on researching and applying automation technology in a logistics company (CNT Export Import and Trading Company Limited, or CNT Exim). This is a development in business strategy, and aims to follow the value chain analysis business development framework.

As with any development strategy this was begun by acquiring current data on the business. The next step was to analyse the data and productivity. After gathering all the required information, the main task is to design and sketch out the development idea. The outcome of this thesis is to propose a new technology service that can improve productivity and optimize expenses for the client company.

In conclusion, this thesis shows the difference between traditional manual workflow and the application of automation technology into the current system. Furthermore, disclosed in the conclusion, the Chief Executive Officer of CNT Exim evaluated how this advanced technology has influenced his company's objective to become a hi-tech modern logistics company. This is considered the first step for CNT Exim to move to a modern high-tech fulfillment logistics company.

**Keywords:** Automation, optimization of loading space, technology development strategy, business strategy, value chain analysis, logistics.

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## Abbreviations

CLP	Container Loading Problem
CNT Exim	CNT Export Import Company Limited
CSCMP	Council of Supply Chain Management Professionals
HS	Harmonized System
ERP	Enterprise Resource Planning
LCL	Less than a Container Load
ROI	Return on investment
SCM	Supply Chain Management

## 1 Introduction

Since early 2018, due to the US-China trade war, many Chinese companies have moved factories to Southeast Asia, especially Vietnam. This led to a significant on transport and logistics service in Vietnam. Last year, the Vietnam Report survey said that 91 percent of enterprises in Vietnam believed that the industry would grow up to 10 percent in 2020, while experts believe it could reach 16 percent. Currently, there are more than 4000 transport and logistics service companies in Vietnam. Hence, there will be tough competition. According to Custom News, 70-80 percent of market share is taken by Foreign Direct Investment enterprises (Hong Nguyen,2019). However, Vietnamese enterprises have been providing basic services or single services. To be outstanding and long-lasting in this industry, Vietnamese enterprises need to have business development strategies.

### 1.1 Project background

Since recent years, e-commerce and trade, and serving individual enterprises have been rising, it has become a motivation for the technology investment in the logistic business in Vietnam. According to a Vietnam Report from Customs News, technology is the key factor and credential for the development of logistics industry. CNT Import & Trading Company Limited (CNT Exim) is one of the first local logistics enterprises to advance their service with up to date. CNT Exim is founded by three young Vietnamese entrepreneurs with extended experience from different areas, such as logistics, information technology, quality control, and marketing. The founders strongly believe that the traditional logistics field will be upgraded to a higher level in the near future.

Currently, CNT Exim has invested an ERP System (Enterprise Resource Planning) to their internal company to manage the whole services that they are providing. There are around 20 office staff and more than 30 warehouse workers using the ERP System. This business process management software contributes to the automatic management in services, products, and human resources. CNT Exim seems to be one of the modern auto-systematic logistic companies in Vietnam. However, there are still many of manual works that need to be handled by office staff and warehouse workers. All inquiries from clients have to be sent by emails or order list forms. Also, manual shipping handling would take more time by warehouse workers if there are LCL shipments (Less than a Container Load).

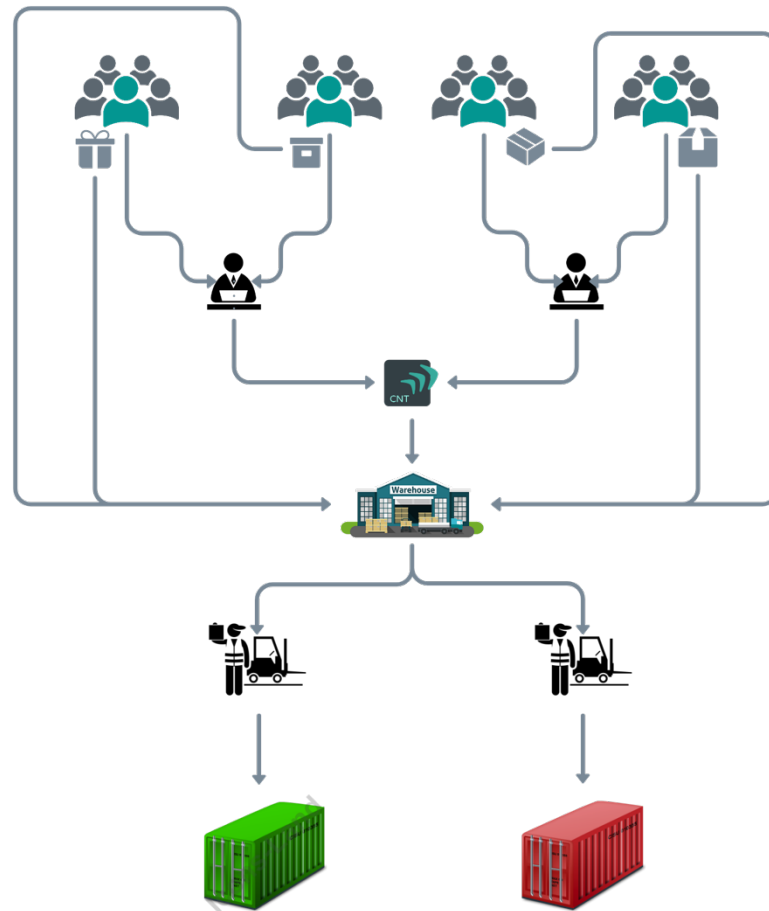


Figure 1: Current CNT Export Import Work Flow Sketch by the Researcher

Figure 1 above shows the current working flow of CNT Trading & Export - Import Co.Ltd. The clients with different items that need to be shipped always need to go through the sales staffs of CNT Exim. The clients then declare the items which required shipping in details to the sales staffs. Besides the basic information like product names, photos, dimensions and weights, the clients provide more information about the packaging method to the staffs. It is always the most time-consuming process for the sales staffs to collect all the information from the clients. All the information from the clients is sent through emails. Any lack of information, the sales staffs need to contact the clients through emails, calls or the social communication applications. In other words, it usually takes more than two days for the information to travel in the system before a completion of an order shipment is made by a new client. However, this may also happen to the long-term partnership clients when they have some new products that demand a shipping order. A clear product declaration is important because it is relevant to the loading in the logistics process. Also, it is the most concerned point for the custom clearance while the product is exported out of the country and imported to the destination country. Overall, the Harmonized System (HS) Code is one of the most widely used industrial classification systems in the export of commodities. The Harmonized System is a

standardized numerical classification system for traded goods. It is used by customs officials all over the world to identify products and collect statistics when assessing duties and taxes. Hence, any mistakes in commodities declaration will slow down the export and import process. Moreover, any delay of shipments may lead to the loss for the shipper and consignee. The current ERP system is a smart tool for CNT to manage the shipments internally when all the shipments information is input manually by the sale staffs.

Furthermore, handling and disposing the inbound and outbound packages in CNT Exim warehouse is also a time-laborious process. At the moment, all the packages for LCL need to be arrived at CNT warehouse at least three days before the shipping cut-off date. When the shipping orders are notified on the ERP system, the logistics managers check and arrange spaces for receiving the packages and sketch out a good disposal plan in details. However, all those arrangement works are imagined and estimated by the existing information that received earlier from the clients. It would take more time for the warehouse workers to arrange then load when receiving all the goods in the warehouse. More clients and more inbound packages require more spaces and human resource in this warehouse processing.

## 1.2 Project objective

Main target customers of CNT Exim are the small and medium enterprises in Vietnam. As a new but full of experienced logistics agency, CNT Exim wants to share and help the similar youth entrepreneurs. Logistics is one of the most important factors in trading business strategies. It would be time-consuming and costly for a trading company to lack a good consultant.

Back-office automation is the first thing CNT Exim needs to invest to speed up the business and maximize the productivity and profits. Various documents used in supply chain management operations include delivery orders, dock receipts, bills of lading (B/L), maritime waybills, and so on. The office staffs process these documents on a regular basis for a variety of reasons, but it is a time-consuming, manual operation that prevents firms from improving effectiveness. Businesses may achieve practically end-to-end document automation with an auto-bot (artificial intelligence) and OCR (involving tasks like data capture, understanding information on the document, and sending the document to the relevant person).

Besides that, most of the shipments from the small and medium enterprises are less than a container load (LCL). That requires a logistics agency to combine these LCLs to optimize the cost for the clients. Therefore, for CNT Exim to be an expert in this industry in Vietnam, the logistics agency has to obtain a great optimization in the management systems.

