

WHITE PAPER:

Containerization and the Development of the Modern Global Economy



GTG Technology Group, LLC helps to build software to manage global transportation management systems (TMS) for all sizes of intermodal and drayage transportation companies. GTG is dedicated to providing TMS solutions designed to provide end-to-end visibility and connectivity. GTG's software was engineered to help businesses in the transportation industry overcome challenges faster, cheaper and more efficiently.

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Introduction

The use of containers in shipping irrevocably changed how goods were sent for trade, making the modern globalized economy possible. Their use is so widespread that nearly everyone is familiar with the iconic, boldly colored containers and the ships that ferry them across the seas. Yet many are still unfamiliar with the origins of this system, which arose out of the “intermodal” shipping concept in the late 18th century.

This document will provide an introduction to the concept of intermodal freight transport and how containerization made this the standard for all goods shipped around the world. Containerization offers the security, speed, reliability, and convenience that make multinational supply chains viable.

The Origins of Intermodal Shipping

Intermodal shipping refers to the system first devised in England in the 1780s to [facilitate the processing of coal](#) to be brought to markets. Initially, this was a very inefficient system with a lot of loss due to spillage and theft. Manual handling of materials to be shipped led to significant revenue reductions, such that a system was devised that kept coal in specialized containers from the point of extraction to the final destination at wholesalers or retailers.

It was at this time that the principles of modern supply chain management were first being developed. Economists and business leaders were both very concerned with shortening the time from production to sale and maintaining efficient inventory levels to bolster profit. Arguably, the profit model of retailers like Wal-Mart and Target, built entirely on this concept of strict supply chain and inventory management, is only possible through intermodal transport.

The reasons for this are clear: standardization of the shipping process and reduction in the manual handling of goods allows for greater control over the process from beginning to end. The system developed in 17th century England allowed for the reliable transportation of coal across the sea, which had been a significant problem prior to this development.

Necessity Is the Mother of all Invention

Once railways had been developed, there arose greater need for “door-to-door” shipping systems. This meant that goods needed to be packaged at the point of production and kept securely until they reached the final point of sale. The early containers had open tops and there was not widespread standardization, which would be a necessity for intermodal transit to make the transition from maritime shipping to rail.

The English innovated again when the Railway Clearing House (RCH) [developed one of the earliest modern containerization](#) systems in the early 20th century. They created wooden boxes that could be easily moved by mechanical systems from the production facility, to rail, and finally road transit without ever removing the goods from their shipping container until the final point of sale. This allowed goods to be reliably and quickly transported in ways that had not been possible prior to this development.

However, the RCH system was flawed in terms of its container design. Limited to the materials and design principles of the era, these wooden containers were very small by modern standards and their curved tops prevented stacking. The idea was sound, but the RCH system was not broadly adopted outside of the United Kingdom.

As with so many technological leaps, the needs of military leaders during the two World Wars fostered further developments in intermodal goods transportation. The Great Eastern Railway of England used wooden containers to transfer luggage and other goods between ships, trains, and road vehicles.

The March Toward Standardization

Military leaders realized standardization between modes would augment the speed and security of shipping methods. This meant supplies could be more quickly allocated to the forces that need them. Indeed, this is widely acknowledged to be a major component of the Allied victory in WWII. The Axis supply chains were destroyed, and the Allies invented novel ways of bringing needed munitions and rations to the fronts, which were spread across the Atlantic and Pacific oceans.

The supply chain model invented during WWII is the most immediate forebear of the contemporary intermodal containerized shipping system in universal use today. Unlike the Axis powers, which had existing overland transit systems in use for excellent supply chain management, the Allied powers had only the high seas to bring supplies where they were needed the most.

This is when pallets made their first appearance, allowing for faster and safer transitions between all modes of shipping. Shipping of munitions is incredibly dangerous, and losses are never short of devastating in terms of human life and precious goods needed for war efforts. For many reasons, the Allies needed to make the shipping process more efficient and less labor intensive and guarantee more goods and soldiers could be allocated to the real business of winning the war.

The Containerization Revolution

Pallets made it possible to avoid labor intensive unpacking and re-packing that occurred at ports and shipping warehouses prior to their widespread adoption. By the late 1950s, 60-75% of maritime transportation costs were incurred in port; today with ocean containerization, this percentage has decreased to 35% of the total seaborne costs.

