

Navigating the Global Supply Chain: Innovations and Challenges in DHL's Intermodal Transport Strategy

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Abstract

In the realm of global logistics, DHL stands out for its innovative approach to intermodal transport, seamlessly integrating various modes of transportation to optimize efficiency. This includes comprehensive services ranging from cargo inspection to customs clearance, all aimed at ensuring smooth cross-border solutions. However, DHL grapples with formidable challenges such as adverse weather conditions, traffic congestion, cargo safety concerns, and a shortage of skilled drivers. To address these challenges, the company is leveraging advanced technologies like predictive weather forecasting and electronic tracking systems. Moreover, strategic initiatives such as improving road transport strategies and adopting a Retain & Rehire approach to driver management are being implemented to enhance operational resilience. Furthermore, the integration of cutting-edge technologies such as 5G and Vehicle-to-Infrastructure (V2I) communication promises to revolutionize DHL's transportation and logistics landscape, ensuring secure, punctual, and efficient delivery of shipments in an increasingly complex global market.

Keywords: Intermodal, Logistics, Technological, Resilience, Optimization

INTRODUCTION

DHL express, in short known as DHL, is one of the largest and also the most successful courier and logistics service provider company in the world, having a presence in 220 countries in the world. DHL has contributed a big part in today's generation of how international logistics works and providing the fastest, safest, smoothest door-to-door courier services. DHL's rich history started in 1969 in the United States. Although it was founded in the USA by Adrian Dalsey, Larry Hillblom, and Robert Lynn. Today, the company is a subsidiary of the German logistics giant Deutsche Post DHL, which was formed in 2002 when DHL merged with Deutsche Post's express and logistics division. DHL express is now a German logistics company as they have pulled out from the USA, due to the strong competition, apart from that DHL focuses on developing itself to provide for its customers instead of challenging and competing with its competition in USA such as UPS and FedEx.

Over the years, DHL has grown significantly, expanding its services to cover a wide range of logistics solutions, including international express deliveries, freight transportation, warehousing and distribution, and e-commerce fulfilment. Being one of the largest logistics provider companies in the world, DHL currently works with 17 partnership airlines, operating more than 260 cargo aircrafts daily, which sums up to a total of 600 flights daily across the world. Apart from their strong air cargo team, DHL also has a very strong fleet operating on the ground all over the world. The combination of its own fleet of aircraft and land transport including cargo vans and trucks, makes the delivery of parcels very seamless and stand out among its competitors.

Overall, DHL Express, a leader in logistics and courier services globally, is dedicated to providing outstanding customer service, fostering innovation, and advancing sustainability. It is able to satisfy the various needs of organisations and people all over the world thanks to its broad network, cutting-edge technology, and committed personnel, making it a reliable partner for international trade.

International Shipping Process Flow Moving Freight Over Borders

In order to improve transportation efficiency, DHL usually uses a combination of various transportation methods (DHL, 2023). For example, when a carrier uses a truck to deliver cargo to a port and loads it onto a container ship. After the ship reaches its first destination, the container is placed in the warehouse. When it

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Above figure 2 is DHL Express Waybill commercial invoice. The shipper has to fill up all the details, which are shipper's and receiver's information, full description of shipment such as goods' name and quantities, and shipment details such as total number of packages in the shipment, total weight of the shipment and shipment dimensions, Schedule B Number/HTS Code and other details (DHL, 2023). Without this information, the shipper cannot deliver their cargo to other countries. The commercial invoice is very important to every shipper because it is the first international document prepared as an exporter, as a bill for the cargo from the importer to the exporter, and is the proof of the transaction.

After preparing all the documents needed, the shipper needs to pack all the cargo properly to avoid the damages and apply shipping labels. DHL will help the exporters with many activities, for example DHL will start with the receipt of the goods, which are unloaded from arriving trucks and placed in a staging area where they are counted and inspected. DHL will arrange for pickup and ground transportation of the shipment from the sender's location in Japan to the point of origin. After gathering all the cargo, DHL will stack the cargo in the origin warehouse to be consolidated with other cargo for loading into one container at the same destination port (Rodrigue & Slack, 2022). DHL also coordinates ground transportation such as trucks and cargo ships, because if the goods are not delivered to Malaysian customers on time, they will face issues such as compensation.

