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The Metal Box That Transformed Global Trade: The Innovative Vision of Malcom McLean behind the Container Revolution

Containerization has been one of the most important innovations in contemporary history. The introduction of container boxes to the shipping industry made large-scale international trade possible. The man behind this innovation was Malcom P. McLean. McLean was such a visionary he was able to find market opportunities others could not and integrate different businesses into his shipping industry. The introduction of shipping containers changed the way the shipping industry ran its business. It significantly reduced loading time at ports and cut the shipping cost. When the cargo arrived at the destination, the unloading time was shortened by moving the containers directly to the vehicles without opening the containers. McLean combined existing resources and invented containers which had a powerful impact on international trade and led to intermodal transportation.

In 2006, on the occasion of the 50th anniversary of container shipping's invention, several authors took the opportunity to make the public aware of the influence of container shipping in world trade and shed light on the unsung hero of globalization. Marc Levinson, in his book *The Box: How The Shipping Container Made The World Smaller And The World Economy Bigger*, and Arthur Donovan and Joseph Bonney in *The Box That Changed the World*, offered insightful tales of the container revolution wrought by Malcom McLean. As the industry's leading innovator, McLean started building cranes on board ships, so that they could unload the containers at any remote port. He also realized that to utilize this technology to its full potential, the size of the containers needed to be standardized. These books provide great visual images, but they fail to analyze the future of container shipping and its impact on the environment.

The effect of container technology on local economic growth is described briefly in *The Local Impact of Containerization*.¹ While port cities experienced a rise in the population, the demand for unskilled workers at port decreased

1 Leah Brooks, Nicholas Gendron-Carrier and Gisela Rua, "The Local Impact of Containerization," (2018-07-10). FEDS Working Paper No. 2018-045. Available at SSRN: <https://ssrn.com/abstract=3213282> or <http://dx.doi.org/10.17016/FEDS.2018.045> (Accessed July 20, 2019).

despite the increase in cargo. In his paper “Rise of the Machine: Evidence from the Container Revolution,” David Gomtsyan talks about the decline in employment in the early 1960s due to automation technology at ports.² Ports experienced a 90% reduction in their workforce, which gave rise to militancy by longshoreman unions. The paper “Effects of Automation in The Lives of Longshoremen” describes the 134-day long strike in 1971 in all the fifty six ports of West Coast of America by International Longshore and Warehouse Union (ILWU) to secure the wages, benefits and employment.³ The paper “Estimating The Effect of The Container Revolution On The World Trade” provides in-depth statistical details about the time when this invention was being adopted.⁴ It provides a summary of resource saving from the adoption of container technology in Europe between 1965 and 1970. In 1967, the British Transport Docks Board (BTDB) commissioned McKinsey & Company, a management consulting firm, to conduct analysis on containers before spending funds on ports.⁵ However, the data in the study is limited to the UK and Japan.

Based on the literature above, this paper analyzes the rise and fall of McLean’s trucking empire with historical facts and uses multiple sources of data to show the impact on the future of shipping industry. The paper argues the containerization of shipping industry has greatly boosted world economy and saved natural and human resources. However, it faces challenges such as mass unemployment of labor and pollution of ocean and these are urgent issues to be solved.

The 18th century economist Adam Smith linked the level of the market to the availability of cheap transportation. He argued that transportation added cost to the products, thus made it more expensive to the people. He also pointed out that waterways were a cheap way of transportation for goods.⁶

2 David Gomtsyan. “Rise of the Machine: Evidence from the Container Revolution,” https://editorialexpress.com/cgi-bin/conference/download.cgi?db_name=SAEe2016&paper_id=224 (Accessed August 10, 2019).

3 “1971 ILWU Strike,” Harry Bridges Center for Labor Studies University of Washington. https://depts.washington.edu/dock/1971_strike_history.shtml (Accessed July 25, 2019).