The concept of “piggybacking,” where truck trailers were loaded onto rail cars and shipped this way, had its origins in the interwar period of the 1920s and 1930s. Due to many legal and economic constraints, only a few shipping companies implemented these kinds of intermodal systems prior to the late 1950s.

American entrepreneur and shipping magnate Malcom McLean, who owned less-than-truckload trucking company McLean Trucking, purchased the Pan Atlantic Tanker company and applied the concept of “piggy-backing” to maritime goods transportation. As the first business to do this, [Pan Atlantic Tanker started a revolution](#) that made it possible to achieve the modern global supply chain.

On April 26, 1955, McLean’s company launched history’s first seaborne container ship, after he had their decks adapted to carry truck trailers. The maiden voyage went from New Jersey to Houston, and by 1966 had accomplished the first transatlantic containerization service ever by bringing goods from New Jersey to Rotterdam.

The Need for International Standards

Due to security concerns, the United States Department of Defense (DoD) published specifications for the standardization of containers. The International Organization for Standardization (ISO) later adopted these with the goal of ensuring interchangeability between different modes of international transportation. The ISO standards are now universally adopted, making global supply chain management possible.

These standards were developed with the intention of achieving optimal efficiency in use of space, strength, and flexibility. The rectangular shape allows for stacking and the steel and aluminum construction materials are both sturdy and flexible, allowing for use in the widest possible number of conditions.

It is not difficult to see the benefits of these systems. Instead of manually unpacking and re-packing goods in ports, computerized systems operated with fewer staff can quickly and efficiently move containers from ship, to train, to truck without any losses. This dramatically increased the workplace safety standards in ports and reduced the amount of time ships had to remain in port.

Shipping liner companies quickly adopted containerization in pursuit of the fastest possible “door-to-door” service, now an essential part of all container transportation companies. Modern logistics companies arose to meet the needs of suppliers and end-users in managing the land, sea, and air components of goods transportation. This has fostered increased standardization and consolidation in the shipping industry.

Standardization Leads to Consolidation and Lowered Costs

In 1980, the world's top twenty freight carriers controlled 26% of the total global shipping capacity. By 2009, the twenty largest shipping companies controlled 69% of the total global capacity. Further consolidation is driven mostly by increasing standardization, leading to great supply chain efficiency. When goods change hands fewer times costs start to plummet, a fact that has been known since the late 18th century.

Containerization was quickly adopted, beginning shortly after it was first developed and continuing through the 1960s, with intermodal transportation increasing the use of containers threefold. By 2005, the ratio of containerized to other forms of freight in some large ports such as Hamburg, La Spezia, and Le Havre was 9:1.

The Advantages and Impacts of Containerization

Intermodal transportation has many definitions, mostly concerned with the shipment of goods via multiple means without the direct handling of the freight. It is easy to see how containerization makes this possible and brings with it many added benefits. Arguably, there is no more efficient mode of intermodal transport than containerization.

The benefits of containerization extend much further than the efficiencies generated by reduced handling of freight, which limits cargo losses and delivery times. There is added value in containerized freight shipping in general, where the goods are sealed and secured at the point of origin. This keeps the identity of the contents secure, which drastically reduces the incidence of cargo theft.

Furthermore, prior to containerization, all goods shipped from East Asia to the Eastern United States had to travel on ships via the Panama Canal. Now, container ships are bringing goods to ports on the U.S. West Coast and loading them onto trucks. This reduces shipping time and costs.

The U.S. Landbridge and the Growth of Western Ports

It was not long before rail cars were enhanced to carry more containers, allowing for even greater reductions in fuel costs and breakage. Containerization and intermodal transportation made a sort of “Northwest Passage” possible, whereby goods travel through a large landmass instead of around it. Eventually, rail cars capable of carrying shipping containers stacked two high were invented to enable them to carry even more goods. With minimal added inputs in the form of fuel and labor, freight trains effectively doubled their earning potential by carrying more goods faster.

This concept is called the “landbridge” service, so named because it connects two legs of sea shipment journeys via land-based transit modes. This term refers to the extensive freight rail network that connects all parts of the United States, with connections to other systems in Canada and Mexico. This service for shipments from Asia to the U.S. East Coast is five to six days faster than shipment via the Panama Canal, though it is still more costly. However, for most freight companies, these marginal added costs bring much more in added revenues realized through greater efficiencies.

