

Supply chains: reduce the bullwhip effect and increase visibility

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The bullwhip effect is an extreme change in supply availability in a supply chain generated by a small change in demand, and is exacerbated when the supply network is global and contains hundreds of suppliers.

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The supply chain disruptions we are facing today did not start with the pandemic. Like so many other recent phenomena, the pandemic revealed the shortcomings and vulnerabilities of these complex systems. COVID-19, climate disasters, war and general labour shortages have contributed to these disruptions and there is no evidence that these circumstances will change any time soon. Therefore, new supply chain strategies are required to ensure Canadian economic stability.

Since the 1980's, the world's economy has transformed into a web of internationally integrated markets for the extraction, production, delivery, and consumption of industrial, commercial, and agricultural goods. Supply chains today are not chains at all but rather a series of networks. They resemble a complex web of relationships and dependencies rather than a straightforward linear chain. It is this complex network that has proven to be susceptible to disruptions and wide-spread variation. Supply chains have always had to manage a delicate balance between supply and demand. During the pandemic, both supply and demand exhibited unprecedented amounts of variation, which still exist today.

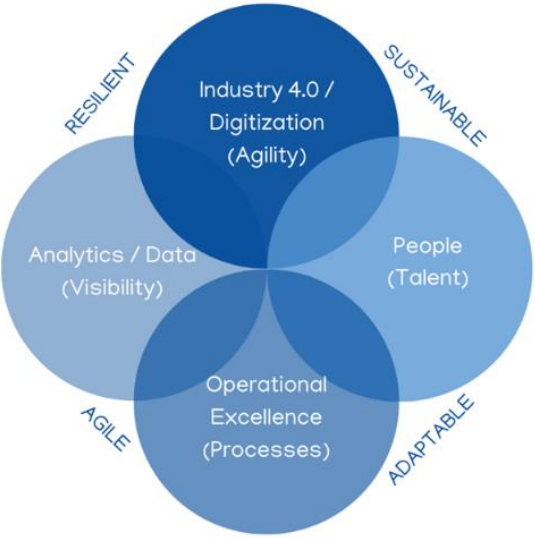
An example of the many disruptions is the worldwide shortage of semiconductors which in part caused by a massive surge in demand for laptops and other electronics needed for employees working from home, students learning online, plus a simultaneous increase in consumer electronics. At the same time, global lockdowns were causing labour shortages that forced chip manufacturing facilities to shut down, further reducing global chip supplies. Weather even played a part in this shortage as a severe draught in Taiwan impacted the water supply for chip production. According to a study conducted by AlixPartners, the global auto industry alone lost \$210 billion in revenue in 2021. The impact continues to effect business as the chipmaking giant Taiwan Semiconductor Manufacturing Co. announced a price increase of as much as 20% in 2022.

The results of this disruption can be understood by a phenomenon called the bullwhip effect. The bullwhip effect is described as an extreme change in supply availability in a supply chain generated by a small change in demand. This effect is exacerbated when the supply network is global and contains hundreds of suppliers. Now add a pandemic, labour shortages, extreme changes in demand and it sets up the perfect scenario for worldwide and long-lasting disruptions.

One way to improve supply chains and reduce the bullwhip effect is to improve **visibility** along the entire supply network. Supply networks require visibility to see and predict disruptions and shortages and be able to adapt in real time. Visibility can take many forms. Visibility could allow companies to see the inventory levels at all of the suppliers and warehouses across the entire supply network, to see the conditions in which resources are extracted and products are manufactured, and to see the exact location of cargo throughout the transportation process and to identify when they will arrive. Many industries, like automotive and retail, have spent decades and millions of dollars to improve this visibility using data sharing technologies like electronic data interchange, however this initiative is industry specific and costly to implement. Not all partners across the entire network can participate and benefit from this information. The other drawback is that on many occasions the data is only shared between the customer and the direct supplier. The hundreds of other suppliers involved in the network cannot see the impact of disruptions and variation both up or down the network.

Data is the currency of supply chains and data provides visibility. To envision a world with reliable and sustainable supply chains, data must be accessible, affordable, and trustworthy. Technologies such as blockchain, RFID, cloud services, and 5G are platforms that can increase visibility. However, these technologies are not accessible to all Canadian companies. These technologies are expensive, companies lack technical capabilities, data is behind paywalls and on private networks, and there aren't standards to define what data should be shared and in what format so that everyone can read and understand it. The Canadian government must provide the framework and incentives to treat supply chain data as a national commodity to be verified and shared so that all Canadian business can benefit from visibility. Not all supply chain data should be private. As an example, a small restaurant, with just 20 recipes and an ingredient list of 200 items was looking to calculate the greenhouse gas impact of the food contained their menu and received quotes for up to \$80,000 to access trustworthy data. For a small business trying to make sustainable supply chain decisions this cost is prohibitive.

Until we have a clear sightline of resource extraction, and the production, delivery, consumption, and recovery of goods, we cannot adapt to the ongoing disruptions that will continue. We cannot adapt to that to which we cannot see.





Stephen Thomson is the Director of the Centre for Supply Chain Innovation (CSCI) (formerly known as the Magna Centre for Supply Chain Excellence)@ Conestoga College. Prior to becoming the director of CSCI, Stephen was a 15 year veteran of the Supply Chain cluster of programs. Stephen has designed and taught courses at the diploma, degree, and post-graduate level program, specializing in data analytics, data visualization, and decision support modeling. Stephen is also the college's SAP faculty lead assisting programs integrate the topics of ERP systems, business processes, simulation games, and advanced analytics into curriculum.

Over the past three years, Stephen has been a primary investigator in applied research participating in multi-disciplinary teams focusing on projects related to the **Digital Secure Supply Chain**. Research topics have included projects related to logistics visualizations, predictive analytics, and the development of a sustainability scorecard framework.

Prior to joining Conestoga College, Stephen had a successful career in various leadership roles within information technology and supply chain management. For 20 years Stephen worked with companies within the consumer goods and automotive manufacturing industries; bringing data to life by creating analytics solutions such as informative dashboards, scorecards, and visualizations that contributed to improved operational performance.