Arrangement of the LCL shipments always is a challenging problem of logistic companies. In particular, they need to know the exact inbound timing of the shipments, the dimensions,



weight of the shipments; or any special requirement of arrangement such as no put on top, no rotating. Those are the key factors that limit warehouse workers to dispose the shipments. Fortunately, there is an online 3D cubic meter calculator for CNT Exim to do that. With this online application, users can easily have a visual like loaded container in 3D after a few minutes inputting the shipment information. This software has saved a lot of time for warehouse workers in optimizing the container loads. However, the software has some limitations. First, it is not free software. Second, CNT Exim has to disclose some shipment information of their clients and that data is not connected to CNT own system.

As a leading hi-technology logistics company in this competitive industry in Vietnam, it is crucial for CNT to invest in modern technology solution. It is time for CNT Exim to have their own 3D cubic meter calculator to complete the closed professional and fast logistics system. In this research, the process to achieve the mentioned objective will be proposed.

## 2 Project theoretical background

### 2.1 Definition of Logistics and Supply Chain Management

There is a confusion over the term Logistics and Supply Chain Management (SCM). These words are used the same, or even interchangeably by many enterprises nowadays. Furthermore, while it is called supply chain management (SCM) in the United State, it is considered logistics management in European countries. Many manufacturers today regard the terms as one in the same way, and also use them interchangeably. Nevertheless, even the phrases share similarities, they are different terms that have distinctive meanings.

Chase to the history, the word logistics has been around, with its origins firmly based in the military (California's Manufacturing Network, 2018). In modern time, Supply Chain Management is a much newer term. Its only originated mid-1990s with the start of motion in manufacturing. Later in 2005, the Council of Logistics Management also later renamed to the Council of Supply Chain Management Professionals (CSCMP). Since then, their meanings have been distorted, that required a clear differentiation between the two disciplines.

Preferring to Supply Chain Management, it is more general and complex term. To be clearer, all partnerships between companies and their connection with suppliers, partners, producers, wholesalers, retailers, and consumers are involved in order to maximize efficiencies that enhance competitive advantage. While, logistics is one of the features in supply chain management, which including sourcing, manufacturing, research, logistics, customer relations, and performance measurement.

In other words, according to CSCMP, logistics is described as part of the process of the supply chain that plans, implements and controls the flow and storage of goods and services between the point of origin and the point of consumption to meet the requirements of the customer. (California's Manufacturing Network, 2018). Overall, logistics should provide the right product to consumers, at the right quality, time, place, and cost. Eventually, it aims to increase consumer satisfaction.

Preferring to Logistics meaning in details, it is subdivided into two sections:

- Inbound: sourcing, handling, storage and transportation operations.
- Outbound: operations of collecting, maintaining, and distributing/delivering goods.

Logistics also involve warehousing, protective packing, order fulfillment, inventory and keeping balance between supply and demand.

In general, management and logistics of the supply chain will be inextricable, as they do not contradict each other but complement each other. It is crucial for team members to use the same language to prevent misunderstanding and delays that could lead to wasting time and money and causing unsatisfied customers.

## 2.2 Business Logistics

In reference for Business, George C. Jackson and David P. Bianco have described business logistics as a group of related operations, all of which are involved in the movement and storage of goods and information, from raw material sources to final customers and beyond to recycling and disposal. In modern business jargon, business logistics seems to be a relatively recent word and concept; its roots can be traced back to the Second World War, when the ability to organize workers and supplies was crucial to the outcome of the war. In the United States, in the 1960s, the first undergraduate level courses and textbooks dealing with business logistics emerged.

As it has developed, the relatively recent growth of business logistics has led to the use of a number of words to refer to it. The principles of physical storage, distribution, materials management, and physical supply were popular in the 1960s and 1970s. Physical distribution and distribution refers to the outbound movement of products to the customer from the end of the manufacturing process; the inbound flow of material to the production chain refers to the physical supply and materials management. The term business logistics was commonly used to represent the extension of the idea as the importance of managing the entire flow of material from the raw materials to the end user was recognized. Presently, the concept supply chain management is being used to represent the value of alliances and collaborations being formed to streamline material flow. The dominant, all-encompassing term for this

critical definition at this time remains business logistics. It could be seen that the important the business logistics has been proven by the increasing uses.

Business logistics is essential to the company in many ways. First, business logistics offers the business with an opportunity to create a sustainable and competitive advantage for itself with assistant that satisfy the demand of customers than their competitors. For instance, the company might provide order filling and delivery quicker, more precise, and more consistent than competitors are capable of offering. Secondly, a superior logistics system is a patented commodity that cannot be easily duplicated owing to its complexity. Several businesses have started to perceive business logistics as an efficient strategic tool. In the 1950s, the initial development of business logistics started with an appreciation of the potential for cost savings if logistical operations management was organized (Business Logistics, Reference for Business). There were a variety of factors that enabled attempts to organize logistical function management. These attempts usually focused on cost reduction and the physical distribution or outbound section of the system. In addition, the economic recession of 1958 was another factor which proved to be significant in focusing careful consideration on logistics. The recession made several enterprises target logistics because it was thought to have more potential to reduce the financial expenses, rather than manufacturing and marketing. As a result, industrial engineers have been researching production for several years to eliminate unnecessary costs.

According to Reference for Business, George and David also mentioned about the evolution of computer system in this industry. The advancement of computer and information systems is another factor whose relevance to the growth of business logistics cannot be underestimated. Business logistics management requires the timely collection and review of tremendous volumes of data to achieve its full potential. In fact, it is not unusual for a company to have thousands of customers ordering thousands of goods, resulting in tens of thousands of transactions and orders, thousands of parts and components delivered by hundreds of suppliers, and numerous factory and warehouse locations, each with inventories to be monitored. Much of this happens through many countries and continents simultaneously.

Hence, innovative technology plays a big role in business logistics. New technology tools can provide better ways for managers to assess the efficiency of logistics networks. Internet apps would open up all supply chain members with internal details. Increasing demand would result in businesses taking inventory out of their networks, with technology providing a great deal of the opportunity to fulfill fast pace and simplified. Zero inventory and immediate availability would be the ultimate, but possibly unattainable, target of logistics.

## 2.3 Logistical Activities

Logistics does not only involve transport. There are several separate logistics operations or logistics roles that an organization uses. For starters, to deliver a product to a buyer from a warehouse, the seller needs to check and modify the available stock in the warehouse before shipping out the ordered goods. In other words, the seller needs to have a record of available commodity and the quantity to be delivered to the buyer. In addition, the seller also needs to make sure that items are treated in the correct way and that they meet the buyer in the desired outcome. They will need to be compensated for if there is any return from the buyer. Consequently, service quality is the performance of the logistics system, and indeed the logistician's role is to build a system that provides the optimal quality of service at the lowest overall cost. Although necessary, cost-cutting must be balanced with the need to provide maximum customer service and satisfaction levels. Fundamental factor for the development of a logistics system is the commitment of standards in customer support that will give the business a competitive advantage over their rivals. There are six main activities that can be the foundation for building a logistics system.

### 2.3.1 Order Processing

Logistics operations start with the processing of orders that may be the work of a firm's commercial department. The commercial department is the one which guarantees the payment and delivery terms have been fulfilled and then handling of the order from within the firm. Basically, the business team receive the customer's order and sends the order to the warehouse. After that, they inform that the buyer has put an order if the customer has made the invoice, and then the warehouse supply the exactly ordered quantities. In several firms, the stock in the warehouse is also deducted from commercial entry. If the company management has given the confirmation for a purchase order, the stock available will be automatically deducted by exact order list so that there is no double ordering. In logistics operations, this is an important step because any mistakes in this step, such as wrong quantity entries, delivery address, can directly impact a whole logistics process.

### 2.3.2 Materials Handling

The circulation of goods inside the warehouse is material handling. It requires storing the inventory in such a way that the warehouse is able to easily process orders. In any warehouse, this is a significant and an ongoing operation. For small business with limited commodity and quantity, it is convenience to transfer a product from one location to another. Whenever this small shop received the order, the shop owner will have to look for the exact location and quantity of the products in his inventory easily.