The U.S. landbridge service had other less obvious impacts on the shipping industry. Now that goods could be brought to the West Coast and then shipped overland to the East without tremendous added costs, ports in these regions could compete for business. Decreasing consolidation and driving up competition could achieve lowered costs and added value for freight companies.

Landbridging also stimulated economic growth for the U.S. West Coast, which embraced containerization to take advantage of the trend. The ports of Los Angeles, San Francisco and Seattle benefited significantly from containerization, spurring economic prosperity throughout the region through added jobs and better wages for more specialized professionals who operate, manage, and design containerization systems.

Freight trains were not the only transit mode that changed dramatically as a result of containerization. Ships specialized to carry containers, known as container ships, began to be built as early as the late 1950s. Instead of modifying or retrofitting existing ships, as McLean did at first, the concept caught on enough that it became economically feasible to design container-only ships.

These ships are designed to spend as little time in port as possible. However, before landbridging, the designers of these ships were limited by the capacity limits imposed by the world’s major canals: the Panama and Suez. Industry standards, [referred to respectively as Panamax and Suezmax](#) size regulations, meant there were very firm limits on the potential capacity of any containership built. Now that intermodal

freight transit is becoming the norm, the potential use of landbridging has allowed engineers to create even more massive containerships.

Aside from these limits, current technical and physical constraints such as propulsion systems and capacity guidelines imposed by ports restrict containership design as well. The diminishing economies of scale presented by larger shipping capacity are offset by associated costs such as port fees and terminal handling charges. However, because these costs are not related to specific inputs and could be reduced as the shipping industry continues to consolidate, mega-sized container ships have become more appealing and there is strong evidence that shipping companies will adopt them where available.

The Birth of Multinational Supply Chain Management.

The factors that [influence adoption of containerized freight](#) shipping are by now well-known: fixed costs associated with individual nations' domestic shipping infrastructure, the spread of leasing companies, and network effects related to the nature of the specific economic system in question. The movement toward landbridging illustrates how changes in fixed costs spurred implementation of containerization in the U.S. Network effects are bit harder to understand, making a deeper look worthwhile.

A “network” is the intricate web of connections that make up an economy. The size of the economy, its wealth, and regulatory and physical constraints are the primary aspects of the observed network effects impacting containerization. One of the biggest barriers to the widespread adoption of containerization is the global system of tariffs regulating trade, which date back to the late 18th century.

Because containerization is best and perhaps only suitable when broadly adopted, regulations of trade and the existing trade networks and partners heavily impact adoption of containerized shipping systems. Containerization also fosters increased international trade due to the lowered long-term costs associated. Without containerization, it is very difficult, and probably impossible, to establish a working international supply chain.

The container allowed shipping to become cheaper and faster, encouraging companies that initially had a purely domestic focus to take their business global. This is apparent in the widespread growth of McDonald's, Wal-Mart, Coca-Cola, and many other internationally renowned brands. Prior to containerization, shipping was not only incredibly labor intensive but automation was impossible. Vessels that used to need to spend weeks in ports due to cargo handling now can be in and out in a fraction of the time, with minimal waste due to spillage and theft.

Economies of scale were formerly limited to domestic markets, and the limits of business growth were defined by the size of the local economy. Now, the only limit on the potential growth of any firm is its ability to effectively utilize multinational supply chains. By allowing goods to be easily and reliably shipped around the world, containers made the modern global economy possible.

There are other benefits that allow for much more accurate and timely inventory management, as well. Containerization allows inventory management to be automated and secured. Whereas freight ships packed with different kinds of goods with different destinations necessitated complex loading and unloading procedures, containers equipped with modern tracking and RFID technology allow freight companies and wholesalers to track goods at every step of the process and optimize how containers are packed and stored on vessels.

The Only Way to Create Global Supply Chains

Containerization did not create multinational trade, but it made the dream of 18th century innovators possible by allowing for increased efficiency in trade. Everyone knows that time is money and the ability to get more goods to market faster allowed for the creation of massive multinational corporations common today.

The International Monetary Fund publishes a *World Economic Outlook* that once called containers the most significant technological breakthrough of the second half of the 20th century. Without the ease of access to production inputs fostered by the globalized freight shipment system it is hard to imagine how the 21st century's digital economy would be possible. The personal computers that led to this new economy could not have been built without inputs from around the world shipped quickly and cheaply. Containerization will only increase in utilization in the future and drive widespread economic growth.