



Ripple in the Tech World

Designing Adaptive and Resilient Supply Chains to Tackle the COVID-19 Butterfly Effect

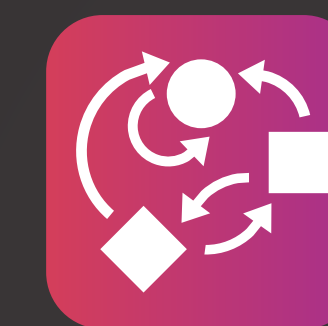
HiTech



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Abstract

A semiconductor chip travels approximately 25,000 miles to reach a user. Along the way, it picks up many dependencies and gains complexity. The prolonged supply chain disruption of the COVID-19 pandemic has heightened the need for transformation along the entire chain. The high tech supply chain in the post COVID-19 world will have to be built on trust and adaptability rather than just efficiency.



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Supply chain in high tech

High tech supply chains are a precision engineering exercise in themselves. Pioneers of creating and adopting new technologies and business models for their operations, the high tech supply chain industry has accelerated its growth and transformation. Comprising of the semi-conductor, computer platforms, software, and engineering services segments, the industry has a global spread. While demand for high tech products originates in all parts of the world, they are mainly supplied from Southeast Asia. Complex supply chains have been built to create, distribute, and retail products such as semiconductor chips, components, and devices. Figure 1 below illustrates the ecosystem of the high tech supply chain.