Next, a few days before the ship departs, DHL will load the cargo into the shipping line's container, which will then be trucked to a warehouse at Nagoya Port. The containers are stacked with other containers ready to be loaded on the same ship and finally loaded on board when the ship is ready. DHL also handles customs clearance for goods exported from Japan. Customs clearance is a necessary procedure before goods are imported or exported internationally. Customs clearance involves verifying cargo documents, paying any duties or taxes, and obtaining approvals needed to export the goods. Customs officers will look at the charges that may be charged on the shipment, depending on the type of merchandise, value and the laws enforced in the importing country. Shipments are released once taxes and duties have been paid (Crowley, 2022). DHL handles the paperwork, duties and taxes properly and the shipment gets to its destination on time.

After passing the customs clearance, the cargo will load to the cargo ship, the crew will ensure that the containers are properly secured for transport and the cargo is ready to ship to Port Klang, Malaysia. The containers are loaded on ships and transferred between ports, much like passengers transfer from one bus to another when travelling on public transport. After the vessel has arrived in Port Klang, DHL will handle the customs clearance process for the import of the goods (Ofilac et al., 2015). In Malaysia, the Royal Malaysian Customs Department (RMCD) oversees the movement of goods into and out of the country and enforces import procedures. This includes verifying documents, paying any duties or taxes, and obtaining approvals required to import goods (Janio, 2022). Customs officials who perform import clearance need to receive all the documents needed to start the process. Sometimes, the process can be started with a scanned copy of the document, but some do require the original before the process can be completed.

After customs clearance, the crew will unload the container. Similar to export handling, it involves unloading containers, transporting them from the terminal to a warehouse, unloading the containers and preparing them for shipment by the consignee. Then, the container is collected at the port and taken to the destination warehouse, where it is disassembled and the cargo is inspected and sorted for onward transportation or collection by the consignee. It is always the freight forwarder (DHL) that performs destination handling. The reason is that it must be the recipient of the shipping container, as he is the only one who can pick up the container from the port (Transporteca, 2018).

Lastly, the container cargo is picked up and shipped to the customer. DHL will arrange ground transportation from the Malaysia destination gateway to the final destination. This includes coordinating with local carriers and providing shippers and receivers with tracking and visibility throughout the process so they can monitor the status of their shipments at every step of the way (Transporteca, 2018). Import haulage is the process of transferring goods from the import warehouse to the consignee's address and final destination of the goods. These shipments are usually delivered by truck, and transit times can take anywhere from a few hours to a few

days, depending on the customer's geographic location. When the customer receives the goods, the transportation contract transaction between DHL and the customer is completed (Mocker et al, 2014).

Challenges Faced by DHL

As the world's biggest intermodal company, there are a lot of calculated risks but also some challenges that are not within the control of the company and would affect the company's operation one way or another, irregardless the seriousness. Having to face challenges, enables a company or an individual to grow, as it becomes a valuable lesson to the company's daily operation and would help them in facing similar issues in the future, allowing them to solve it without breaking a sweat.

Extreme Weather Affects Aircrafts

The first challenges faced by the DHL company are the unpredicted weather conditions in certain delivery areas. To be more specific, DHL conducts their intermodal transportation between countries by using aircraft to carry their cargoes and parcels, because air transport is way faster to cross international borders compared to sea transports. However, to operate the aircraft and to stay on track with the daily shipping schedule, air transport requires the best weather, but weathers are sometimes unpredictable such as haze, hail, snow and extreme rains. Furthermore, when the visibility is low, any passenger or cargo planes are not allowed to take off due to safety measures, causing the total intermodal operation coming to a standstill. Such challenges caused by nature are usually unavoidable because the force of nature is not to be played with, but improvements can be made to dodge such challenges by utilising the latest technology related to weather prediction and weather study. Getting first-hand information or latest weather information hours before the actual weather condition will be about to give DHL an upper hand in dealing with weather related challenges and successfully avoid it, preventing a delay in their international shipments.

