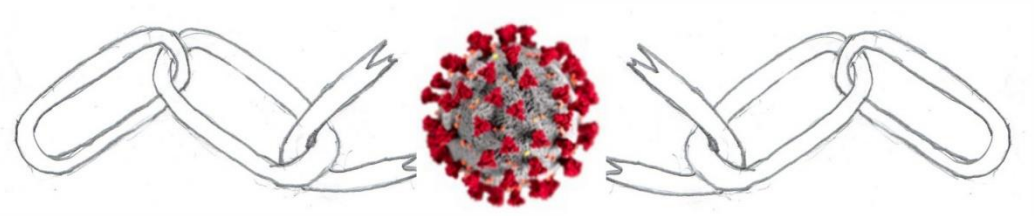
Did Covid19 Break Your Supply Chain?



Is it time for Supply Networks instead of Supply Chains?

Dr. Peter Green

Introduction

As many organizations are finding, their supply chains are only as strong as their weakest links. Whether the products they need, or precursor products that their suppliers need, are dependent on supply chains that flow through Wuhan or Lombardy, manufacturers and distributors are effectively shut down.

We have built a whole "science" of "Lean" supply chain management with the objective of getting products as cheaply as possible while carrying as few products as possible in inventory. This has led to Global supply chains that have proved extremely fragile in face of issues like the Covid19 epidemic.

As one fairly reputable source put it "The last boat from China arrived at the Port of Los Angeles last week." While this may not be strictly true, the dramatic drop in traffic through this port means that a critical element in many organization's supply-chain, namely manufacturing plants in China, is broken.

Also, the millions of people being laid-off in hospitality and travel due to the virus, and millions more will be furloughed in manufacturing and distribution due to the lack of supplies. This will result in demand-shock, which will result in many organizations being almost, or completely shut down.

In this white paper, we examine the alternative to "Supply Chains", which is "Supply Networks" and how these might work from technology viewpoint to prevent the types of disruption to supply chains that we are now starting to see with Covid19.

Networks

I recently "binge-watched" 3 hours of a documentary on PBS by Dr. Niall Ferguson called "Networld". It is about human networks and how technologies such as the printing press and the Internet have enabled these networks to flourish, for better and for worse. This is also available on Amazon Prime and Niall wrote a book "The Square and the Tower" which covers the same subject in more detail..

Niall is one of my favorite authors on economic history. He wrote his Ph.D. thesis on the last great collapse in global supply chains in 1914, with the outbreak of World War I.

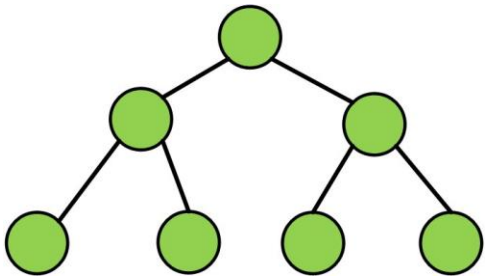
According to Niall the last time, but not the first time, we had a collapse in global supply chains was just after globalization reached a maximum in 1913. Now it looks like we are going to have another collapse in Global supply chains.

One of the things that struck me about Networld was how robust networks are. Which made me think about supply chains and only being as strong as their weakest links. Networks, in contrast are self-repairing and amazingly redundant. Knock out one node and another takes its place, quickly and with minimal disruption.

Some examples of robust networks include:

1. GM that was making Chevy cars in one of its plants, then switched almost overnight to making tanks in World War II, and now is switching to making hospital ventilators. Presumably different components for the ventilators will now be produced by its same supplier network, or if they cannot deliver, by alternate suppliers.
2. Your brain. People have sustained major brain injuries and yet been able to continue with pretty normal lives.
3. Al-Qaeda – a terrorist organization that is proving to be very difficult to destroy because it is organized as a loose-knit collection of cells rather than using a top-down command hierarchy that is easy to eliminate.

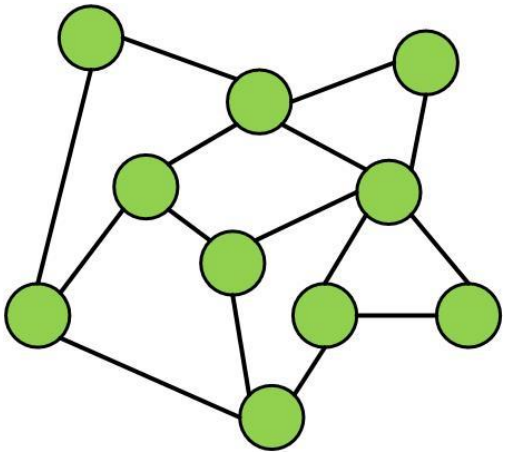
So, what has this got to do with supply chains?



Supply Networks versus Chains

A typical supply chain to make a product looks like a tree, as shown at right, with cascading BOMs (Bills of Materials) through multiple suppliers. Break any one node and product manufacturing fails.

In a network, by contrast, materials flow from node-to-node depending on the availability of materials (raw, intermediate, and finished products) at each node (manufacturing plant, warehouse, or distribution center) according to availability of materials and the ability to process and ship those materials.



Such a supply network has tremendous redundancy. Some material flows may include a certain node but avoid other nodes because of capacity, available materials, or other constraints (such as shutdown or lack of medically fit workers).

To take a simple example, you make a product that contains a special bracket. The cheapest source for this bracket previously was a company in the USA that sold such brackets and assembled them from sheet steel using self-tapping metal screws. Because this was a special-order item, for your

product, the brackets were made to order, with a typical delivery time of a few days.

