REVIEW --- The Megaships That Broke Global Trade --- With a new generation of giant container ships, firms and governments made a big bet on the future of globalization -- and lost.

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FULL TEXT

On August 16, 2006, five tugboats dragged Emma Maersk from a Danish shipyard and towed her backward to the sea. The length of four soccer fields, her keel nearly a hundred feet below her deck, Emma was far larger than any container ship ever before ordered and by far the most expensive. ***[Complexity]*** She was a bet on globalization: ***[Emergence]*** By transporting a container more cheaply than any other vessel afloat, she and her six sister ships were expected to stimulate even faster growth ***[Evolution and Adaptation]*** in international trade, lowering the cost of moving goods through the supply chains ***[Networks]*** that had reshaped the global economy and turned China into the world's workshop.

The opposite occurred. ***[Nonlinear Dynamics]*** Though supremely efficient at sea, Emma and the even larger ships that followed in her wake became a nightmare. By making freight transportation slower and less reliable than it had been decades earlier, they helped to stifle the globalization of manufacturing well before Brexit, Donald Trump and Covid-19 came along.

Container ships are the workhorses of globalization. Operating on regular schedules -- such that an identical vessel departs Shanghai every Wednesday, stops in Singapore nine days later and arrives in Antwerp five weeks hence, with tight connections to barges and freight trains -- intermodal container transport gave manufacturers and retailers the confidence to plan tightly organized long-distance supply chains. ***[Networks]*** Before Emma, each new generation of ships since the dawn of the container age in 1956 had been slightly larger than the one before. ***[Evolution and Adaptation]*** The rationale was straightforward: On a per-container basis, a larger vessel cost less to build and operate than a smaller one, allowing the owner to undercut competitors' cargo rates and still earn a healthy profit. ***[Systems Theory]***

Their size was expected to give Emma and her sister ships an immense cost advantage on the most important route in shipping, the roughly 14,000-mile haul between China and northern Europe. Maersk forecast in 2006 that a global trade boom would double the demand for container shipping by 2016. ***[Pattern Formation]*** Its concern was having enough ships to handle all that cargo.

The major ship lines, almost all of which were state run or family controlled, felt compelled to follow Maersk's lead. ***[Collective Behavior]*** Megaship mania took hold, and orders for ships even larger than Emma flooded Asian shipyards. With the help of low interest rates and generous shipbuilding subsidies from the Chinese and South Korean governments, ships were to be had for far less than the true cost of building them. ***[Complex Systems May Be Open]*** But the expected trade boom never occurred. Instead, international trade collapsed amid the financial crisis in 2008-09, and when it picked up again, its growth was far weaker than before. In the decade before the crisis, trade had expanded by 78%. In the decade after 2008, it increased less than half as much. Merchandise trade -- exports plus imports -- came to 51% of the world's economic output in 2008, but hasn't reached that share again. ***[Complex Systems May Exhibit Strong Transitions]***

By the early 2010s, there simply weren't enough container loads to fill all the new capacity. Had the U.S. imported as much in 2016 as it did in 2011, relative to GDP, an additional half-trillion dollars of imports would have entered the country in a single year. The trade slump wiped out the cost advantages of larger vessels. ***[Relationships Contain Feedback Loops]*** Freight rates fell so low that revenue didn't cover operating costs, flooding the oceans with red ink. Some carriers folded. Others found merger partners. The survivors sought shelter in alliances with competitors, in hopes that several ship lines working together could generate sufficient cargo to fill their ships. ***[Game Theory]***

The megaships themselves, though, played a role in slowing the growth of trade. ***[Dynamic Network of Multiplicity]*** As ship lines trimmed capacity by anchoring vessels and canceling services, a box filled with time-sensitive merchandise might have to sit longer at the port before it could be loaded aboard ship. Discharging and reloading the vessel took longer as well, and not only because there were more boxes to put off and on. The new ships were much wider than their predecessors, so each of the giant shoreside cranes needed to reach a greater distance before picking up an inbound container and bringing it to the wharf, adding seconds to the average time required to move each box. Thousands more boxes multiplied by more handling time per box could add hours, or even days, to the average port call. Delays were legion. ***[Cascading Results]***

Once, container ships would have been able to make up those delays en route. ***[Evolution and Adaptation]*** But that was, and is, no longer possible. To save fuel and reduce greenhouse gas emissions, recent generations of vessels are uniformly designed to steam more slowly than their predecessors. Instead of 24 or 25 knots, they travel at 17 or 18, adding several days to a long ocean voyage. ***[Complex Systems May Be Open]*** And where earlier ships were able to speed up if required to get back on schedule, the megaships cannot. By 2018, 30% of the ships leaving China departed late.

The land side of international logistics was scrambled as well. ***[Complex Systems May Be Nested]*** At the ports, it was feast or famine: ***[Nonlinear Dynamics]*** Fewer vessels called,

but each one moved more boxes off and on, leaving equipment and infrastructure either unused or overwhelmed. ***[Systems Theory]*** Mountains of boxes stuffed with imports and exports filled the patios at container terminals. The higher the stacks grew, the longer it took the stacker cranes to locate a particular box, remove it from the stack and place it aboard the transporter that would take it to be loaded aboard ship or to the rail yard or truck terminal for delivery to a customer. ***[Relationships Contain Feedback Loops]***

Freight railroads staggered under the heavy flow of boxes into and out of the ports. ***[Cascading Results]*** Where once an entire shipload of imports might be on its way to inland destinations within a day, now it could take two or three. Queues of diesel-belching trucks lined up at terminal gates, drivers unable to collect their loads because the ship lines had too few chassis on which to haul the arriving containers. And often enough, the partners in one of the four alliances that came to dominate ocean shipping didn't use the same terminal in a particular port, requiring expensive truck trips just to transfer boxes from an inbound ship at one terminal to an outbound ship at another. ***[Relationships Contain Feedback Loops]***

Today, much of the world's trade moves in vessels far larger even than Emma Maersk, each able to carry more freight than 10,000 full-size trucks. ***[Evolution and Adaptation]*** After a prolonged rate war, consolidation has finally allowed the carriers to push up cargo rates by idling ships, but hidden costs have soared. ***[Game Theory]*** Governments have picked up many of those costs, subsidizing international trade by funding higher bridges, deeper harbors, stronger wharves and larger cranes to accommodate megaships, as well as the vessels themselves. ***[Complex Systems May Be Open]***

Shippers have borne a considerable burden as well. ***[Emergence]*** To reduce the risk that goods won't arrive on time, businesses are keeping more inventory, shipping via multiple routings and producing in multiple factories rather than in giant sole-source plants. ***[Systems Theory]*** Such measures, reversing a decades-long focus on minimizing production, transportation and inventory costs, don't flatter the bottom line. With proper accounting, the globalization of manufacturers' supply chains no longer seems such a bargain, regardless of whether populists and pandemics are raging.