Road Congestions and Accidents

DHL is renowned globally for its exceptional parcel delivery services, consistently rated among the best for door-to-door delivery worldwide.. From the door-to-door services provided by DHL, we are able to tell that DHL relies heavily on road transport such as a van, truck, and cars, as only road transport has the advantage of providing door-to-door services. Despite the advantage of mobility and the ability to reach rural areas without any hassle, road transport is easily affected by road conditions such as road congestion and road accidents (Jovan,2022). Ever since the car are more affordable, congestion has been a huge problem to cities all over the world, as individuals and families are able to afford a private vehicles, causing the amount of private vehicle to overflow, and the amount of car that are flooding into the city centre daily during mornings and evenings, becomes the main cause of road congestion. Road congestion leads to road transport not being about to move or moving at a slower than usual pace, causing delays in the last mile delivery services. On the other hand, when there are more vehicles on the road, there will be less space for drivers to manoeuvre in traffic, therefore minor collisions would happen; or in worse cases, careless drivers might cause a big traffic accident by driving recklessly causing major congestion on the freeways.

DHL last-mile delivery van scheduled to distribute 30 parcels between 9 am and 5 pm may encounter delays due to morning traffic congestion on highways as commuters head to work, thus impacting the company's delivery timeline. In the end, the driver was only able to deliver 22 parcels before the day's end. Which then relates to cumulating parcels to the next day and more parcels will be delayed again, in the end causing a cycle of unfinished deliveries.

Damage During the Intermodal Shipping Process

Intermodal shipping involves different modes of transportation, such as trucks, trains, and ships, to move cargo in containers from one point to another. While this method helps streamline the shipping process and reduce costs, it also poses several risks to the cargo's safety. Improper packing of the goods is one of the main factors that causes damage during the intermodal shipping process. If the cargo is not packed or secured properly inside the container, it may shift or fall during the transit and cause damage to the goods (Das,2021). Furthermore, handling errors during loading, unloading, and transfer between modes of transportation, the

cargo may be mishandled, dropped, or hit by other objects and resulting in damage. To avoid damage during the intermodal shipping process, DHL should ensure that the cargo is properly packed, labelled and secured, and equipment used are in a good condition.

High Demand Of Orders And Driver Shortage Affects Delivery Frequency

Intermodal shipping is an efficient and cost-effective method of transporting goods over long distances. However, driver shortage is a critical yet common issue in the transportation industry and it affects the frequency of deliveries during the intermodal shipping process. A lack of drivers is already causing delays and rising costs for businesses in North America and Europe (Reuters,2018). The shortage of drivers means that DHL has fewer drivers to transport goods from one mode of transportation to another especially after the pandemic due to high demands of ordering. Without an adequate supply of trucks and manpower shortage, DHL cannot move goods efficiently from one mode of transportation to another and it will delay the whole process. Eventually, the shortage creates a bottleneck in the supply chain and DHL needs to find innovative solutions to address this issue to ensure timely delivery of goods and to gain back the trust from their clients.

Recommendations

Using the Sod5g Test Track

Sod5G test track is a specialised facility that is equipped with various technologies and sensors to enable testing and development of 5G technologies and applications under real-world conditions. The Sod5G test track has two RWS, one 5GTN base station, and IoT sensors for weather and traffic data collection (Tahir et al., 2022).

The two Road Weather Station (RWS) and Roadside Units (RSU) are likely 5G-connected devices that are installed along the test track to enable communication between vehicles and infrastructure, and to provide real-time data about traffic conditions and other relevant information. Then, the 5GTN base station is likely a 5G wireless base station that provides connectivity to the test track and enables researchers and engineers to test various 5G technologies and applications using high-speed wireless networks. Following the IoT sensors for weather and traffic data collection are likely a network of Internet of Things (IoT) devices that are installed along the test track to collect data about weather conditions and traffic patterns. This data can be used to improve the accuracy of simulations and testing scenarios, and to better understand the impact of 5G technologies on traffic and transportation.



Figure 3: (A) Visibility and weather detector; (B) surface state sensor; (C) road weather station and camera; (D) test track; (E) test track equipped with IoT sensors (red spots); (F) drone; (G) field measurements in a real environment; (G) 5GTN road weather stations

Implementation of Vehicle to Infrastructure (V2I) Technology

V2I is a way for vehicles and roadside infrastructure to communicate with each other. This helps transport infrastructure stay up and running and makes it easier for drivers to get where they are going (Radovan et al., 2022).

Real-Time Traffic Information

V2I technology can provide freight carriers with real-time information about traffic conditions, which can help them choose alternative routes or adjust their travel times to avoid traffic congestion.