For large operation, their warehouses are often half a mile or more in size. Therefore, the volume of inventory in the warehouse to be processed will be overwhelming. For that reason, it is critical for the warehouse manager to probably manage their inventory, how goods travel to dispatch center in order to maintain productivity. Consequently, the handling of materials is a significant logistics feature.

Another important activity in logistics management is to properly organize material inside the warehouse so that it can be quickly transported and dispatched. As the warehouse increases in size, this will be more important. Take the combination of robotics, Artificial Intelligent, and humans is used by Amazon for material handling as a sample. Amazon is expected to ship 16 lac a day in a box, which is equivalent to 70,000 parcels in every hour. That will well managed by the right material handling equipment and techniques employed by Amazon.

### 2.3.3 Warehousing

Take LG or Samsung as an example, they have large markets on over the world. Their production take place at specified plant, but the distribution is global. Consequently, warehousing plays a major role and is one of the main logistics operations.

The main point in warehouse operations is that the warehouse should be in close vicinity to the dealers or distributors, which allows timing distribution of goods. If there was a branded name product that took one week to distribute, then this product may not travel as much on the market as another product that takes two days to deliver, even if it is non branded. Therefore, it's important to have a closer warehouse for the branded business so that the items can be shipped quickly. The first thing it does is to lease a new warehouse so that it can be closer to the markets and closer to the end consumers when a brand develops itself in a new market.

The warehouse location also lowers the burden on the mother warehouse (large warehouses which stock most of the products). These warehouses can carry the strain of deliveries when there is a peak in demand or any decrease in output. They can become interdependent to guarantee distribution of goods to customers.

### 2.3.4 Inventory Control

Imagine a company has 100 units of a commodity in stock, but the demand is only 10 units, then 90 units have been invested in vain by the company. This is money that can be used as working capital and is money to which interest is applied by banks. Meanwhile, another company had a demand for 500 units, but only 200 units were made, assuming the demand would be lower. Now they have lost the orders, which is the cost of a chance. The ideal company will be one that has produced 100 units, knows the demand will be 50 units, and is

ready even if demand increases. But they track demand on an ongoing basis and are ready for it without much investment in manufacturing.

According to the sample cases above, it shows that inventory control is among the most effective logistics functions, especially after the introduction of new production strategies such as Just in Time Manufacturing, Process Improvement or other production processes where the cost of inventory control is reduced.

### 2.3.5 Transportation

On discussion about another big logistics operation, which is one of the logistics segment's most resourceful and revenue-heavy. There are many factors influence on expensive transportation, cost of fuel and physical distribution are the two most concerned problems. Fossil fuel like coal and oil are used in transportation are in fact expensive. Due to there widely used corporations spend lakhs on managing transportation costs because it is one of the company's largest variable costs.

Transportation includes the physical distribution to the distributor or retailer and from the supplier to the end customer of products from the business. Companies are typically only interested before the seller or the dealer receives the point of distribution. For the distribution to the end customer, the seller is then liable. Transportation, however, is also an expense to the dealer and reduces his profit in order to negate his expenses, so the business needs to give the dealer greater profits.

The better a company's inventory and warehouse management, the lower the company's transport costs. In terms of the cost-effectiveness of transport, economies of scale play a major role. FMCG adopted the technique of "breaking the bulk" to reduce transportation costs and also to strengthen logistics activities as a whole.

### 2.3.6 Packing

It's easy to find two kinds of packaging, one that the customers see on the supermarket or chain store shelf where the package looks appealing and makes the customer purchase the products. Another one is transport packaging where the products are packed in bulk in order to prevent any breakage or spillage. It also enable the safe delivery of products in mass quantities from one location to another.

The logistics team has important responsibility for packaging the product to minimize loss to the business cause by damaged packages. This is the reason why a large number of firms invest their resources on the packaging of the product, particularly on export markets. Packaging may cost only one or two percent of the value of the product (Jesse Genet, 2017), but if it is damage during transporting, it will result in a hundred percent cost loss.

## 2.4 The Influencing Factors on Transportation Cost and Price

### 2.4.1 General Factors

There are eight main factors suggested to improve quality and transportation in logistics. Regarding to Vietnam market, hi-technology and competitive price are the most concerned. According to the Vietnam Report (Figure 2), competitive price is one of the top factors that a logistics manager needs to pay attention to while improving the quality of it (Hong Nguyen, 2019). However, transportation cost is difficult to be exactly estimated because a retailer only knows about the freight cost for a shipment weeks later, after the carrier sends an invoice. While freight costs are often unpredictable, they are not a complete mystery; they consider a variety of economic circumstances, as with so many variables. Thus, the entrepreneurs should have adequate knowledge of the eight influencing factors in transportation cost and price in Vietnam.



Figure 2: Top 8 Main Factors to Improve Quality in Transportation and Logistics

Implementing digital technologies would allow for the creation of a single supply chain, consisting of the technical cycle elements of the supplier's storage complex, shipper, and product delivery. Communication with a single chain information center (server) would allow for the timely transmitting of information, allowing for operative planning by all process parties, including the case of adjustments or disruptions at specific chain links.

Overall, the top one key influencing direct impact to the cost is fuel. Of course, the cost of maritime and land transport is connected to the price of fuel. As fuel costs decrease, cargo ships and freight trucks are cheaper to run and freight prices are dropping. Savings (or losses) are pushed on either implicitly or via a fuel cost aspect incorporated into the pricing model of

a carrier to customers. And if fuel costs rise, of course, carriers can pass on the extra cost to merchants.

Rates depend almost as much on the volume of the commodity shipped by distributors as it depends on the actual price. Providers will be willing to sell limited space at a premium if capacity is limited. On another hand, if demand is sluggish, at least temporarily, a provider might be talked into giving a more favorable rate. One of the obvious examples is the current container demand around the world during this CoVid -19 Pandemic. The sea rates have risen since the beginning of 2020 due to the high demand of empty containers while the shipping lines reduced its sailing capacity after the lock down. An empty 40-foot-high cube container price can reach 8000 US Dollars in January 2021, while it was around 2000 US Dollars at the same period in the earlier years (Viet Hung - Xuan Quang, 2021).

As mentioned earlier, cost will be effective by the packaging. Until products are shipped from one location to another, packaging can be viewed as an unavoidable element that requires due consideration. Transport mode (apart from the product category) very often affects the type of packaging required. For example, long-distance road transport needs different forms of packaging for a product, as opposed to the same product that is transported by air. The mode of transportation therefore defines the form of packaging needed. Since packaging costs ought to be integrated into efficiency figures, this may raise the cost of the product. More packaging also means more weight and volume, which will lift shipping costs. However, several logistics providers also provide the best optimization solutions to save as much as they can. Containers, trucks loading optimization are considered as a type of packaging.

Government regulation can have a direct effect on the freight sector and its bottom line; in case governments also set max driving times for transport companies. Other government regulations will also affect freight costs; the New Zealand Carbon Trading System, for example, has been projected to raise freight costs by several dollars for every thousand kilometers traveled. In another scenario, Vietnam government set a limited truck driving time into the main cities. Therefore, an entrepreneur has to pay more cost for transporting goods by a small car with higher rates instead of shipping by a truck with a lower rate at the rush hours in the city.

According to Unleashed, I can see the main factors that a logistics firm can control are time and space. Weak of labor management may slow down the transportation time. Packaging and containers loading optimization directly impact transportation loads space. However, these two factors are totally under control by a modern technology solution.



## 2.4.2 Containerization

Surprisingly, shipping containers and containerization are not concerned and thought about much. In fact, it was a big revolution for global trade. Since containerization was implemented, it has become one of the important parts of the supply chain system. I will discuss more about containers and containerization in this part. Hence, it will be easy to figure out the way to deliver products from one location to another place effectively as possible.

Containerization is a method of moving ingredients, raw materials, parts and completed goods from one location to another by using specific intermodal container assets, usually recognized as shipping containers. The most significant aspect of the shipping container is that it is intermodal. Many different forms of transportation can be easily carried. However, a container is carried by truck on road, railway or even transported on vessel, normalization makes it simple and easy to transport and handle these containers. That implies savings in cost and productivity throughout the supply chain. Every minute saved is considered as a good impact on environments and improvement of margins.

