

Supply Chain Driven Supply and Demand Augmenting Resiliency Integrated Artificial Intelligence

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ABSTRACT

Is it correct to say that Supply and Demand still rule Supply Chains, or is it the other way around? Either way building a resiliency augmentation to support both situations is a must system that we are missing from any supply and demand or supply chain. Presently, we do not have any Business Resilience System (BRS) built in any of our existing chain of supplies nor within any demand or supply that both business and consumer may ask for when it comes to either one of them. Far from what some economists consider the dismal science, they drive most decisions in the supply chain, and supply chain managers need to be fully aware of the economic conditions that drive their business, their suppliers, and their customers. Last Christmas was a good example of a lack of resiliency. The port of Los Angeles came to an absolute halt when the chain of cargo ships seating off the port and lining up for their goods to be unloaded. Yet, the port authority could not provide the necessary labor resources to be in place to unload these cargo ships. Such shortage of labor and lack of having a contingency plan as a resiliency system created a chase at consumer level from supply and demand, naturally supply chains were in a mess.

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Introduction

Given the age of technology and the Internet of Things (IoT) and the age of Big Data is at the front edge of our technology for collecting information. We need to increase our knowledge and have the power of decision-making capability to go on forward for our day-to-day operation and to be able to forecast in a short term and predict in a long term. These are what we need to possess for our resiliency planning in place [1].

With the incoming rush of Big Data (BD) from the omni direction due to existing IoT in our today technological life, one cannot ignore all of the information and analysis available today to assist in making suitable supply chain decisions. It is up to supply chain professionals and data analysis to identify, analyze and track the key economic trends and key indicators that not only impact their business but also offer a window into their supplier's strategical and tactical needs and planning, in order to meet their demands of short, mid, and long term. For that, most of these businesses are in need of augmenting a smart Business Resilience System (BRS) along with the integration of Artificial Intelligence (AI) in place to be able to hash out all these omni-directional Big Data (BD) by analyzing them via means of Data Analytics (DA) and Data Predictive (DP) means [2-5].

In any operation, whether small, medium or large, supply chain managers in charge are responsible for internal resources for continuous and uninterrupted function and trend of the supply chain, while supply and demand still ruling it as a strong variable of this function.

Their direct access of these managers to a wide range of practical market intelligence based on their Business Intelligence (BI) or Artificial Intelligence (AI), driven by Data Analytics (DA) and Data Predictive (DP), would create the perfect opportunity to be internal company advisors [4].

Supply chain managers are able to deal with Macro and Micro decisions all of the time, especially when analyzing suppliers' cost drivers, which also impacts the inventory control elements of their operation to meet their supply and demands at critical moments. However, bear in mind that inventory is one of the most expensive and essential assets to many companies and enterprises. It represents as much as even some cases up to 50% of their total capital. It should be considered as part of these supply chain managers Quantitative Analysis (QA) as their management responsibilities.

Managers have long recognized that good inventory control is critical for their survivability from operational capital and has a direct correlation with the Supply and Demand as well as their Supply Chain perspective. On one hand, a firm can try to reduce costs by reducing on-hand inventory levels, given the uninterrupted flow of the Supply Chain. On the other hand, customers become

dissatisfied when frequently inventory outages, called stock outs, cannot meet the Supply and Demand flow situation.

Moreover, the companies must find a balance between low and high inventory levels. As we know and would expect, cost minimization is the major factor in achieving this delicate balance.

Under all the above scenarios, any operations small, medium, or large range requires a smart business resilience in place along with AI integration that acts based on Big Data and Machine Learning (ML) and Deep Learning (DL) components of such intelligence system [6-8].

Supply Chain Dive

Consider a supplier not only in the United States needing, but also, globally to raise prices to compensate for increased labor costs driven by employee shortage during particularly, COVID-19 Pandemic period and in some cases, induced wage pressures with understanding that the employment trends and associated wage analysis is a macroeconomic element. Pricing between the buyer and seller during contract negotiations is a microeconomic issue. However, Buyers and Sellers should continuously meet on the Supply and Demand Curve no matter how.

Let us look at the heart of economics familiar to the supply chain and their managers in charge of this chain and what occurs in the marketplace, where buyers and sellers meet and bargain over goods and services. The equilibrium point is in constant motion on their meeting curve to reach incremental or large fluctuations in supply and demand.

Furthermore, demand is the quantity that consumers are willing and able to buy at different prices. Yet, supply is the quantity of goods and services businesses are willing to provide at different prices, given the time and occasion of the occurrence. The illusive equilibrium point is where supply and demand are equal, and that is where the prices will settle on the meeting point on the curve, and that is exactly the point where the buyer and seller compromise at a price agreeable to both sides.

However, by definition and understanding of economics, either Macro or Micro approaches vary given the time and place. Some academics look at the concept of scarcity and what people are willing to pay for a particular product or service when it comes to supply and demand versus supply chain based on the economics of that point of crossing each other at any given time and place of it. However, other economists look at it as the study of production and consumption.

