How technology is reshaping trade

Trade has always been shaped by technology. Robert Atkinson examines how digital technologies are transforming goods and services production

Trade has always been shaped by technology. As technology improved shipping and logistics, trade became cheaper and more extensive. As technology enabled production to be more sophisticated, minimum efficient size of factories got larger, and that meant companies needed to sell to broader markets. Today is no different. New technology developments has the potential to reshape trade patterns, potentially in unexpected ways.

Some, like the rise of digital goods and services promise to expand trade. Others, such as the emergence of what some call 'industry 4.0' (the integration of digital technologies into the production of goods) might actually reduce trade by making it more economical to produce more locally.

Let's start with the fact that if everything was easy to produce and with few economies of scale effects, there'd be little trade, just as there was before the first industrial revolution in Great Britain. At the most extreme level of this, every city would be self-sufficient. It would be like living on the Starship enterprise with everything coming from the replicator: *"tea, Earl Grey, hot."*

But for most industries technology went in the other direction, with massive scale effects and specialization. Consider that 92 percent of the world's most-sophisticated semiconductors (those made at process nodes 10 nanometers (nm) or below) are manufactured on the island of Taiwan (and the remaining 8 percent in South Korea).

These are exported around the world, not just because their value to weight ratio is so high, but because there are few if any companies in other parts of the world that can even make them. Consider also that each segment of the global semiconductor value chain has, on average, enterprises from 25 countries involved directly, and enterprises from 23 countries in support functions.

Likewise, if automation was extremely high there would be less globalization, given how a significant share of global trade is based upon wage arbitrage, with production of lower-skill manufacturing goods often moving from high-wage to low-wage nations.

It makes economic sense for companies do this if the production process requires a significant amount of lower to mid-skilled labour. But if automation technologies improve so that companies are able to replace even more labour with machines, the advantage of producing in a low-wage nation and paying to ship the product long distances is reduced.

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At the same time, if transportation costs are very low there would be much more trade. Indeed, the rise of the container ship and cargo containers, coupled with electronic data interchange, lowered shipping and logistic costs, leading to an expansion of global trade.

Going forward, the increase in the share of the economy that is digital—and able to be moved around the globe instantaneously and at almost no cost—is growing. This will mean an increase in the share of the economy that is traded.

Case in point, in the old days when one used a bank, all the revenue stayed in the local community and the country. Now with the rise of fintech and online banking, people can bank in cyberspace, turning what was once a local-serving industry into a globally traded one.

When it comes to recent trends, the pattern is on the side of trade contraction. As the McKinsey Global Institute points out, total exports as share of GDP has fallen. Trade is still growing but the share of output moving across borders fell from 28.1 percent in 2007 to 22.5 percent in 2017.

Some of this may be due to technology forces, some to broad economic ones and still others to political ones as more and more countries focus on localization barriers to trade. It's not clear what the future trends will be.

One factor that could continue this trend is the potential increase in automation and robots. To the extent that relative factor endowments determine the international division of labour and trade, the use of robots and other automation technologies could alter the location of manufacturing of particular sorts of goods by altering their relative factor intensities.

Assuming that low-skilled human labour and the use of robots are close substitutes and that robots controlled by high-skilled workers could perform, for example, clothing production and electronics assembly more efficiently than low skilled workers, then these activities become relatively more skill- and capital-intensive.

Doing so would allow countries with a low ratio of low-skilled to high-skilled workers to reduce their labour-cost disadvantage and make labour-intensive manufacturing more competitive. This is because the rate of return of robots and other automation technology is inversely related to the cost of labour: the more expensive the labour, the more likely a firm is likely to automate.

Now instead of a company sourcing production for the North American market in a country like China or Thailand with significantly lower labour costs, the use of more advanced automation technology could make such production in the United States more cost competitive.

The result would be a decentralization of production with more production being located in the markets it is intended to serve. This could at least be true in sectors where economies of scale and minimum factory sizes are not enormous and where there is some interchangeability of products in the marketplace.

For example, imagine that robotics improve and can cost-effectively play a key role in assembling athletic shoes. With these technologies, shoe manufacturers could find it cost effective to produce shoes in high wage nations.

Couple that with the fact that such automated production if it uses flexible automation technologies could enable more customization of products, at the same cost as mass production processes using low-cost labour.

To date industrial robots have primarily been deployed in the automotive, electrical and electronics industries. By contrast, in many labour-intensive industries, such as garment-making, widespread automation is not yet suitable.

But robotics and automation technology is improving, in part enabled by better software, including artificial intelligence, so the potential for the 'robotization' of more industries is certainly possible.

Such effects may be reinforced by combining robotization with other new automation technologies, such as three-dimensional (3D) printing. The latter lowers the costs of prototyping and small volume production and could facilitate the initiation of manufacturing of new products, whose large-scale production could become economically feasible through the deployment of robots.