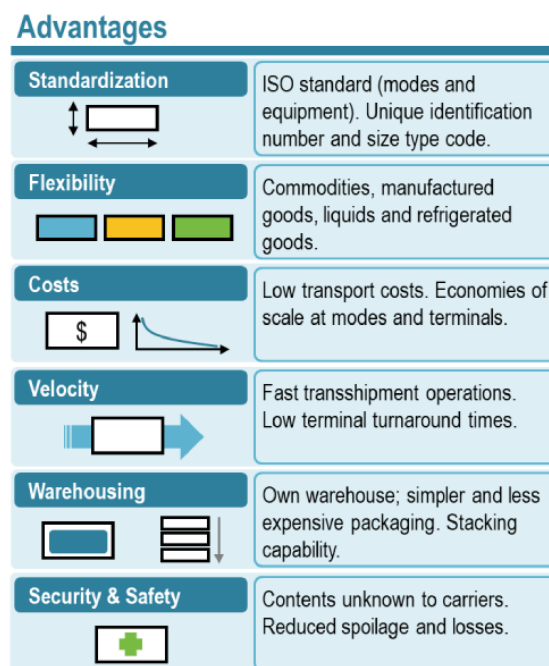


Figure 3: Advantages of Containerization

Containerization brings to the global trade six advantages. Standardization is the first pro that makes logistics effective of containerization. The container is a standard transport commodity which can be managed by different modes (ships, trucks, barges, and wagons), machinery, and terminals anywhere in the world (ISO standard). Each container will be

identified by a unique number and code of size type. A container is a specific unit of transport and, as such, can be handled.

There are two type containers, dry and cold. Therefore, a wide range of goods such as material (coal, wheat), vehicles, and refrigerated goods can be carried easily. This is the flexibility that containerization can bring to. It is possible to recycle empty containers and reuse them for other purposes.

Because of the benefits of standardization, container shipping provides lower transport costs. It is about 20 times less costly than traditional means to carry the same quantity of break-bulk freight in a container. Containers make cost savings at modes and terminals that have not been possible through standard processing of break-bulk. The key cost benefits of containerization arise from the reduced cost of freight transportation.

There are limited and quick transshipment activities, and ship port turnover times have indeed been decreased from 3 weeks to about 24 hours. For this transportation advantage, the containers utilized in transport chains are quicker. The transport networks for containers are well linked and provide a large range of shipping services. Containerships are quicker than standard freight vessels as well.

The container is a warehouse of its own, preserving the freight it holds. For container vessels, particularly consumer goods, this means simpler and less costly packaging. A net benefit of containerization is the loading capacity on ships, trains (double-stacking), and on the ground (container yards). A container yard can raise its loading capacity with the appropriate gear.

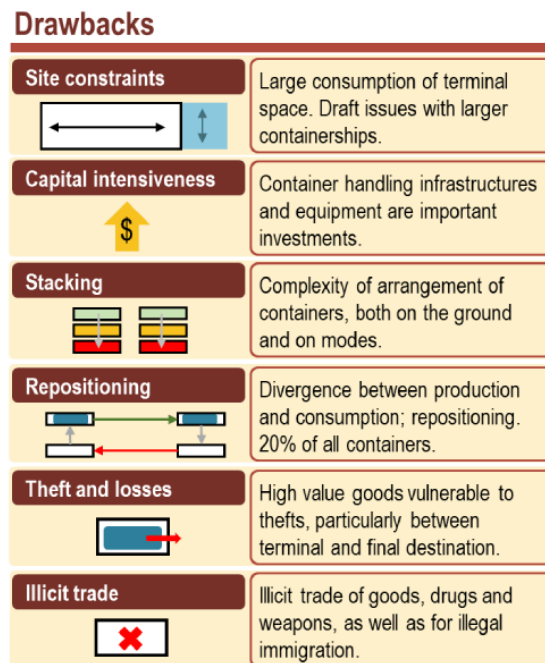


Figure 4: Drawbacks of Containerization

On the other hand, the cons of containerization still exist. Containers are a major user of port space, which means that many transportation ports have been moved to the rural outskirts. With the arrival of larger container vessels, especially those of the post-Panamax class, draft problems at the harbor are emerging. A large container ship post-Panamax needs at least 13 meters of draft.

Transport systems and services for container handling (giant cranes, warehousing facilities, inland roads, rail access) are significant investments in resources that involve huge amounts of available capital. In addition, the trend towards automation is boosting the capital intensity of port facilities.

The difficulty of container arrangements, both on the ground and in modes (container ships and double-stack railways), involves regular replenishment, resulting in increased costs and additional time for terminal operators. The bigger the load unit or the yard, the more complicated its control of operations is. This is the main factor impact to the cost increase that I mentioned above.

Many containers are transported empty due to trade imbalances (20 percent of all flows). However, a container uses up a large amount of space, either complete or empty. The observed disparity between output and demand allows containerized assets to be repositioned over long distances (transoceanic).

A level of cargo risk between the port and the final destination was indicated by high-value goods and a load device that can be violently opened or taken away (on a truck). Each year, about 1,500 containers are lost at sea (falling overboard), largely due to bad weather. In fact, lately 2020, there were more than 1800 containers in the worst container tragedy, ONE Apus. The ONE APUS, a 14,052 TEU cargo vessel built in 2019 and operated on the Ocean Network Express (ONE) Far East Pacific 2 (FP2) service, suffered several stack collapses on board in the latest maritime tragedy due to extreme poor weather while the ship was en route from Yantian in China to Long Beach in the USA (Hariesh Manaadiar, 2020). It is one of the primary reasons for enterprises to consider purchasing insurance for loaded containers.



Figure 5: A photo shows the ONE Apus as it arrived into view in Kobe, Japan, December 8, 2020. Photo: Twitter @mrnkA4srnrA

Besides normal global trading, some criminals would take advantage of the containerization. They use containers as closed and private boxes to transport illegal goods such as drugs, weapons, as well as for illegal immigration. For example, according to The Guardian, as they were shipped across the Channel, thirty-nine Vietnamese migrants suffocated, suffering intolerable temperatures sealed inside of a sealed container over almost 12 hours in absolute darkness. However, it is just a very rare case.

Although the cons of containerization exist, the benefit that it brings to the modern world is much greater. And the cons are not absolutely unable to solve. Every enterprise and logistics

manager would understand and know to balance and boot the pros of the containerization most effectively.

### 2.4.3 Container loading problem

One of the most difficult problems in cutting and packaging is the single container loading problem (CLP). It is a three-dimensional optimization problem in packing a set of rectangular objects, called boxes and containers, in such a way that the packing optimizes some criterion that can satisfy a set of constraints. It's an important aspect of any supply chain so it has to be addressed on a regular basis in a variety of cases, including the type and characteristics of the products to be shipped, the number and sizes of trucks or containers to be used, and each company's own loading constraints. Because of the negative effects of excessive traffic on environmental resources, properly loading these containers, that is, reducing the blank spaces within them, is not only a financial requirement, but also an ecological problem.

#### 2.4.3.1 Optimization computer software

One of the most common uses of truck and container scheduling software is to calculate the space and payload required for a shipment. It is difficult to calculate the exact time and money saved using this software, it mainly depends on the specifics of your business, but it is really important. Calculating freight savings and payback times based on reducing free space or maximizing the space utilization rate of freight vehicles is typical in calculating the effectiveness of using cargo sorting optimization software (e.g. Cube-IQ, CargoWiz).

Load Planning system by Optimization company software will give you the optimal layout to maximize weight or space usage. The optimization computer software optimizes the placement of goods in one or more different sized transports. In this regard, the software is design to choose the right means of transport for the shipment. The system can help logistic companies see the process of arranging goods using hypothetical cubes on their PCs, or they can also do the sorting in practice through clear 3D schematic-based loading instructions. Researchers have developed their own algorithm, which explains why software company license can keep adding features all the time (Goodloading, 2019). New ongoing research provides continual improvement, which means logistic companies can get more optimal stacking options again. In addition, optimization computer software commonly has a complete database engine built in without the need for 3rd party database software. It allows customers to share database across multiple users. Optimization computer software's database comes with the ability to export or import full data with CSV, Excel or XML files. The specifications in CSV and Excel files are pre-imported by the user (PackVol, 2020).