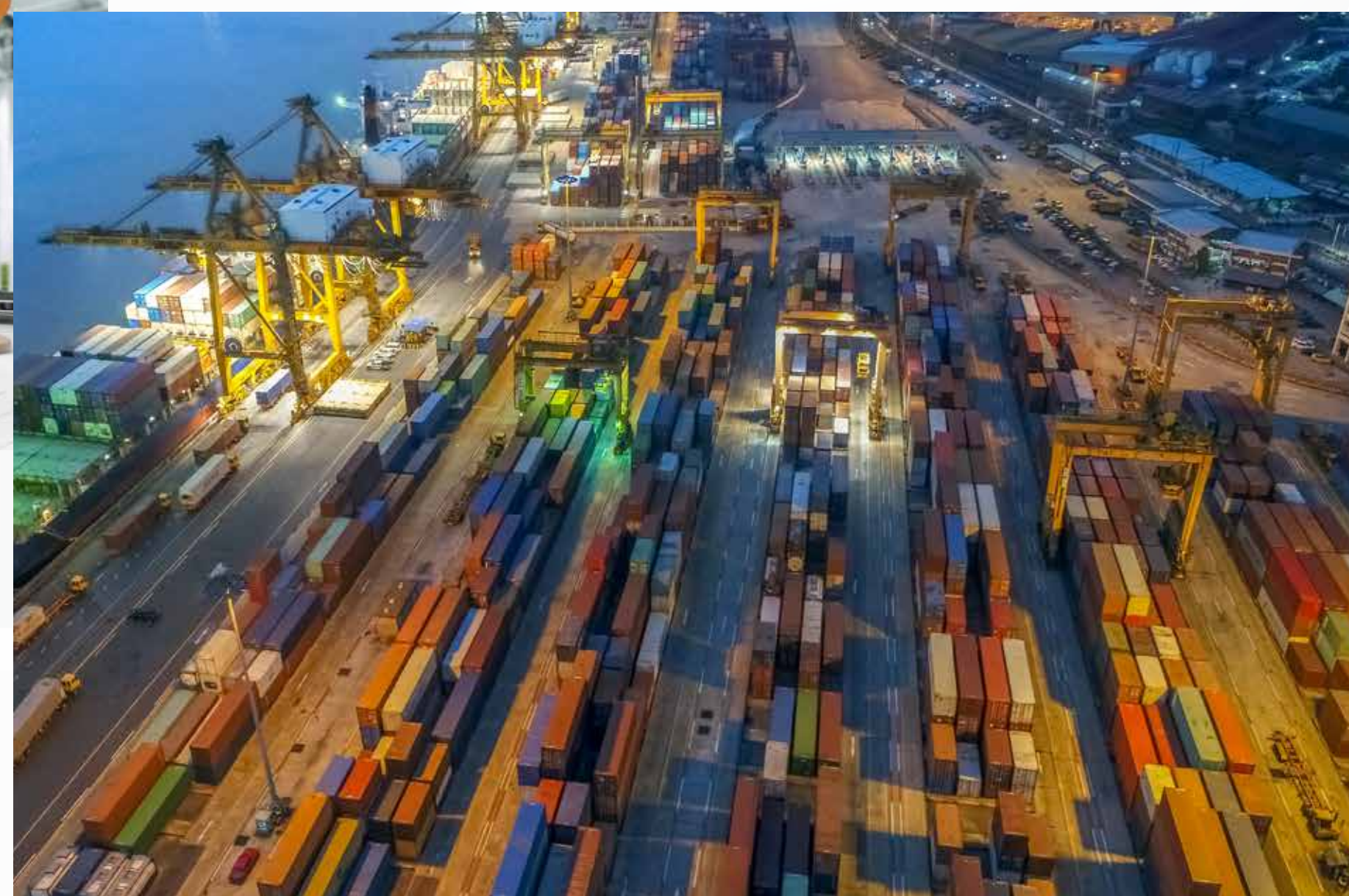


Figure 1: The complex supply chain ecosystem in the high tech industry

In this tightly integrated network, a ripple in one part immediately manifests in other parts of the supply chain. To avoid the ill-effects of such adverse changes, companies pile up inventories at various points to disengage themselves from other parts of the network.

Typically, in the supply chain industry, to avoid any shocks during peak season, the average inventory levels of many US companies increase between January and June and gradually deplete between July and December. Stocking up on inventory comes at a price and is not always the best response to changes in the supply chain. Organizations need to institute effective demand management and risk mitigation strategies to meet customer service level agreements. However, except for a handful of global companies, many do not invest enough in developing risk management strategies for their supply chains.

Impact of COVID-19 on high tech supply chains



The Japanese tsunami and the Thailand floods of 2011 led to severe shortages of semiconductor chips and hard disk drives, respectively, which led to sharp price hikes. Companies manufacturing these products operated in areas impacted by the natural disasters. Despite these disruptions, since then, very few companies have put in place robust supply chain risk mitigation strategies. However, with COVID-19, all of this is about to change. Such prolonged disruptions to the supply chain have been unheard of and the current pandemic will force companies to revise their supply chain risk management strategies. In particular, the pandemic will put relations among supply chain stakeholders to the test.

In the aftermath of the pandemic, trust and agility, rather than efficiency, will have a far bigger influence on the design of supply chain networks.



Transformation and the butterfly effect

Referred to as the 'sensitive dependence on initial conditions', which is the basis of chaos theory, the butterfly effect describes a scenario where a butterfly flapping its wings in China can cause a tornado in Texas, America. The principle, developed by mathematician Edward Lorenz¹, explains the unpredictability of events such as weather forecasting. In the context of supply chain, the ongoing COVID-19 crisis will introduce unpredictable events that will influence how supply chains respond and perform. Currently, supply chain software can handle a wide array of disruptions, but not unprecedented disasters like COVID-19 or the 9/11 terrorist attacks. Tackling such unpredictable events will push companies to design new, adaptive, and resilient supply chain networks that cater to end-to-end processes and to all stakeholders. Such a supply chain network can correctly assess, qualify, and profile butterfly effects, and in turn, trigger the appropriate chain of events as responses with minimal false positives well in advance.