4 Daniel M. Bernhofen, Zouheir El-Sahli, Richard Kneller, “Estimating the effects of the container revolution on world trade,” https://project.nek.lu.se/publications/workpap/papers/WP13_4.pdf (Accessed July 20, 2019).

5 “How Container Shipping Could Reinvent Itself for the Digital Age | McKinsey,” McKinsey & Company, 2018, <https://www.mckinsey.com/industries/travel-transport-and-logistics/our-insights/how-container-shipping-could-reinvent-itself-for-the-digital-age>. (Accessed September 1, 2019).

6 Adam Smith, “That the Division of Labor in limited by the extent of the Market,” *An Inquiry into the Nature and Causes of the Wealth of Nations*. Edinburgh: A. and C. Black, 1859 [1776], 10.

As McLean said, “Freight is the cost added to the price of goods.”⁷ Lower transportation costs contributed to the development of global economy after container boxes were used. The standardized containers further stimulated the economy. The decision to standardize the dimensions of containers played a significant role in the success of the containerization of trade. Today, the shipping cost of products from a manufacturer to an overseas market halfway across the world is approximately one percent of the total retail price. For instance, it costs roughly 45 cents to bring a \$45-dollar pair of shoes from a factory in Asia to a market in the USA.⁸ With lower transportation cost, the volume of goods moving between countries has increased exponentially. Containerization of trade has become one of the most influential innovations in the 20th century.

The Start of the Trucking Empire

The most interesting fact about the container technology is that it was developed by McLean who started his business from trucking and his intermodal transportation revolutionized the cargo handling. It all started during the Great Depression, when America was suffering from a bad economy. As the Depression tightened its grip, President Franklin D. Roosevelt ordered the government to create federally funded jobs through the Work Progress Administration (WPA) on May 6, 1935.⁹ In 1931, McLean refused to continue his studies after graduating from high school because of the Great Depression. While working as an operator at a service station in the village of Red Spring in North Carolina he also earned supplementary income by delivering freight locally. Later, when McLean learned that the federal government was funding jobs through the WPA, he bought a 125-dollar truck with a \$35 down payment for transporting dirt at a nearby road construction site sponsored by WPA. After several months, McLean obtained another truck. When he realized it was hard to survive in the competition of delivering vegetables to the Northeast, he turned to a local textile mill in Fayetteville, NC.

The brutal winter of 1937 turned out to be miserable for McLean. Bad weather caused accidents, grounded most trucks and cost his company a fortune. McLean, therefore, had \$15,000 in debt. The textile mills, along with

7 Joe Nocera, “A Revolution That Came in a Box.” *The New York Times*, May 13, 2006, <https://www.nytimes.com/2006/05/13/business/13nocera.html> (Accessed Nov 20, 2019).

8 Wade Motawi and Andrea Motawi, *How Shoes Are Made* 3d ed. (CreateSpace Independent Publishing Platform, 2015), 140.

9 Franklin D. Roosevelt, “Executive Order 7034 – Creating Machinery for the Works Progress Administration,” May 6, 1935, in *The American Presidency Project*, <https://www.library.ucsb.edu/research/db/1193> (Accessed Nov 25, 2018).

many other businesses including McLean's trucking company, had a hard time of survival. In 1937, while running his truck back and forth to New Jersey with loads of cotton bales, McLean was not pleased that the laborers at the port spent a long-time unloading cargo from his truck and loading it onto ships. Ships had to wait at the ports for several days until the longshoremen broke down the loads and manually fit them into the tight space under decks. This was an old method that had been used for thousands of years and caused traffic congestion at the port known as breakbulk method. Insurance was very expensive at the time for marine freight because damage and theft frequently happened during the loading and unloading. There was a famous saying that "twenty dollars a day and all the scotch you could carry home," longshoremen used to get twenty dollars a day and also they used to steal liquor bottle from the shipment while loading and unloading.¹⁰ When McLean was waiting at the port, an idea struck him that "it would be easier to lift my trailer and, without any of its content being touched, put it on the ship."¹¹ This idea brought a revolution in the world nineteen years later.