According to Goodloading (2019), the main goal of the optimization computer software is to help users load goods of different sizes into different vehicles using a software program, avoiding mistakes from a "pen & paper" approach. It can offer the 3D view visualization and interaction which make it possible to check loading results quickly and make the appropriate changes if necessary. The next goal is to provide standalone software that can run without an internet connection on all major Windows, Mac OS X and Linux platforms at an affordable price point. The main benefit is to save time, avoid mistakes and ultimately save money. In some emergency situations experienced by customers, when logistic companies need to take action or decide quickly how many trucks or containers to need, the application can make a significant cost savings on the delivery or additional container. The license is per computer and is valid for all eternity, with no additional fees, and also all future updates are free.

#### 2.4.3.2 Order cycle time

When it comes to delivering goods to an output customer, it is common to use the term order cycle. The term replenishment cycle is used in the case of an enterprise buying additional inventory as well as in managing input materials. Basically, one firm's ordering cycle is another company's replenishment cycle. For simplicity the research uses the term order cycle time in the discussion that follows (Jackson, and Munson, 2019). As mentioned above, customer service mainly manifests itself in the order fulfillment cycle. The time to complete operations in an order cycle is the key to quality. customer service. From a customer point of view, a high level of customer service means that an order cycle time must be short and stable, so improving the order fulfillment cycle will contribute to improving service quality. customer. This relationship can be established between the customer service quality indicators and order fulfillment. The cycle time of an order includes the following steps:

- Order preparation is the activity of collecting customer service or chemical requirements. This communication can be filled out directly by the customer or seller on the order forms; Phone directly to sales staff or choose from the order form in the computer.
- Order transmittal (Order transmittal) is the transmission of an order request from receiver to order processing place. There are two basic ways to deliver orders. Human delivery is by sending the order letter or the salesperson directly bringing the order to the order receiving point. This method is low cost but very slow. Transfer orders electronically: using phone, computer, copier or via satellite. This way order information can be transmitted instantly, accurately and reliably, thus it is increasingly being replaced by the first.
- Order entry: Order entry is the activity that takes place before the execution of an order. It includes: (1) checking the accuracy of order information such as product

description, quantity, price; (2) check the availability of ordered products; (3) prepare a written order of refusal, if necessary; (4) check the credit status of the customer; (5) copy order information; and (6) invoice writing. These operations are essential because the order information is not always in the correct form required to proceed; either may not be correctly represented, or the business realizes that additional preparation is needed before an order can be realized. Checking orders can be done manually or automatically. Technology innovation offers a significant benefit in order receipt. Barcodes, optical scanners and computers greatly increase the productivity and accuracy of the above operations.

- Order filling involves the activities of: (1) the collection of goods in stock, production or purchase; (2) packing for shipping; (3) building delivery program; (4) prepare shipping documents. These operations can be performed in parallel with order verification.
- Order status reporting: This operation does not affect the total order execution time. It commits that a good customer service has been provided through maintenance. It informs customers of any delays in the ordering or delivery process. Includes: (1) order tracking throughout the entire order cycle; (2) inform the customer on the progress of order fulfillment during the entire order cycle and delivery time.

Traditionally, the order cycle time consisted only of activities that occurred from the moment an order was placed to the moment it was received by the customer. Special operations like next order deal with them that will affect the entire length of the ordering cycle. Customer operations such as product returns, claims resolution, and bill of lading are not a technical part of the ordering cycle. In regard to this cycle, the step is costing the most time for the business as well as customers is the order fulfillment with shipping and delivering. From a time, perspective, an order response cycle or a lead time is defined as the time period from when a customer sends an order to when the customer receives the goods. Factors of lead time include order lead time, order assembly and processing time, stock replenishment time, production lead times, and lead times. These times can be controlled directly or indirectly through the selection and design of order delivery, stockpiling policy, order processing procedure, shipping method, and method planning (Feldman, 1989). Therefore, the container loading problem causes direct impact on the delay of processing of shipping and delivering, as discussed below.

Stocking up time is about the capacity of the stockpile which also has an effect on the lead time of the order, usually the stock at the warehouse is used. When the stock is no longer available, it is necessary to replenish the stock with the back order or proceed to production. The process of preparing goods is sometimes as simple as manual labor, but sometimes it is also quite complicated and highly automated and highly automated.

Shipping and delivery time extend from the moment the goods are placed on the vehicle to travel to the time it is received and unloaded at the buyer's place. It may also include the time it takes to load the cargo at the start and the discharge at the end. Measuring and controlling the delivery time can sometimes be difficult using a charter service, however, most firms today have exerted their capacity to provide customers with this information

### 3 Project Implementation

#### 3.1 Researching

Initially the researchers mainly focused on setting up a set an automation customer service that can pull up the productivity for CNT Trading & Export - Import Co.Ltd. Currently, it takes a bunch of time for paper works. Therefore, researchers have tried to design and propose a solution to save time and cost to maximize the profits and productivity for both clients and CNT Exim. This research mainly focuses on problems related to the stack and calculation for optimization for loading space in container when the firm receiving new shipments orders. This application should be integrated with the current ERP system of the company. The research studies and re-design and shorten working flow.

Raconteur have summarized the future logistics trend in researching supply chain management (figure 6). According to EyeforTransport 2019, there are top five technology that logistics industry has invested; it is lead by warehouse automation in the rank; cloud logistics and artificial intelligence are listed at the top. It indicates the important for investing the automation technology into this industry.



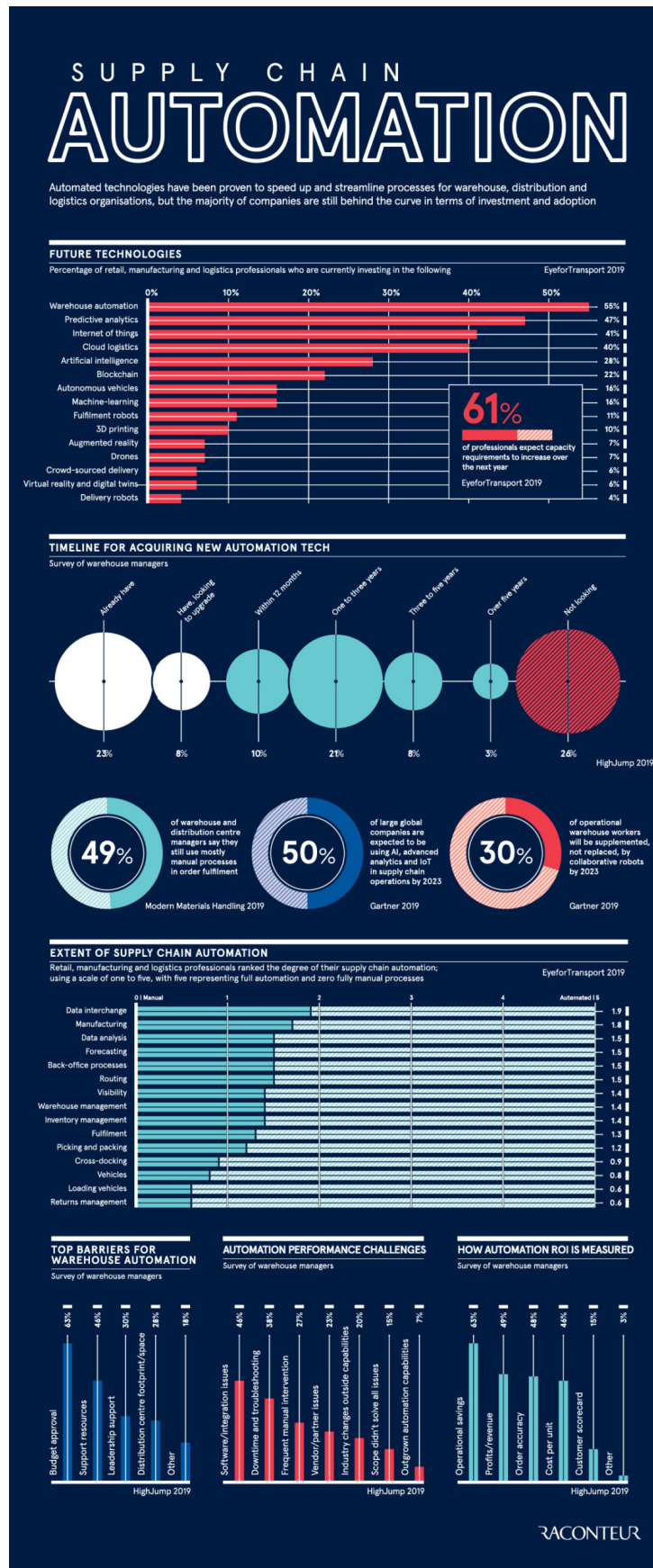


Figure 6: Automation Tehcnology Researches Charts in Supply Chain by Raconteur

In this regard, the researched issue is about create a new management tools that integrates with clients and an application of the algorithm on Three-Dimensional Container Loading Problem (3D-CLP) to save the warehouse operation time.