The entire trajectory of supply chain software and developing a supply chain network has been oriented primarily around cost-centric optimization in the last few years, with specific areas of transformation on supply chain demand, execution visibility, and prediction/forecasting accuracy. The focus on trust and visibility, in an optimal world, would lead to more decision-enabled action; however, in an exceptional environment such as that created by the COVID-19 pandemic, visibility only leads to better diagnosis, not an actual solution. Modern supply chains will need to provide solutions in real-time based on exceptions.

Companies must, thus, move their focus to managing the well-being of the 'supplier' in the supply chain network. This means keeping a check on supplier certification, performance, and capabilities in order to sustain disruptions and shocks in the system.

[1] MIT Technology Review; When the Butterfly Effect Took Flight; February 22, 2011; <https://www.technologyreview.com/2011/02/22/196987/when-the-butterfly-effect-took-flight/>; Accessed April 23, 2020

How will corporations in the post COVID-19 era take care of the overall supply chain network beyond their immediate employees and stakeholders? To solve this, organizations must redraw stakeholder maps and extend enterprise boundaries deeper into their supply chain ecosystems.

Companies will be willing to pay a premium for partners who are in their proximity, as this would drastically reduce risks associated with global logistics.



Designing the new high tech supply chain

The COVID-19 crisis is pushing countries and companies to alter their behavior to deal with an increasingly hostile and uncertain world. This uncertainty will also impact supply chain design in the post COVID-19 world, as described below:

1. In the aftermath of the pandemic, supply chains will be redesigned at multiple levels within a company. The new networks will trickle down to the micro geo-location level to integrate deeper with ecosystem partners on demand sensing, consumer behaviour, and socio- and bio-environmental factors. High tech customers are developing commercial blockchains with their partners to establish new networks.
2. While supply chains will continue to operate using lean processes, agility will be much sought-after. Industry experts have even referred to such processes as 'leagile' processes. In a leagile system, companies can manage their supply even as demand fluctuates, with efficiency and agility to prevent overstocking or shortages. Such a system will comprise the following characteristics:
 - In the post COVID-19 world, suppliers and other trading partners will be onboarded faster.
 - Factory capacity and warehouse space will be 'uberized'.
 - Organizations will revise their approach to intellectual property. Supply chains are expected to enter uncharted geographies at breakneck speed. To achieve this, companies are uberizing their supply chain services. Ride-sharing companies globally are preparing themselves and their networks to service these opportunities for last-mile supply chain components.
3. Organizations, especially in the business-to-business (B2B) sector, will offer their customers greater real-time visibility into their supply chains. Digital twins will be used to replicate the operations of suppliers, contract manufacturers, logistics service providers, and other trading partners.
4. Risk management processes will be key to designing new supply chain networks. High tech companies will mitigate risks associated with single sourcing and one-country supply chains. Cybersecurity will get its due in the new supply chain world. Credible data capture at source will be the new mantra to drive supply chain efficiency, which will be driven by technologies like 5G and the internet of things.
5. The demand for predictive business intelligence will rise in order to control the vagaries of supply chains. Artificial intelligence and machine learning will be used for demand forecasting, predictive quality, estimating lead times, and to develop other supply chain metrics. While the use of ML and AI in supply chain is already pervasive, every company needs to develop a maturity model to strengthen current AI systems, which can be fragile. The systems need to be more resilient so that they can adapt to major changes such as those caused by butterfly effect events.
6. Supply chain decoupling strategies will shift from mere inventory management to holistic supplier engagement initiatives. Supplier diversity and single supply base decoupling will require massive investment and shared responsibility. Enterprises will need to invest in supply chain risk management, visibility, and performance. They will also need to refine control tower capabilities to assess dependencies and access all the tiers of the supply chain network as part of the end service or product offered to consumers. Based on this continuous visibility, enterprises need to predict and take necessary action with respect to the overall supply chain, and make necessary proactive and continuous investments to sustain the well-being of the entire network and avoid negative cascading effects. Organizations need to shift from finding alternate sources

of supply to understanding supplier performance and providing reinforcement and sustainability solutions. This will protect participants in the entire network from any decline in supply chain performance because of factors beyond the control of suppliers.