The trucking industry in 1937 was very fragmented and competitive because of the lack of any regulation. During World War I (1914-1918), the American government felt a need for an alternative transportation system because there were congestion problems on railroads. Clydesdale Motor Truck Company manufactured trucks for the U.S. Navy and exported them to England for military purposes.¹² The demand for trucks was high, and the Clydesdale Truck Company had a hard time keeping up with the call. However, after the U.S. Navy canceled a large order in 1938, Clydesdale Motor Truck Company collapsed, and the government sold fleets of trucks to the farming, shipping, and other industries at low prices. The trucking industry took over much of highly profitable intercity shipping from the railroads.¹³ Railroads objected that trucks had access to the public roads because railroad companies paid for the road maintenance and had to accept the fixed price of shipping set by the government. When the Great Depression slowed down the trucking industry, the industry came under the supervision of the Interstate Commerce Commission (ICC), and they were regulated under the Motor Carrier Act of 1935.

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- 10 Mark Levinson, "The Box: How the Shipping Container Made the World Smaller and the World Economy Bigger Princeton," (New Jersey: Princeton University Press, 2008), 9.
 - 11 Oliver E. Allen, "The Man Who Put Boxes on Ships," *Audacity: The Magazine of Business Experience* no. 2, Spring 1994, 13.
 - 12 Tiffany Willey Middleton and James M Semon, *The Clydesdale Motor Truck Company: An Illustrated History 1917-1939* (North Carolina: McFarland, 2013), 21-23.
 - 13 Thomas Gale Moore, "Trucking Deregulation, The Concise Encyclopedia of Economics," *Library of Economics and Liberty*. <https://www.econlib.org/library/Enc1/TruckingDeregulation.html>. (Accessed September 1, 2019).

McLean survived the Depression, and in the late 1930s, when textile mills returned to business, he quickly acquired more trucks to keep up with his expanding business. When he formed McLean Trucking in 1940, his company had 30 trucks and the gross annual revenue was more than \$230,000. In 1950, his company employed 2,000 people at 37 different terminals, and it was one of the top truck freight carrier corporations in the southeast with annual gross revenue of \$12 million.¹⁴

As an entrepreneur, McLean always looked for ways to expand his company, and he also wanted to help the returning veterans. McLean found that veterans were qualified for the Servicemen's Readjustment Act of 1944, also known as the GI Bill of Rights, under which veterans were provided funds to start their own business.¹⁵ McLean called several veterans and offered them to be owner-drivers of his company. In this way, he was able to expand his business with government funding. In December 1950, McLean offered a special prize, a fully furnished house worth \$25,000 that would be given to the driver with a perfect driving record. Even though this decision cost the company \$25,000, the money he saved by dropping insurance on his freight was much more.

Truck traffic doubled every decade, and the number of trucks on the road jumped to nine million in 1952 compared to one million in 1920.¹⁶ As truck drivers were paid by the ton-mile carried, the size of trucks increased exponentially. Vehicles with axle weight more than 18,000 pounds wore out the highways. In 1950 nine states implemented an out-of-state tax to trucks. The tolls made it difficult for truck drivers to maintain a profit. McLean realized that the free use of roads was coming to an end. He visited several railroad companies and offered to work together by carrying his trailers on rail flatcars, which was called piggyback service. By using this cross-modal transportation, McLean knew he could easily avoid those rising road taxes. However, because of the long ongoing tension between the Southern Railway and trucking industry, the companies declined his offer.

Once McLean learned that railway was not interested in "piggyback," he began to pay close attention to the marine industry to ship his company's truck trailers. In 1954, McLean told the ICC that "highway transportation costs had hiked up to 50 percent since 1940," and he was looking for new methods of

14 Arthur Donovan and Joseph Bonney, *The Box That Changed the World: Fifty Years of Container Shipping – an Illustrated History* (New York: Commonwealth Business Media, 2006), 20.