The concept for the new management tools requires the automation to replace human works. Hence, the office - sales staffs can have more time to handle more clients and expand the markets. In figure 7 below, it shows that the process shipping order from clients to CNT has been shortened one step. Compare to the currently work flow that described in the figure 1, manual works are replaced by the new managing tool. The clients will directly interact with system. And the system will handle directly send shipping orders arrangement to the warehouse staffs.

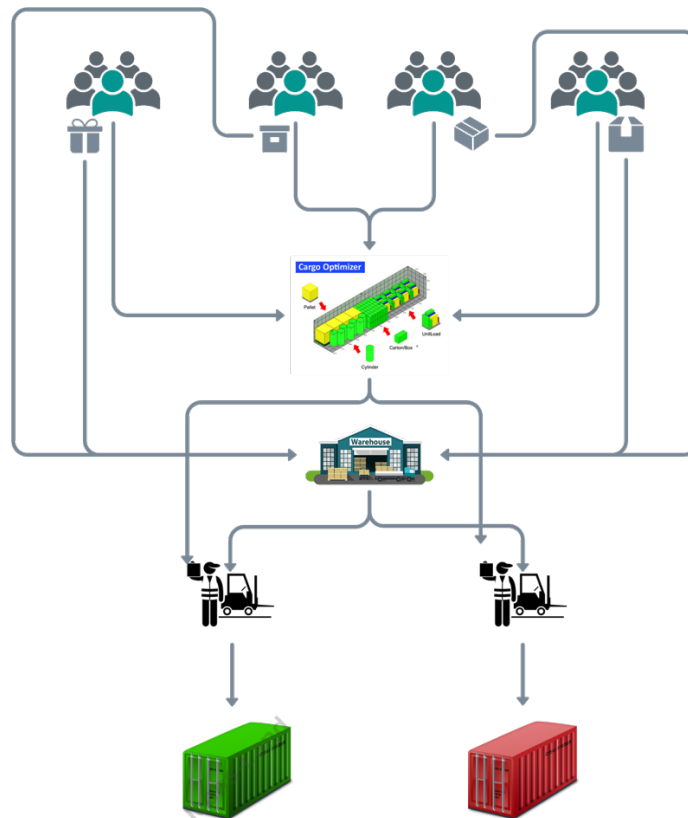


Figure 7: The New Work Flow with the Proposed New Management Tool

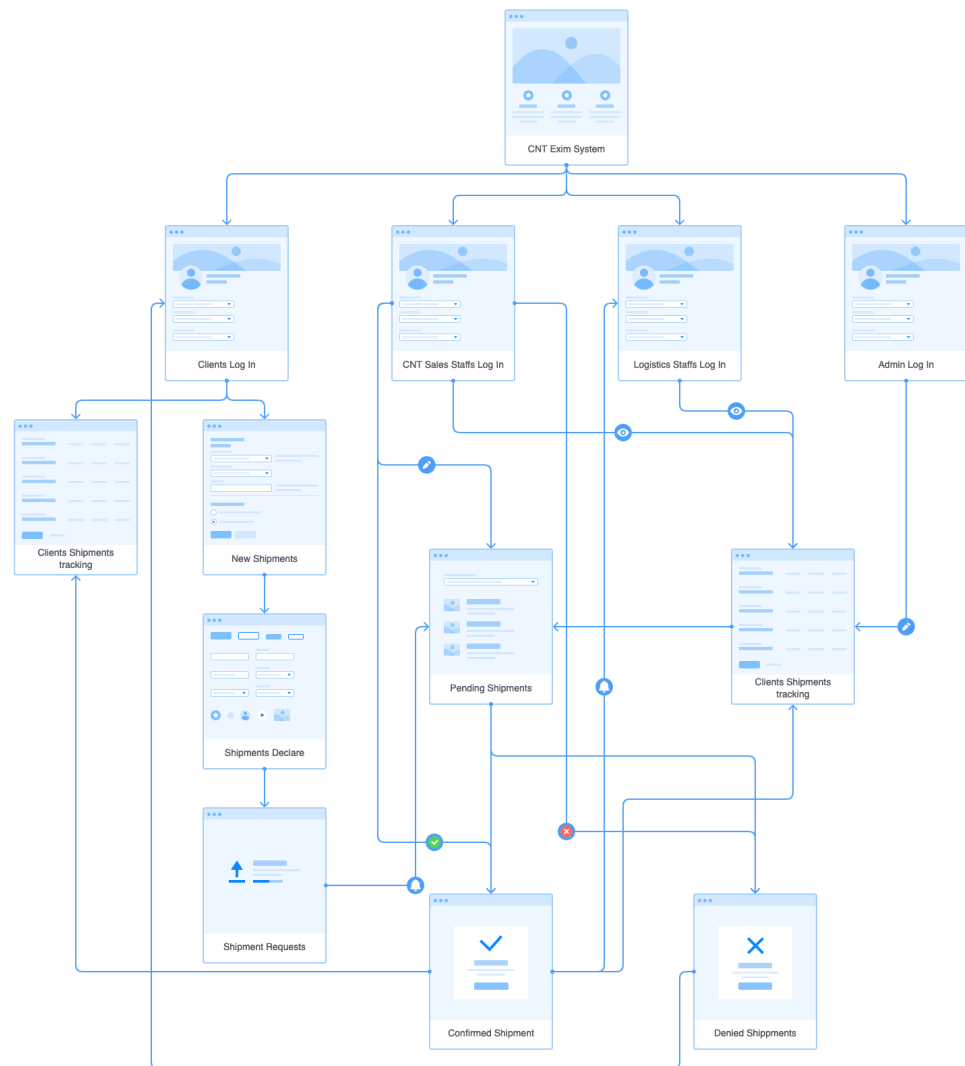


Figure 8: The Users flow of the Proposed Management Tool

Researcher designed a sketch out a user flow for the automation management (Figure 8). The user flow is easy to see that the clients and the whole CNT Trading & Export - Import Co.Ltd are working together on the same pages with less paper and manual work. In this new system, clients will have their own account to tracking and create new shipment orders. The clients have to input the requested information of the shipment to the system. Any lacking and mistake information will be informed immediately while the clients inputting it. The bot in the system will detect and give an estimated a cost for to the clients after submitting the shipping orders. It saves a bunch of time for the office and sales staffs why getting shipments information. Otherwise, the sales staffs just need to take around five to ten minutes to reviews and confirm final quotations for the shipping orders to the clients. In the stages, both of parties would receive all the needed information. All shipments inbound and outbound timing will be scheduled automatically according to the vessel bookings. In reality, all

inbound and outbound timing is very important and hard to be scheduled. In this case, the system is required to be programmed scheduling by orders. The order rule is following by the shipping destination, cut-off and departing time, commodities and special requests from the clients.

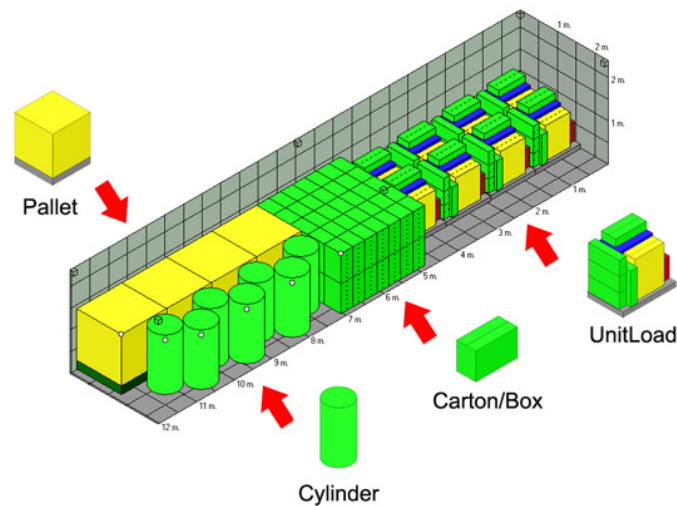


Figure 9: A sample of 3D Container Loading for a Mixed Cargos from Dreamsoft Optimization

In this research, it describes an efficient container loading planning algorithm that can consider all the current and limited container features to quickly generate a set of viable plans for One container ship on a multi-port trip for CNT Trading & Export - Import Co.Ltd.