Efficient Routing

V2I technology can enable freight carriers to optimise their routes based on real-time traffic data, weather conditions, and other factors. This can help reduce travel time and improve efficiency (Hashim et al., 2022)

Improved Logistics

V2I technology can enable better communication between freight carriers, logistics providers, and warehouses, which can improve coordination and reduce delays.

Improved Safety

V2I technology can help improve safety on the road by enabling vehicles to communicate with each other and with infrastructure. This can help prevent accidents and reduce the risk of cargo damage.

Better Use of Assets

V2I technology can help freight carriers better utilise their assets, such as trucks and trailers. This can help reduce the number of vehicles on the road, which can help reduce traffic congestion.

Using the Electronic Container Tracking System (AVANTE) System

AVANTE's supply chain security system helps to monitor and track the movement of cargo through the entire supply chain, from the point of origin to the point of delivery. The AVANTE system consist of three element which are:

Electronic Cargo Tracking System and Solution

Intermodal Real-time Container Tracking

Rail Car Transport Security Tracking System

The Electronic Cargo Tracking Solution (ECTS) is most effective when the entire history of a transportation process is monitored and tracked in real-time mode and end-to-end mode with a holistic approach. AVANTE provides these functionalities using patented active RFID container security tracking technologies (Miler, 2015).

AVANTE's active RFID technology provides real-time monitoring and tracking of containers throughout the supply chain. The technology is embedded in the container and transmits signals to a centralised platform where data is analysed and used to provide real-time visibility into the container's status.

In addition, AVANTE's solution offers end-to-end mode tracking, which ensures that the entire transportation process is tracked and monitored from origin to destination. This includes tracking the container's movement, temperature, humidity, and other critical parameters throughout the supply chain.




How does it work?

The system monitors the containers and detects if someone has tampered with them. It does this by using sensors that are placed on the containers, as well as tags that are put on the containers. If someone breaks into a container, the system can tell because the sensors will pick up changes in the security seal.

Transportation workers and staff have special badges that include a "transportation worker identification card" (TWIC). This card beacons their location and proximity to the container for personnel safety and container security. In case of an emergency, the driver and staff can press a panic button to call for help.

A GPS, GPRS, and SATCOM device is used to help locate containers and cargo on trucks, rail trains, aircrafts, and vessels. If someone breaks into a container, or if something goes wrong with the cargo such as abnormal temperature, high levels of mechanical shock and absence of the driver, the device will report that information to the driver in real-time.

Table 1: Main components of the AVANTE End-To-End Supply Chain Security System and Tracking Solution

<ul style="list-style-type: none"> • ZONER™CTID TAGS with temperature, motion, shock, light, sound, humidity and other optional sensors <ul style="list-style-type: none"> - Detect intrusions through any of the six sides of the cargo area - Can be located directly on the goods to provide localized status information or mounted on walls for general conditions. 	
<ul style="list-style-type: none"> • ZONER™SSID BADGES with panic button <ul style="list-style-type: none"> - Associates personnel and staff with goods for accountability - Active (433MHz ISM) RFID technology 	
<ul style="list-style-type: none"> • RELAYER™RFID COMMUNICATION DEVICE <ul style="list-style-type: none"> - Communicates with and monitors the ZONER™tags and badges - All data is stored and sent to a central server via GPRS or SATCOM - Relays the exceptions and intrusions to stakeholders via SMS, email and phone 	

Rehire

Focus on Driver Risk

This refers to implementing measures to improve the safety and well-being of drivers who are at higher risk of accidents or health issues due to various factors such as age, medical conditions, or lifestyle choices (Perry, 2022). This can include providing targeted training programs, regular health checkups, ergonomic equipment and vehicle features, and flexible work arrangements to accommodate their needs. By prioritising the safety and well-being of at-risk drivers, companies can improve their retention rates, reduce accident rates, and promote a culture of care and respect for their employees. For example, in the United States, the number of drivers exceeds 3.6 million, and over 55% of them have received a Department of Transportation (DOT) medical card that is valid for one year or less. Due to the extended hours of sitting and lack of physical activity, many drivers experience health problems that lead to them failing their medical exams. Consequently, these drivers lose their jobs when their card expires, whether it be temporarily or permanently, and this results in carriers losing experienced drivers.