15 "The G.I. Bill of Rights: An Analysis of the Servicemen's Readjustment Act of 1944," *Bulletin*, July 1944, n.d., 3 <https://www.ssa.gov/policy/docs/ssb/v7n7/v7n7p3.pdf> (Accessed May 5, 2019).

16 Donovan and Bonney, *The Box*, 23.

interstate shipping at a lower price.¹⁷ As a standard rule of thumb, goods could be moved eight miles on the deep waters at the same cost as one mile by rail. But, because of high costs in the seaports, five major intercoastal carriers were spending half of their total income in 1953 in merely loading and unloading the cargo.¹⁸

McLean had to come up with a new way to replace the breakbulk method. In 1954, after getting inspiration from a railways method to carry freight cars by water, also known as “Fishyback.” McLean sent a request to the ICC to convert his trucking business into a fifty-million-dollar Sea-Land transportation company providing services between southern and eastern ports of America. Even though building a new shipping industry required enormous capital investment, McLean was able to find that some surplus ships manufactured through the Jones Act in World War II that were available at a low price.¹⁹ Even though a trip from Wilmington, North Carolina to New York City would take 30 hours by sea instead of 18 hours by road, it would cost 50 percent less.²⁰ After getting permission from the ICC, McLean started Sea-Land services in 1955. The original method used to handle the cargo trailers was roll-on, roll-off, or “ro-ro.” On January 1956, McLean acquired a loan of \$22 million and he brought two World War II-vintage tankers.²¹

In the same year, while looking for the companies that were already operating shipping business coastwise, he came across Waterman Steamship Corporation located in Mobile, Alabama. He tried to acquire the corporation but failed. However, he succeeded in buying one of the Waterman’s subsidiaries, Pan-Atlantic Steamship Corporation.²² Pan-Atlantic Corporation provided McLean the operation certificate for his shipping business between the Mexico Gulf and east coast ports, and Tampa, a Gulf terminal company of Florida.

McLean knew that he could not own two competitive companies—McLean Trucking and Pan Atlantic—because they both provided transportation service in the same market. Following his attorney’s advice, McLean resigned from his trucking company and he re-registered the stock to a new company named McLean Securities Corporation. Later, he sold his

17 Donovan and Bonney, *The Box*, 34.

18 Dodge, William H., and Marvin J. Barloon. “Discussion of ‘The Interrelationship of the Changing Structure of American Transportation and Changes in Industrial Location’ (Barloon).” *Land Economics* 41, no. 2 (1965): 180-82, doi:10.2307/3144274.

19 Frittelli, John. “Shipping Under the Jones Act: Legislative and Regulatory Background,” *Congressional Research Service*, 28. May 17, 2019. <https://fas.org/sgp/crs/misc/R45725.pdf> (Accessed on September 1, 2019).

20 Frittelli, Shipping under the Jone Act, 35.

21 Markey, David, “Modern Piracy,” *ABC-CLIO*, 2011. 156.

22 “Waterman Steamship Corporation, Petitioner-Appellee, v. Commissioner of Internal Revenue, Respondent-Appellant, 430 F.2d 1185 (5th Cir. 1970).” <https://law.justia.com/cases/federal/appellate-courts/F2/430/1185/463249/>(Accessed July 5, 2019).

shares of his trucking company and used the six million dollars to buy Pan-Atlantic on the same day.²³ Within a month after the transaction went public, seven railroad companies sued McLean to stop him from starting a new sea-trailer service. However, the complaint against McLean was dismissed.²⁴ Three months later, McLean bought the Waterman Corporation, one of the largest shipping companies with more than 120 ships. Surprisingly, Waterman was so conservatively managed that it held a cash reserve of \$25 million, while the company's entire market value was only \$20 million. After taking over as the chairman of Waterman's board of directors, McLean announced that the company had sent the *Ideal X* and the *Almena*, two World War II tankers, to Bethlehem Steel shipyard in Baltimore as a trial extension to sea-trailer service.