The concept of 3D-LCP is about the stowed items being weakly heterogeneous boxes where the unusable space within the container is being minimized. Hence, the ultimate achievement of this algorithm implementing with 3D bin packing is about the optimization on the usable space for boxes within a container for logistic companies. With the development and support of existed opened source algorithm, which explains why 3D bin packing can keep adding features all the time. New ongoing research provides continual improvement, which means this technology gets more optimal stacking options again. The new program supporting 3D bin packing performs stacking in containers, trucks, ULD, and rail wagons (multidimensional), but it also optimizes stacking on pallets and carton boxes. The stacking goods may not only be boxes (square, rectangular), but may also be nested rolls and L-shapes (e.g. sofas). For a sample of 3D loading from Dreamsoft Optimization, it shows that all the cargoes can be arranged in efficiently (figure 9). UnitLoad from Dreamsoft Optimization is the cargo kind that user has the option to save a loaded pallet as new cargo (figure 10). It will provide information about all of the cargo on the pallet. This functionality can be used for two-stage loading. Start with loading goods into pallet, save loaded pallet as new cargo, then load into container again with UnitLoad. Interlock Load Pattern (figure 11) is must have function in the

new CNT logistics management tool. For some loading scenarios, it can improve load efficiency.

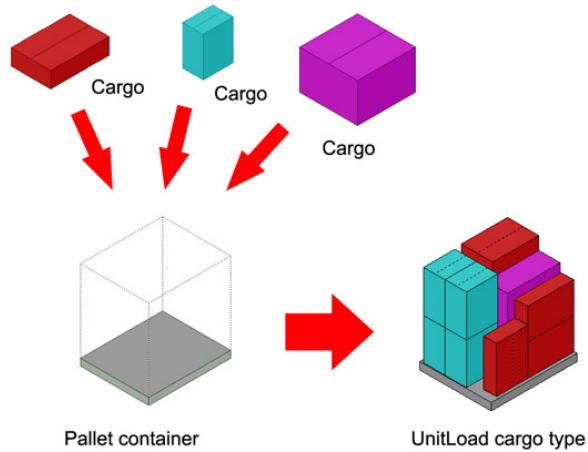


Figure 10: Save Load Pallet as UnitLoad in Dreamsoft Optimization

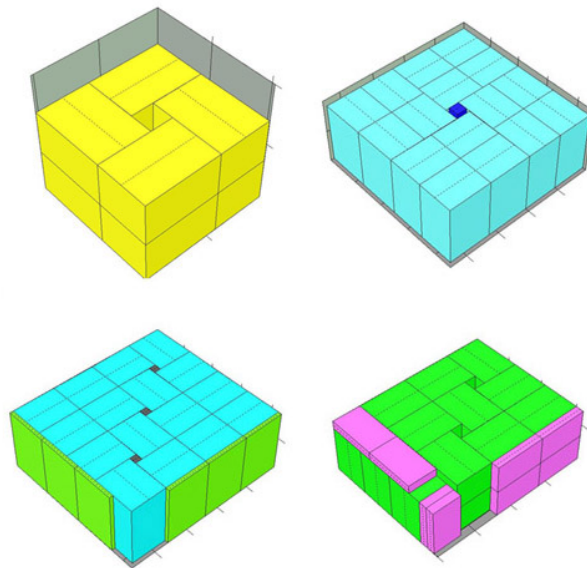


Figure 11: Interlock Load Pattern Functions of Dreamsoft Optimization

### 3.2 Analysis.

The proposal suggests an back-office automation to help the operation department of CNT Exim in tons of manual work. Short interviews with the staffs in the office and warehouses show a promising result if there is a built in auto-bot in CNT management system. Interviewees has been suggested an automation logistics system as researching above , the auto-bot can replace the sale staffs to point out the missing or mistakes in requesting a new

shipment order. A shipping order process will inquire clients to spend more time in requesting a new shipping order, however, it would reduce 100% time for sale staffs to work together with the clients. If there is a auto-bot in the management system as described, interviewees believes that they would have more spare times to work. It may help them to get more deals and solve more problems in stead of spending time oon back and forth with clients or inputing packageing information to another third party software. In the interviews, the warehouse staffs shared that the most important thing for quick inbound and outbound arrangement is accuracy. For the current workflow, the warehouse staffs might found the missing or inaccurated information because they are not the one who interact directly with the clients; sales staffs might skips the information while they have to deal with too many clients in one day, they would pass that problems for the warehouse staffs to deal with clients later. It will be another timing problems. With automation technology, all required information wrong be miss while it was programmed by rules.

	Manually	With Auto-Bot
Office staffs		
Average time to get a shipping requests from client	20-30 mins	0 mins
Average time back and forth to client for a shiping requests	48 hours	02 hours
Average shipping order is verified in one week per staffs	20 orders	30 orders
Warehouse Staffs		
Time to set up one container load plan	30 - 45 mins	05 mins
Reality time for loading time	24 hours	04-05 hours

Table 1: Working Flow Time Comparison between Manually and with Auto-Bot.

The proposed program is also designed for container loading space and handling of container data. The program is used by those planning to arrange goods on containers, for freight centers, involving exchange, planning and information processing, and good sorting. The program is an integrated software system, in addition to arranging of good loading to containers, there are two essential parts:

- Model Editor - graphic utility. The company can use it easily and quickly create the suggested system of this research.
- Expand the system's collection and share with everyone.

In addition, easy to use drag and drop method, the programmed planning process is supported by built-in custom queuing rules settings and automatic checking of conflicts and queue limit. With the help of the control program the user himself can easily customize the look, content and appearance of information about goods and electronic data exchange format with needs and preferences mine. At the enterprise level, custom settings and preferences can be instantly replicated across all computers by file installation. Unlike some other programs, it does not work with just a load condition of the container. Instead, it allows the user ability to plan the loading of goods through the entire trip providing feedback on possible loading conflicts not only at the currently planned plan, but at the loading and disembarking containers are on the voyage. The list of goods in the program is an important component that allows the user to input, edit and efficiently analyze the list of planned containers with the help of other functions.

In respect to the analysis on the impacts of the system, the research measures in two areas of payback period and saving cost. The average target payback period of investment projects by corporations generally aims to be 2 to 5 years. From there, it becomes clear that the investment in using software to optimize the stacking of goods on pallets, trucks or containers is a worthwhile investment. In practice, the calculated parameters will not be the same as the simple hypothetical example scenario above, but they still show that in a wide range of cases savings and payback are completely real. A Container usually has 2 indices: Volume and Size. Whichever index is larger balances the quantity of goods against that index. Example: Container 20 tons 15m<sup>3</sup>. Volume (20 tons) > Size (15m<sup>3</sup>). Therefore, people will line up to fit a size of 15m<sup>3</sup> (so that the cargo does not move) and not exceed a volume of 20 tons. Therefore, the calculation performed is heavily depending on these figures.

For the transportation of goods by container, it will be more economical than the road transport by truck. For the application of algorithm of 3D bin packing for loading space optimization, a container shipping from China to the US costs about \$ 3000 USD, so it can refer to the table below in column "1000 km" or "2000 km" for approximate payback time and costs. This assumption is provided based on the actual data from logistics activities and operations at CNT Exim. The table below is prepared after the interview with the director and manager at CNT Exim in regard to the potential implementation of the new algorithm for the calculation of container loading.

Estimation of a 5% increase in the usable space of the Container, the cost of shipping is US\$ 2.00/km:

Shipping number	Average delivery distance			
	500 km	1000 km	1500km	2000km

per week	Amount saved per year (\$)	Payback period (weeks)	Amount saved per year (\$)	Payback period (weeks)	Amount saved per year (\$)	Payback period (weeks)	Amount saved per year (\$)	Payback period (weeks)
20	52000	5	104000	0.25	139000	0.18	208000	0.12
10	26000	1	52000	0.5	69000	0.375	104000	0.25
5	13000	2	26000	1	35000	0.75	52000	0.5
1	2600	10	5200	5	7000	3.75	10400	2.5
1/2	1300	20	2600	10	3500	7.5	5200	5

Table 2: Estimated Payback Cost and Time in Difference Delivery Distance for Different Shipping Volume per Week.