But, when this supplier runs out of self-tapping screws and is unable to substitute nuts bolts and washers, because they came from the same factory in Wuhan, your supply chain is broken.

Now, let's look at the supply network approach. You have three or more, possible suppliers of the bracket. One is your existing supplier, one can make the bracket out of welded steel, and one can make the bracket using 3D printing.

Now, if you need 100 brackets, for a production job next Tuesday, you can inquire from your suppliers what they can deliver by that date and at what price. The first supplier replies that they have enough components in stock to deliver 76 brackets at $1.25 each. The next supplier states that they can deliver 20 brackets at $5 each (due to time constraints) and the third supplier responds that they can deliver 20 brackets at $10 each (due to equipment constraints).

You now have a supply network that is robust. You can order 76 brackets from the first supplier 20 from the second and 4 from the third. If the first supplier suddenly calls up and says they can only supply 72 brackets, because they did not have as many self-tapping screws in stock as they thought they had, then you can ask your third supplier make more.

I realize that this is a simplistic example and that good supply chain managers have been doing something like this all along. But, by thinking in terms of supply networks rather than supply chains, we have built redundancy into our manufacturing or distribution process.

The good news is that supply networks will enable you to have a much more robust delivery network but the bad news is that, in general, there will be an increase the cost of your products over waiting for the lowest cost supplier to deliver needed products into your supply chain.

Also, it implies that everyone in the manufacturing supply chain has to adopt rapid-response, make-to order, processes so they can respond to demand from other nodes in the supply network for goods (and possibly services) on short notice.

Commentary

We have seen the fallacy of trying to buffer against demand-shock with buffer stocks in warehouses, when all the major supermarket chains ran out of toilet paper. Wal-Mart had enough toilet paper in their supply chain for 4 weeks and a supply chain that, under normal circumstances, took 4 weeks to replenish this (using Lean just-in-time manufacturing practices).

As a result, I conclude that people were not irrational in stocking up on toilet paper as they knew (maybe intuitively, maybe from leaked information) that, once gone, the toilet paper would not be replenished for 4 weeks, so they needed to horde enough for 4 weeks, at least.

The good news is that people naturally form local supply networks. We have a friend who works in a local hospital and ran out of toilet paper. We were able to give her some of our buffer stock to tide her over until organizations like Kimberly Clark ramp up their manufacturing to replenish their customers' supply chains.

I believe that the probable outcome of the Covid19 virus is the replacement of long supply chains stretching into China and elsewhere with much more local, in country, supply networks.

I believe that we will see an acceleration of the decoupling from China as a source of supply and much more reliance on manufacturers in the USA, Canada, and northern Mexico. There will also be a dramatic reduction in demand for products as their cost increases relative to the income of average people.

As Tom Friedman stated in his 1999 book "The Lexus and the Olive Tree: Understanding Globalization", we are about to see another dramatic swing from the Lexus to the Olive Tree, from a global focus to a local focus, just like we did in 1914, but hopefully not with a world war.

Will this be better or worse? Neither, but it will be different, with far more emphasis on the local needs of people and far less on the needs of globe spanning corporations.

Will Globalization, with a capital G end? As a manufacturing and distribution philosophy, probably yes. Global supply networks will continue to exist but with fewer links between clusters of local in-country nodes both in the USA, China and elsewhere.

There will still be things that China is really good at making that we need in the USA and vice-versa. But the days of knee-jerk reactions, such as "we should move production to China because they can make our product for 10 cents less" are over.

My personal belief is that the powerhouse global supply-network for the second half of the 21st century will be between the USA, Canada, UK, Australia, New Zealand, and India. These nations have a shared heritage, strong common security relationships, speak a common language, and have ever strengthening trade relationships. They also have demographics on their side, as opposed to China, Japan and the EU which have rapidly declining populations.

What does this imply for technology? Supply-networks imply the need to communicate information about demand and supply in real-time, across the network. We also need to be able to track the flow of materials across our supply networks, quickly and efficiently, so we can react quickly to changes and disruptions.

It is no longer sufficient to do materials planning based on an assumed one-week delivery from our supplier of my brackets. We now need visibility of each of our supplier's supply networks and their capacity to deliver. We also need to enable distributed decision making by the many actors in our distributed supply-networks.

The important technologies in all of this will probably be:

- Cloud-computing and distributed networking.
- License-plate-number LPN container tracking to track materials in the supply chain at many different geographic locations, including materials in transit.
- Mobile computing and the use of GS1 standard barcodes for tracking materials.
- Real-time distributed Artificial Intelligence to assist materials managers with supply-network decision making.
- Development of standard information exchange protocols, such as EPCIS, that enable each node in the network to keep other nodes informed about their delivery capabilities.

Not for the first time in history, we are entering a challenging and exciting time. It is noteworthy that the Chinese symbol for Crisis consist of the symbols for Danger and Opportunity.

As a result of the Covid19 variant of the Coronavirus we will be probably see an increase in in-country manufacturing of products used in the USA and much less coming from elsewhere. But we will also see a drop in overall demand. That is, unless we are unfortunate enough to engage in a foreign war, which will be much less likely because we will be much less dependent on other countries to supply or purchase materials that we need or produce.

Author

This paper was written by Dr. Peter Green, who currently serves as the Technical Director of KnarrTek Inc. and Milramco LLC. Dr Green obtained his BSEE and PH.D. Degrees from Leeds University in England. Subsequently Dr. Green was a senior member of technical staff at MIT and a Professor of computer engineering at WPI. Dr Green is an expert in materials tracking within the industrial, medical, and construction supply chains. He is also an expert in using real-time Artificial Intelligence to assist mangers with operational decision-making in industrial organizations.

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