On April 26, 1956, Pan-Atlantic Steamship Corporation launched a new 524-foot-long tanker named *Ideal X* with metal platform installed.²⁵ McLean changed his original idea of ro-ro ships, and instead of using conventional truck trailers, he used reinforced trailer boxes separated from their wheels and undercarriage. Those containers were lifted off to ships through crane at a rate of seven minutes per container. It took just eight hours to load 58 containers on *Ideal X*, and the ship had its maiden voyage from Newark, New Jersey port to Houston on the same day. The dimensions of container boxes were thirty-three feet long, eight feet wide and six feet high because that was the maximum size of a container truck trailer could carry. After realizing the advantage of container shipping over conventional shipping, the Waterman Corporation's main focus shifted and aimed to improve the technology for more efficiency. Before the launch of *Ideal X*, Waterman Corporation needed to make sure all the new technology was safe and efficient before they could reveal it to the public. The president of Waterman contacted the Brown Trailer Company to order container boxes. Brown Trailer Company had built 200 reinforced aluminum boxes for military transportation purpose from the Pacific Northwest to Alaska. McLean was so impressed with the quality of the containers that he ordered 200 boxes with dimensions of 33-foot at \$2,800 apiece.²⁶ Keith Walto Tantlinger, the vice president of the engineering department at Brown Trailer Company, resigned at that company and became the vice president of the engineering department at Waterman and Pan-Atlantic. After having enough quality containers, Waterman started to try to lift containers onto the ships faster and safer. Instead of developing a new crane, Tantlinger and his team used Sun Shipbuilding's rotating cranes. They were readily available and cost half of the new cranes. Tantlinger designed

23 Ibid.

24 Donovan and Bonney, *The Box*, 45.

25 "The JoC: 175 Years of Change," *The Journal of Commerce* (April 27, 1956), https://www.joc.com/sites/default/files/joc_inc/history/p15.html (Accessed November 30, 2018).

26 Donovan and Bonney, *The Box*, 56.

and patented a new spreader to lift the boxes off the trucks. In a process which was known as "fitting," a steel apparatus claw grabbed the object from the top, and an electrical device locked the claws. This new invention made the loading cost drop from \$5.86 per ton to \$0.16 per ton.²⁷

From his early days in the business, McLean knew that even with the most advanced and futuristic equipment, a corporation could not survive without enough customers. He recruited new college graduates to promote his company, and they suggested the customers ship their overland freight by his company's ships. At first, most customers were anxious to put their cargo on ships because they wanted to see the results of the Ideal X experiment before making up their mind. After several months of the successful launch of Ideal X, Pan-Atlantic operated three more converted tankers, the Almena, Maxton, and Coalinga Hills. This new shipping method allowed McLean to cut the freight prices. Within the first two years, Pan-Atlantic moved more than 67,000 tons of containerized freight.²⁸ McLean's company continued to expand his domestic trade after he moved the headquarters from Mobile, Alabama to New Jersey in 1962. Furthermore, he started shipping service from Seattle to Alaska. A decade after launching Ideal X and establishing a firm foot in the domestic market, McLean bid for military shipping through Sea-Land, an unsubsidized U.S.-flag carrier, which allowed him to take his ships overseas. Through Sea-Land, McLean won the two most crucial contracts with the Army for about \$82.5 million, which gave him sufficient financial support to carry out the experiment with containers and to gain the overseas market.²⁹

As the demand for containerization increased, several other companies like Matson and the federal US Liners adopted this technology, but they used different sizes of containers, which created a problem at the international ports. In 1961, the Federal Maritime Board and American Standard Association established 10, 20, 30, and 40 feet as the standard length with the fixed height and width of eight feet for each container. The International Organization for Standardization adopted the ASA standards in late 1968. Along with standard containers, other specialized containers like "high-cube" boxes of nine feet six inches high and 53-foot high were introduced in 1991 to the shipping routes between the U.S. mainland and Puerto Rico.