Furthermore, when loading into the container, to pay attention to order so that the equal volume between positions. It is necessary to plan to avoid having too many goods packed into one area, leading to imbalance causing the container to capsize. At the same time, the center of gravity of the cargo (heaviest cargo) should be placed in the focus area of the container. When stacking by Container, layers of rows will not be avoided. The bottom floor row is subject to the strongest gravity, can be distorted or damaged. Therefore, you need to grasp the principle: Big - heavy goods below, small - light goods above, Solid goods below, liquid goods on top. Depending on the nature of the goods, the management of the company often arrange more padding, the lining to reduce the gravity load, helping to protect the goods intact. Especially, the goods stacked in many layers must have a lining to not break the goods.

- For common goods, people often use cartons to store goods. The symbol on the package will indicate the maximum number of layers the carton can withstand.
- Pineapple bags or Jumbo bags: transportation of granular items (such as beans, plastic beads, etc.) or powder. This bag is for soft, light, easy to store goods.
- Flexitank soft bag: liquid bag, can only be used once.
- Wooden crates: Contains fragile items (such as glass, pictures, handicrafts, etc.) or deformable details (such as machinery, metal articles, etc.)
- Some Containers have a simpler way of preserving such as using straw as a lining for agricultural products, using wooden bars, iron frames to separate rows. The container transporting cushion only needs reinforcement (fix the goods to the corners with ropes, or ligaments, etc.) is okay.



All of these characteristics have to be integrated and expressed in the planning of the loading into container through the use of 3D bin packing. With the three-dimensional function of the system, it is visible and visualized for users in respect to these tasks.

### 3.3 Finding

Today, with the development of society increasingly high, the demand for freight also increases rapidly. A good and quick customer service can lead to success for the logistics firms. Less paper works and easy tracking can help both of clients and staffs save a bunch of time and work productively. The clients will get notification immediately while inputting shipping information on the system. At that time, the sales and office staffs can contact and approach more potential customers instead of supporting clients to fill the shipping order forms with bunch of information that only the clients have. The only thing the sales staffs will do in verifying all the information and quotation to clients before confirm it. An autonomous system

In particular, container shipping is a popular and widely used form of transportation because this form of transport is a large amount of goods, while saving costs. The specifications of the container are marked on the case or on a safety sign. Specifications of the container include:

- Maximum weight or gross weight of the container (Maximum Gross Weight) when the container is filled up to the safe limit. It includes the maximum allowable weight plus the container weight.
- Net tonnage of container (Maximum Payload) is the maximum allowable weight of goods in the container. It includes weight of goods, packaging, pallets, materials used to dunnage, supporting goods in the container.
- The Tare Weight depends on the material used to make the container.
- Container internal capacity means the maximum cargo capacity of the container

In respect to the analysis above, all of these criteria are key and most prominent components in respect to the measurement of effect of using algorithm for the optimization of loading space for logistic companies. In addition, according to the interview with the management at CNT Trading & Export - Import Co.Ltd, it is also noted the following optimization coming along with the use of software and integration of algorithm for the calculation and operation of the company's activities:

- Create a 3D picking plan using complex stacking rules including stacking order, partial loading, weight balancing distribution. This leads to optimize the load in the order of goods sorting:
- Suitable for loading or unloading along the transport route of the vehicle.
- Optimal load according to partial load, balanced weight distribution:

- Suitable for transporting goods to remote areas, remote areas where the terrain is complicated (many hills, many curves, potholes, dirt roads, etc.) to avoid overturning the means of transport when moving.
- Load optimization under comprehensive stacking and box orientation rules. Hence, this optimization rule is suitable for setting priority for the placement of "fragile" goods, susceptible to damage by physical forces such as glassware, ceramics, liquids, machinery, device, etc.
- Store and retrieve full stowage cases. Then, managers can access the queue status of shipments through loaded value, actual over loaded weight, and so on from That shows the direction to improve the transportation of goods in the business. Then, from the point of view of the transporter, the storage and retrieval of cargo sorting cases helps them always have a sorting plan when needed or have data to compare the efficiency between optimizations.
- Distribute actual load instructions (electronic or printed) in clear 3D diagrams
- Import and export data files about complete sort cases to other settings when moving data or communicating with colleagues.
- Trucks can be guided to queue by the support of the algorithm with 3D bin packing, with the axle weight limit fully considered, as opposed to some other systems that only calculate axle weights, the algorithm with 3D bin packing will keep these weights. within automatic limits. This results in completely legal and safer downloads. The system's advanced loading and unloading optimization features include:
  - Load the cargo in reverse unloading order (i.e. the first loaded is unloaded later)
  - Load goods around an area only (similar to the principle of cooling in an ice machine, cooling around first and then inside)
  - Loading truck or trailer off grade

Furthermore, observed from users' perspectives of the system, management at CNT Trading & Export - Import Co.Ltd report that the system presents users with a complete list of containers with their characteristics in a clear tabular format. Data contained in the catalog of goods can be entered manually or imported from a structured text file (CSV file). In the list of goods, the user can select one or a group of containers to be sorted, defaulted or edited. To arrange containers the user can drag them with the mouse from the container portfolio window and drop them into a Bay. The container checklist of the goods is tidy and not sorted in the flight plan. Users can search and analyze a catalog of classified goods, group and filter it by combining different criteria. The ability to copy commodity catalogs to clipboard in combination with sort, filter and group functions makes it a perfect tool for generating various container statistics reports.

Users can catalog goods according to their needs and departments:

- Hide unnecessary columns and bring up the item which users want to see.
- Add properties by customizing.
- Resize the column width and rearrange the position of column in the table.

The most frequently used functions in the catalog are immediately accessible through the right-click menu and tool buttons settings. For an immediate reference to the list of goods, the information displays a summary of the most essential parameters of the container, currently selected in the list of goods.

#### 4 Conclusion

As is known, in recent years information technology has developed extremely rapidly and has been widely met in all fields of society, especially in management, an area where the element of science and technology has decision. That incident led to an information explosion, causing managers to fall into a state of "information flood". Therefore, experts say that today we live in a society "very rich in information but poor in knowledge". That situation requires the development of mining methods, discovering useful information and knowledge hidden in the "mountains" of data to serve the work of managers, experts, thereby promoting the production, business and competitiveness of business organizations.

The costs of relocating (also called repositioning empty containers) in situations like these are not small at all. Indeed, they amount to \$ 15 billion to \$ 20 billion per year across the industry. Affected companies include container carriers, charterers, and other logistics companies. For a carrier, the usual positioning accounts for 5% -8% of total operating costs. By implementing an efficient market for the exchange of empty containers, carriers can avoid about a third of the relocation costs arising from their operational limitations. Such a market would allow carriers to lease containers for one or more booking requests, temporarily exchange containers between two or more parties at multiple locations, or sublease containers. For large logistic businesses, the handling costs they pay for terminals, warehouses, and multilateral operators typically represent 60 to 75 percent of the total reimbursement cost of relocation (Tien, et al, 2019). According to the HighJump Survey in 2019, the hardest barrier for warehouse automation is the budget approval while 63 percent of logistics warehouse managers shared that information. The estimated investment to this project would reach to 100,000 US Dollars. This is not a small amount for a medium scale logistics company in Vietnam. The project would take around six to twelve months to finish this. However, for a long run business, researcher believes it is a good investment. Same with the survey data of HighJump 2019, it shows that the return on investment (ROI) on

operational saving would reach to 65%. Respectively, 49% and 48% of the logistics firms confirmed the ROI measurement on profits/revenue and order accuracy. This is what the researcher expects on this automation project.

According to CNT Exim's evaluation, the proposed logistics plan has 3 outstanding strengths. First, it can effectively support the company's objective of applying automation and digitalisation into working procedure. Secondly, the points made about time and cost saving are highly recommended to be applied in the near future. Finally, the simplifying process is also well considered to digitalise the paperwork. As a result, sale team will have more time and put more effort into contacting and assisting customers which can boost sale. However, there are 3 points that need to be improved in further research. Regarding the investment cost proposed of 100,000 USD, it requires complicated procedure to obtain efficient capital. Furthermore, it can take up at least 6 to 12 months to complete the plan and start its operation. The fund required for IT specialists can be up to 24,000 USD per year which is another concern to the company's budget.

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