Take Good Care of Driver

Commercial truck driving is a physically and emotionally challenging occupation. It's common for new drivers to quit within a year, due to the highly competitive and physically demanding nature of the job. Many times, drivers are not adequately prepared for the realities of the profession, and after a few cross-country trips, they simply get paid and quit. As a professional truck driver with more than 25 years of experience, I know we can do better to improve the health and wellbeing of our drivers.

Health coaching, meal planning, and actionable tips and resources are essential for keeping active on the road. And, if carriers really want to make a difference, they should offer cash bonuses or time off for drivers who make healthy choices. This will help create a more satisfied workforce that is ready to hit the road and meet the high demands of the job.

Retain and Rehire

Drivers who return for money or who have recently been medically requalified are highly experienced drivers who are eager to get back behind the wheel. As an employer, do not pass up the chance to bring someone back who is already familiar with how you operate and the routes you cover (Jamaludin et al., 2018).

While the professional driver shortage is wreaking havoc on the industry, it is critical that the employer reconsider the relationships with drivers and adopt a more driver-centric approach. Therefore, it is able to create a healthier, happier workforce that is more efficient and productive by focusing on those behind the wheel.

CONCLUSION

In conclusion, DHL uses intermodal transport, which combines various transportation methods to improve transportation efficiency. The process involves the preparation of necessary documents such as commercial invoice, export packing list, bill of lading, certificate of origin, and permits or certificates. DHL also helps with cargo inspection, ground transportation, stacking of cargo, customs clearance, and loading of cargo into shipping containers. The Royal Malaysian Customs Department oversees the import of goods and customs clearance in Malaysia. Once the cargo arrives in Malaysia, DHL handles the customs clearance process and coordinates with local carriers for the delivery of goods to the consignee's address. The transportation contract transaction between DHL and the customer is completed when the customer receives the goods. Overall, DHL provides a comprehensive range of solutions for moving freight over borders, ensuring the safe and timely delivery of shipments.

DHL, as the world's largest intermodal company, faces several challenges that affect its daily operations. The first challenge is the unpredictability of weather conditions in certain delivery areas, which can cause delays in intermodal transportation by air. To overcome this challenge, DHL could utilise the latest technology related to weather prediction and study to get first-hand information about weather conditions, hours before the actual weather event. DHL heavily relies on road transport for its door-to-door delivery services, which are easily affected by road conditions such as congestion and accidents. Road congestion causes delays in last-mile

delivery services, which may result in incomplete deliveries, causing a cycle of unfinished deliveries. DHL needs to find innovative solutions to address this issue and avoid a bottleneck in the supply chain.

Intermodal shipping, which involves different modes of transportation, poses several risks to the safety of cargo. Improper packing of goods, handling errors during loading, unloading, and transfer between modes of transportation, and equipment failure are some of the main factors that cause damage during the intermodal shipping process. To avoid damage to cargo, DHL needs to ensure that the cargo is properly packed, labelled, and secured, and the equipment used is in good condition. The driver shortage is a critical issue in the transportation industry, affecting the frequency of deliveries during the intermodal shipping process. The shortage of drivers means that DHL has fewer drivers to transport goods from one mode of transportation to another, leading to delays and rising costs for businesses. DHL needs to find innovative solutions to address this issue and ensure timely delivery of goods to gain back the trust of its clients.

Lastly, the various technologies and approaches that can be used to improve transportation and logistics operations. The Sod5G test track is a facility equipped with 5G technologies, sensors, and Internet of Things (IoT) devices that can be used to test and develop 5G technologies and applications in real-world conditions. The implementation of Vehicle to Infrastructure (V2I) technology, which enables communication between vehicles and roadside infrastructure, can improve logistics, safety, and asset utilisation in transportation operations. The AVANTE Electronic Container Tracking System provides real-time monitoring and tracking of containers throughout the supply chain using active RFID technology, and can detect tampering and abnormal conditions such as temperature and humidity changes. Finally, the Retain & Rehire approach focuses on driver risk by implementing measures to improve the safety and well-being of drivers who are at higher risk of accidents or health issues. This can include targeted training programs, health checkups, ergonomic equipment, and flexible work arrangements. By prioritising the safety and well-being of at-risk drivers, companies can improve their retention rates, reduce accident rates, and promote a culture of care and respect for their employees.

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