Many countries did in-depth research on the flexibility, cost, and benefits of containerization before funding port facilities for containers. For instance, the British government conducted an in-depth analytical study of container

27 "The History of the Shipping Container," *Freightos*, <https://www.freightos.com/the-history-of-the-shipping-container> (Accessed November 24, 2018).

28 Donovan and Bonney, *The Box*, 63.

29 Marc Levinson, "The Box That Changed Asia and the World," *Forbes*, July 16, 2012, <https://www.forbes.com/global/2006/0313/030.html#732c4d4a4cd7> (Accessed December 1, 2018).

shipping in 1960. The consulting firm McKinsey & Company conducted a quantitative assessment from 1965 to 1972. The research indicated that productivity of the dock labor increased from 1.7 tons per hour to 30 tons per hour, and the insurance cost decreased from £0.24 per ton to £0.04 per ton after adopting the container technology.³⁰ Like the UK government, many countries waited for a couple of years to see the efficiency of new technology before making any change.

Containerization of shipping took a new turn in the late 1960s and early 1970s when big purpose-built container ships were under construction. This period was full of dramatic events in the transportation business. In 1968, the Federal Maritime Commission and the antitrust division of the Justice Department refused to approve the deal to charter U.S. Liners' container fleet to Sea-Land. To maintain a position in the market, Sea-Land needed more funds, and McLean turned to Reynolds Tobacco Company, a company based in the home city of McLean Trucking, Winston-Salem, N.C. R.J. Reynolds purchased the Sea-Land for \$530 million in cash and stock, and he employed McLean as the president with a five-year contract.³¹ McLean sold the company's shares at its peak price and received a total of \$160 million. With the money, Sea-Land was able to fund the SL-7 program, which bought eight ships for \$250 million. These SL-7 ships carried 2,000 TEUs (a measure of volume in units of twenty-foot long containers) at the speed of 33 knots. They were designed for the new market of time-sensitive cargos, and the first SL-7 was into service in October 1972. In 1973, the Yom Kippur War broke out, and Arabic members of OPEC took revenge on the United States (for supporting Israel in the war) by imposing an oil embargo on America. By mid-1974, the embargo caused the oil price to rise four times higher than that before the war. The SL-7 turned out to be a white elephant for the Sea-Land. In 1981, it had to sell few SL-7 ships to the U.S. Navy for \$268.4 million, less than two-thirds of the original price.³²

After the SL-7 program failed and the embargo ended, Sea-Land ordered 12 new D-9s diesel-powered container ships which helped the company reduce its fuel cost. At the same time, R.J. Reynolds (RJR) made internal changes such as reorganizing the financial management department of the company and centralizing the cash management system. McLean was not happy with all these changes. He did not want to develop his company in such a way.

30 Daniel M. Bernhofen, Zouheir El-Sahli, and Richard Kneller, "Estimating the Effects of the Container Revolution on World Trade," *Journal of International Economics* 98, (February 2012): 36-50, doi: 10.1016/j.jinteco, 9.

31 Debbie Norton, "Reynolds to spin off Sea-Land," *Star News*, Feb 22, 1984. <http://news.google.com/newspapers?nid=1454&dat=19840222&id=PEhOAAAIAIBAJ&sjid=kBMEAAAIAIBAJ&pg=4837,6105106> sec 4B. (Accessed August 23, 2019).