7. Today, supply chain software is run on the cloud and is based on the software-as-a-service (SaaS) model. SaaS helps companies build adaptive and agile supply chains, onboards partners faster, and allows companies to share unused capacities. The cloud combined with 5G, AI, IoT, and blockchain can create an extremely powerful intelligent computing system to handle the complexities of new high tech supply chains.
8. For high tech companies, intellectual property (IP) is core to their success. In a post COVID-19 world, new supply chains need to be designed with strong cybersecurity to protect IP. As a supply chain network grows, different partners will need access to different types of data. Such data segregation, masking, and access control will ensure that the right partners make the right investments in innovation.
9. Next-generation supply chains will have numerous new business models characterized by software-based end-to-end supply chain ownership, supply chain services implementation and operations, supply chain health

monitoring, partner management, and managing exceptional and chaotic events with shared risks and business outcomes. While some companies will move towards vertically integrating their supply chains with complete control over networks including micro location-based manufacturing and managing supply chain risks, many will shift to 'as-a-service' models with different degrees of offerings.

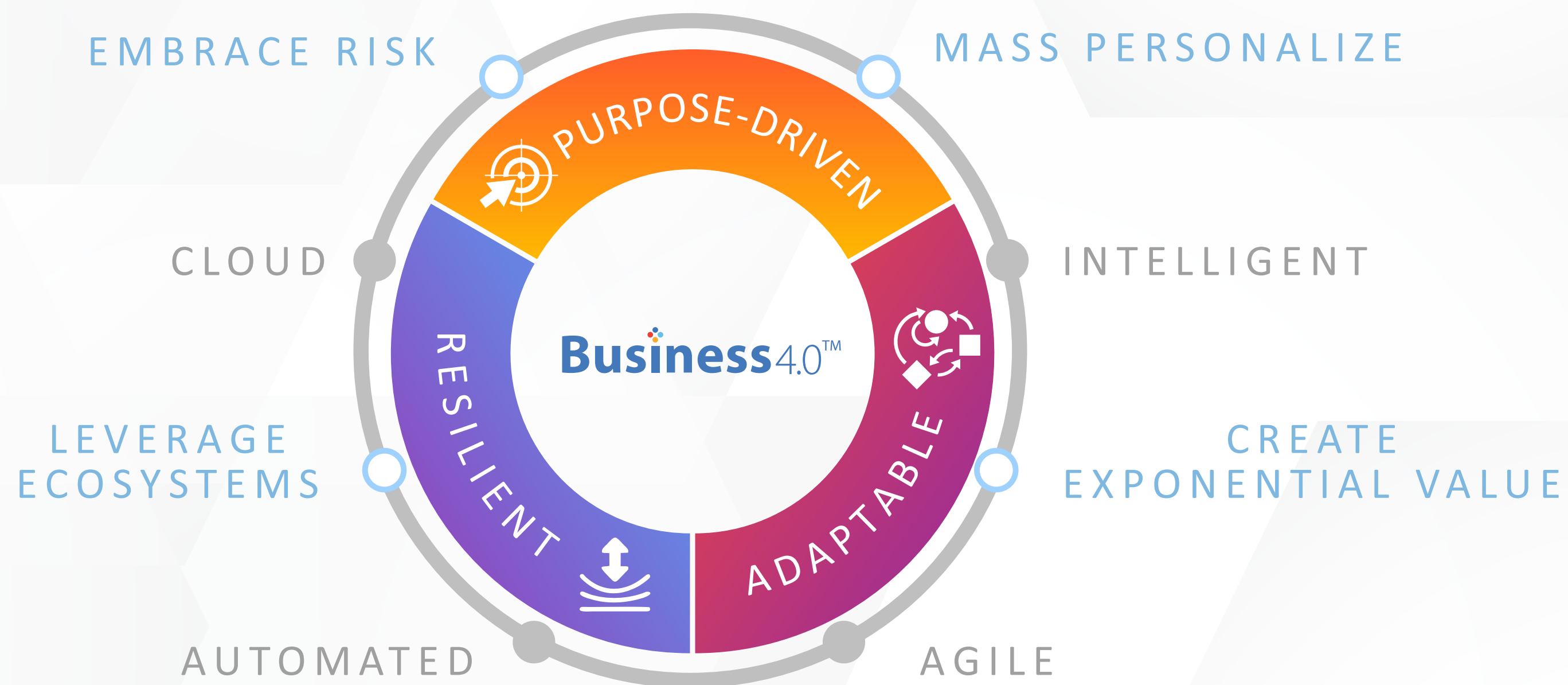
10. The new supply chain also needs to have a predictive design rather than just offer visibility, catering to zero-day scenarios thanks to insights derived from abundantly available data and new correlations.
11. An effective antidote to butterfly effect events is additive manufacturing or 3D printing, particularly as it can produce complex parts at affordable rates. When parts can be printed based on demand, anywhere and anytime, it will promote a resilient and demand-driven supply chain. If parts such as an inexpensive washer for a home music system can be 3D printed, it would remove the need for shipping the product. Additive manufacturing is easily one of the most critical parts of the supply chain that can make it demand-driven or pull-based. Combined with blockchain, 3D printing can make IP infringement completely secure, thereby providing value for designers and encouraging them to increase output.