Indeed, additive manufacturing is becoming more common for product prototyping and some mass production, including by Ford, GE Aviation, Nike, Under Armour, and Siemens.

Some studies have predicted that once high-speed 3D-printing is mass-adopted and cheap enough, global trade may decrease by as much as 25 percent, since 3D-printing locally can substitute for more centralized production that is shipped widely across the globe.

But while 3-D printing requires less labour and reduces the need for imports and is likely to grow in importance, given the complexity of most production and the inherent limitations of additive manufacturing, it's unlikely that it will be game-changing.

But for all the talk—some might even say hype—about robots, AI and automation, it's not clear just how capable automation technology will become in the next decade.

In other words, current manufacturing systems largely enable either high-volume, low-mix output (eg. producing large quantities of the same unit; mass production) or low-volume, high-mix output (eg. producing smaller quantities of different units; batch production). The latter are often located in lower-wage nations.

But convergence of digital technologies and manufacturing increasingly enables a new production paradigm: a high-volume, high-mix approach that will enable cost-efficient production in smaller factories more evenly distributed around the globe to serve local markets.

Indeed, Rauch, Dallasega, and Matt have argued that these emerging technologies will enable more decentralized and geographically dispersed manufacturing systems. This could enable more reshoring of work now located in lower wage developing nations.

While increased and improved automation technologies could reverse the decades-long trend in offshoring of production from high-wage countries to low wage, it's not clear what the impact of digital trade—the cross-border transfer of products, services, and data over the internet—will be.

As Microsoft CEO Satya Nadella stated, we saw two years of digital transformation in 2 months. The development and now widespread use of easy-to-use network technologies like video conferencing, cloud computing, and online work management systems means companies will be even more able to and willing to distribute work geographically, including across borders.

Firms and customers can use their personal devices and the internet to find and access digital goods (like music and software) and services (like cloud storage and data analytics services), many of which complement trade in physical things (whether manufacturing or e-commerce packages).

Digital technologies have changed trade, especially by lowering costs and enabling trade. Despite the popular misconception that data flows only benefit search engines and social networks, the reality is that most industries rely on cross-border data flows.

Digital technologies and data flows are particularly critical to the automotive and transport sector. As Swedish commercial vehicle manufacturer Scania's Hakan Schildt told the *Financial Times* in 2018, *"[T]ransport is becoming a data business."*

As connected devices, data-driven insights, and advancements in AI accelerate innovation in this sector, the ability to exchange data is crucial to improving the quality and safety of vehicles and transportation systems.

In addition, health research is increasingly an international endeavour that depends on the aggregation and sharing of personal data. The ability to transfer and share health data maximizes the potential for individual researchers and life sciences firms—regardless of location—to advance scientific knowledge.

Estimating the value of transatlantic data flows and digital trade is challenging. For example, approximating value by the aggregate volume of data transfers has significant limitations. The value of data depends on its content. Some data flows may be non-monetized—representing intra-company transfers that are commercially valuable, but not captured in a formal transaction.

While precise, comprehensive, and consistent measurement of the value of data and digital trade in and between the United States and EU is not yet possible, there are a range of estimates that support what we know anecdotally—that data and digital trade represent an important and fast-growing part of the global economy.

In August 2020, the US Department of Commerce's report *New Digital Economy Estimates* calculated that the digital economy accounted for 9 percent of US GDP in 2018. Traditional trade statistics capture some of the EU-US digital trade relationship, but not all.

The US Department of Commerce's ICT and potential-ICT based digital trade data provides the broadest, and most recent, estimate of transatlantic digital trade, which in total, was worth $295 billion in 2018.

Data flows and digital products and services should be able to flow seamlessly across borders to firms and consumers situated throughout the world. Yet, countries are enacting a growing range of artificial barriers to global digital trade, including regulations on data, intellectual property, and digital platforms, to name just a few. The problem is that international trade rules have not kept pace with technological innovation to ensure these changes are used in this way.

To fully maximize the potential of free global digital trade, the world's leading digital economies need to put in place rules to protect it. Some 71 countries are trying to do this at e-commerce negotiations at the World Trade Organization.

Setting new rules on digital trade will not be easy, but there is a way forward. The United States, Japan, and their partners need to realize that they all share more in common than some of the political and trade tensions suggest and that they all stand to benefit from a deal. This most definitely applies to the EU, who is sadly absent in many digital trade debates.

The growing number of barriers that have been enacted in the last few years show that the alternative—a global internet and digital economy that is fragmented behind digital trade barriers—is a real and dangerous prospect

that will become a near certainty if the world's leading countries can't come together to put in place new, high-standard digital trade rules covering data flows.

In summary, since the emergence of the first industrial revolution, technology has changed trade patterns and flows. Today is no different as digital technologies transform both goods and services production. ■

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