32 Donovan and Bonney, *The Box*, 150.

Therefore, he resigned from the director position of RJR in 1977. A year later, after cashing out much of his RJR stock, McLean acquired U.S. Liners for \$160 million. However, the shipping industry had another shock in 1978 and 1979 due to a hike in oil price. Many experts, including McLean, predicted that the oil prices would go up to \$100 a barrel within the next few years. Instead of manufacturing the SL-7, a fast-paced container ship, he ordered container ships that would be comparatively low in speed but consume less oil and were supposed to sail around the globe, loading and unloading the cargo at ports along the way. These new ships were built to carry around 4,400 TEUs that was approximately 50 percent more than the conventional ships.³³ Due to the rise in fuel price, Sea-Land was still not able to use its existing SL-7 ships; however, like most corporations, Sea-Land changed its existing vessels to make them more fuel-efficient.

In June 1984, when the U.S. Liner's first Econship started its service, the company received the worst news. A conflict among the OPEC members caused the price of oil to collapse suddenly, and instead of raising from \$30 to \$50 per barrel, the price dropped to nearly \$10 per barrel. This caused massive damage to the U.S. Liners' plan. The company lost its Middle East shipment service because of the collapsed oil market, and the slow fuel economic ships did not help the company at all to gain the market share. After losing \$3.5 million in the first quarter of 1985, the company lost \$15.3 million, \$43.6 million, \$71.2 million, \$62 million, and \$77.4 million respectively in the next five quarters. U.S. Liners did not survive long enough. It filed for bankruptcy protection on November 24, 1986.³⁴ Later, Sea-Land made a low and profitable bid for the 12 Econships of U.S. Liners, and after some structural changes, the ships began to operate in 1988.

McLean made no excuse for the failure of U.S. Liner. Many factors worked behind the container industry, and failure of one factor could break the whole empire. Despite the giant failure, five years later McLean founded a new company named Trailer Bridge which served between cities of the U.S. mainland and Puerto Rico by operating 53-foot roll-on, roll-off trailer barges. McLean was the sole owner of all three companies: McLean Trucking, Sea-Land, and Trailer Bridge. All of them were listed on the New York Stock Exchange. Although McLean lost the leading position in the container revolution, his idea sparked a revolution which completely changed the world.

Impact of Containerization

After World War II, there was tremendous growth in world trade, and containerized shipping played an important role in promoting this aspect of

33 Donovan and Bonney, *The Box*, 154.

34 *Ibid.*161.

globalization.³⁵ In the past half-century, container shipping has turned into a mature global transportation industry. International shipping is responsible for 90% of the world trade carriage.³⁶ A study shows that from 1990 to 2008, the container traffic grew continuously at an average rate of 9.5%.³⁷ As per 2018 reports, APM-Maersk is the world's largest container shipping company based in Denmark with more than 600 ships in service and a fleet of more than four million TEUs.³⁸ International trade enhanced by container revolution has played a key role in the second wave of globalization and the fast development of the world economy in the past few decades. Globally, the container shipping industry generated more than \$436.3 billion in revenue and provided 13.5 million jobs in 2007.³⁹

Despite the positive change to the world economy, the containerization of shipping also had negative effects. First, some workers lost their jobs. The American Association of Port Authorities stated that labor cost accounted for half of the cost of the shipping from Chicago to Nancy, France. However, with the introduction of machinery, the labor cost per unit decreased by half, along with the time spent in ports and the money spent on insurance for cargo.⁴⁰

This rapid development created a substantial challenge to port labor. Laborers opposed this change because they saw the threat of losing their jobs, and it had shifted the power away from longshoremen. To maintain the influence over the ports and new dockside equipment, longshoremen preserved their work by imposing new rules on container packaging. In 1960, the International Longshore and Warehouse Union and the PMA signed the Mechanization and Modernization Agreement. According to the M&M agreement, the employer would subsidize the laborers who either retired early or were replaced by machines.⁴¹ In 1971, a 134-day strike on the West Coast was the last attempt by longshoremen union to oppose the container

35 "The Humble Hero," *The Economist*, May 18, 2013. <https://www.economist.com/finance-and-economics/2013/05/18/the-humble-hero>. (Accessed Jul 23, 2019).