Growth in the new Business 4.0™ era

It is difficult to assess the complete fallout of the unfolding financial and psychological damage caused by the COVID-19 pandemic. As companies grow and transform in the new Business 4.0™ era, they will have to focus on building a resilient, purpose-driven, and adaptable supply chain.

PURPOSE-DRIVEN, RESILIENT & ADAPTABLE with Business 4.0™



To establish such a supply chain ecosystem, there must be collaboration across society, industry, and government. To sustain the adoption of a new supply chain network, organizations must share business benefits, transformation, optimization, and value creation across all stakeholders in their ecosystem.

Trust will be the bedrock of the new supply chain ecosystem, particularly in a shared economy, which will be the norm. Predicting events based on AI and ML capabilities will become par for the course and technologies like blockchain will build trust and ensure speed in the post COVID-19 world.

Going forward, high tech companies will have to rely on technology to develop new supply chains for a changed world order, and in turn, a new era of doing business.



About the authors:



Spandan Mahapatra

Spandan Mahapatra is the chief technology officer of the HiTech business unit at Tata Consultancy Services (TCS). He leads the portfolio which manages the Digital and Enterprise Transformation and Technology domains. He also heads the Business Solutions group within TCS' Alliance and Technology Unit. His team includes a large pool of highly skilled business and technology experts that drive sales, digital solutions development, demand generation for digital business, digital sales, and delivery.

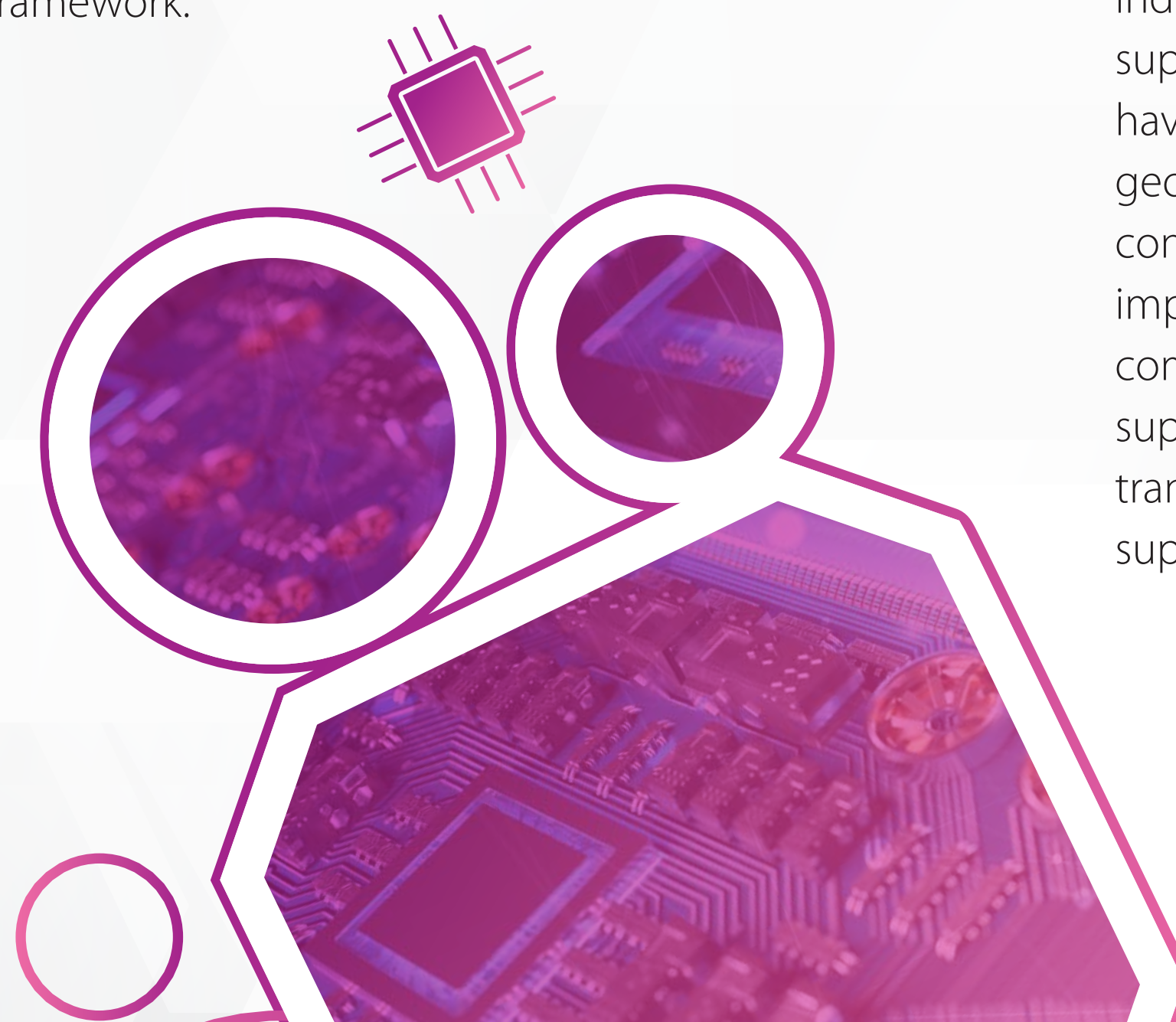
Spandan and his leadership team have been instrumental in establishing one of the largest advanced technology innovation platforms on hybrid cloud at the TCS Innovation Lab in Cincinnati. The platform drives interoperability with over 40 technologies across infrastructure and application solutioning layers.

Spandan is a digital thought leader and advises customers globally on reinventing business models and driving digital reimagination initiatives by using the core capabilities of the Business 4.0 framework.



Vijay Muttur

Vijay Muttur is the Head of the Enterprise Transformation Group within the HiTech business unit at Tata Consultancy Services (TCS). With more than 30 years of experience across industries, he has a deep understanding of the supply chain and customer experience space, having seen the sector evolve amidst changing geopolitical contexts. He has anchored consulting engagements and technology implementation projects for high tech companies. He has also advised clients on supply chain and customer experience transformation engagements and implemented supply chain software solutions.