36 "Shipping and World Trade," *International Chamber of Shipping*, <http://www.ics-shipping.org/shipping-facts/shipping-and-world-trade> (Accessed May 31, 2019).

37 "World Container Traffic and Throughput, 1980-2015 (Millions of TEU)," *The Geography of Transport Systems*, https://transportgeography.org/?page_id=2629 (Accessed on Nov 15, 2017).

38 "Total TEUs of Leading Container Ship Operators in 2018," *Statista*, <https://www.statista.com/statistics/198214/total-teus-of-worldwide-leading-container-ship-operators-in-2011/> (Accessed Dec 1, 2018).

39 "Valuation of the Liner Shipping Industry," *world shipping council* (December 2009). http://www.worldshipping.org/pdf/Liner_Industry_Valuation_Study.pdf (Accessed Aug, 2019).

40 Daniel M. Bernhofen, Zouheir El-Sahli, and Richard Knelle, "Estimating the Effects of the Container Revolution on World Trade," *Journal of International Economics* 98, (February 2012): 36-50, doi: 10.1016/j.jinteco, 36.

41 Donovan and Bonney, *The Box*, 88.

revolution. They demanded all the containers except those packed by the shippers to be packed and unpacked by the longshoremen instead of the manufacturer. Even though mechanization took away many jobs, however, the increased workload at the ports provided highly paid skilled jobs like crane operators, engineers, port managers, and marine pilots.⁴²

The second bad effect was pollution. With the advancement in shipping technology, the volume of the ships in the ocean increased. According to one study in 2012, the total shipping industry accounted for 961 million tons of CO₂. In addition to air pollution, container ships were also accused of damaging marine life through noise, waste-dumping, and oil spillage in ecologically sensitive locations. The data from the maritime industry insider suggests that fifteen biggest ships in the world can emit as much as 760 million cars.⁴³ The data is based on the size of the engine and quality of fuel used in container ships. However, companies like Rolls Royce are presenting their prototypes of future container ships which will run on electricity.⁴⁴

After the terrorist attack on September 11, 2001, containerization gained massive attention of the press. Many containers entered the US ports without being inspected, raising nationwide concerns. Containers provided a safe medium for people to smuggle illegal stuff into America. It was common for human traffickers to use container boxes.⁴⁵ However, several initiatives have been taken over the past few years. Cargo shippers are required to transfer the data of the shipment in advance to be analyzed. U.S. Customs and Border Protection introduced the Customs-Trade Partnership Against Terrorism [CTPAT] to fight against the security threat. CTPAT participants agreed to adopt tighter security standards at their ports and reduce the inspection delay at U.S. customs.⁴⁶

42 Daniel Stoker, "Working in Ports," <https://www.imarest.org/membership/education-careers/careers-in-the-marine-profession/how-about-working-in-ports> (Accessed Nov 30, 2018).

43 John Vidal, "Health Risks of Shipping Pollution Have Been 'Underestimated,'" *The Guardian*, April 9, 2009, <https://www.theguardian.com/environment/2009/apr/09/shipping-pollution> (Accessed Nov 30, 2018).

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Conclusion

Malcom P. McLean died in 2001. He was named “Man of the Century” by the International Maritime Hall of Fame for his innovative ideas, but his contribution is little known by the public.⁴⁷ McLean never claimed the invention of containerization, but he was proud of introducing container ships. McLean was always on the hunt for new opportunities to make a profit. When he ran a trucking company, he hired hundreds of veterans as owner-drivers who could benefit from GI bills to fund his company. Later he made use of government’s surplus ships to save himself from large capital investment in expanding his business. McLean was wise enough to place all his companies at right spots where he could take advantage of government subsidies. He used his unsubsidized SeaLand Company to compete with other non-US-flag liners and international shipping corporations. Although shipping containers such as Conex boxes in the military, Sea Train in 1929, and Higgin box in 1945, existed before containerization, none of these systems was well developed or coordinated to explore their real potential as McLean did.⁴⁸

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