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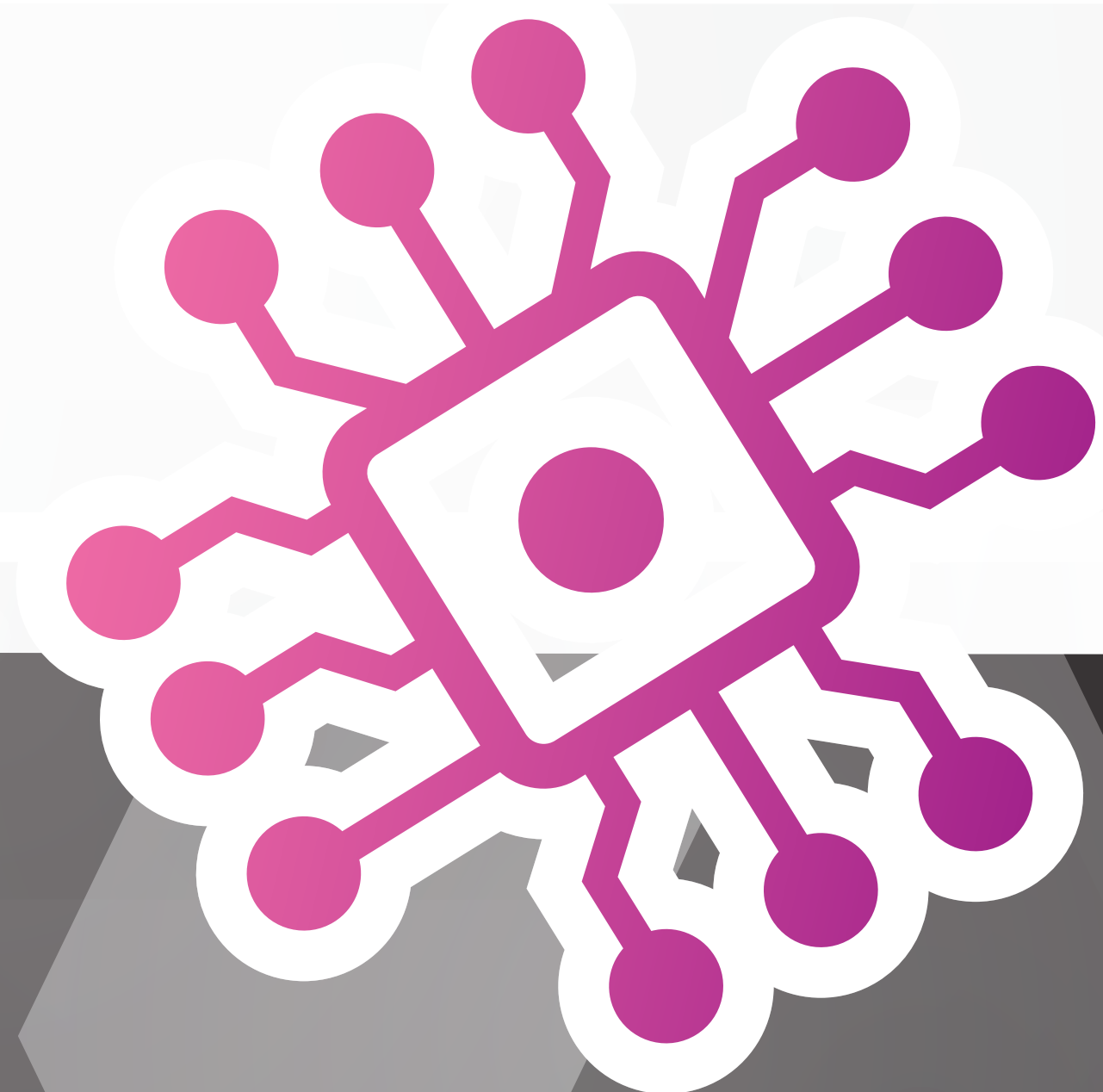
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