Overall, in any event, the heart of economics familiar to supply chain, when it comes to the final transaction between buyers and sellers, come to a comfortable zone that is satisfactory to either side as a result.

Let us take a look at a supply and demand example relevant to almost anyone in the supply chain or even as a consumer. For that, we look at the energy sector and crude oil as supply chain versus supply and demand minus any unexpected events such as the war between countries as a source of supply chain and supply for countries that are in demand of such source and are the consumer of this source.

However, bear in mind that the price of a barrel of oil is quite volatile and has been on the rise for the past year or so. This increase impacts all businesses, from transportation companies

dealing with higher fuel costs, to plastics companies paying a higher price for raw materials, to workers with a higher commuting cost.

Furthermore, as a note, even under normal conditions, the flow of energy, events such as cyber-attacks of smart malware might bring such flow of energy under the interrupted condition that may temporarily or permanently become a threat to our economy. For instance, the event in the United States around October-November 2021 was a manmade threat by cyber-attackers. Their demand had to be met by the ransom of crypto-currency, and the transaction could not be traceable either or even natural disaster. For example, the winter of 2021 brought the economy of a state such as Texas to its knee, just because the state and local governments did not have any resiliency augmentation in place either [9-10].

To elaborate further on the economics of diving into supply chain economics, we may state that, Macroeconomic issues such as global demand, coupled with geopolitical pressures to adjust output, have reduced inventory levels, leading to higher market prices. Less oil = higher prices. Such events can be seen in the 1973 war between the Arabs nations and the state of Israel. It brought supply chain flow to a choking point for supply and demand in the United States that us as the consumer end up lining for 5 gallons of gasoline to put in our car, we had to stand in line for miles and miles at the pump of gas stations for those who remembered it.

The bottom of the line is that we drive by the virtual supply and demand curve every time we pass a gas station with a digital price on its sign. The price rises when the supply is low, causing drivers to drive less in order to save money. Less driving equates to less demand and greater supply, causing the price to drop and the driving to increase.

As a result, we may say that Equilibrium means steady pricing, whether high or low.

Economic Indices Parameters

For professionals that are involved in supply chain, Data Analytics and Data Predictive (DP), there is a wide range of public and private data and a vast amount of statistics and data analysis that will help inform business trends and patterns.

The Bureau of Labor Statistics (BLS) is by far one of the most important government sites. Full of relevant information and data to help manage the supply chain, it is also the Producer Price Index (PPI) home.

The PPI is a family of indexes that measures the average change in selling prices by domestic producers of goods and services. The focus of data with the PPI is threefold: industry classification, commodity classification, commodity-based Final Demand, and Intermediate Demand (FD-ID).

The Consumer Price Index (CPI) is a market basket of consumer-driven goods and services, an excellent tool to analyze pricing trends [11].

Note that, The Consumer Price Index (CPI) is a measure of the average change over time in the prices paid by urban consumers for a market basket of consumer goods and services. Indexes are available for the U.S. and various geographic areas. Average price data for select utility, automotive fuel, and food items are also available.

As not to penalize the buyer or seller, linking future contract costs to an index like the CPI or PPI is a fair alternative to poor performance, broken agreements, and deteriorating relationships.

Additional macroeconomic data comes from the United States Bureau of Economic Analysis. Their focus is on macroeconomic issues such as gross domestic product (GDP), personal income, the balance of payments, international trade, and foreign direct investment.

This data is used to make long-term decisions and to understand long-term global economic trends. Familiarity with the BLS, the BEA, and also the Department of Commerce and the Department of Labor, offer macro and microeconomics trends critical to supply chain professionals.

Resiliency Augmentation

By definition, some authors consider that resilience refers to the ability of an organization to carry out its functions and return to a stable state after major disturbance or stress by considering the before and during while others consider resilience as the ability of a system to maintain certain functions, process, or reactions after experiencing a disturbance [12, 2].

All these above definitions, deliberate progress toward the goal of long-term sustainability depends on understanding the dynamics of linked social and ecological systems. The concept of social-ecological resilience holds promise for interdisciplinary syntheses. Resilience is a multifaceted concept that has not been directly operationalized, particularly in systems for which our ignorance is such that detailed, parameter-rich simulation models are difficult to develop. We present an exploratory framework as a step towards the operationalization of resilience for empirical studies.

We equate resilience with the ability of a system to maintain its identity, where system identity is defined as a property of key components and relationships (networks) and their continuity through space and time. Innovation and memory are also fundamental to understanding identity and resilience. By parsing our systems into the elements that we subjectively consider essential to identity, we obtain a small set of specific focal variables that reflect changes in identity. By assessing the potential for changes in identity under specified drivers and perturbations, in combination with a scenario-based approach to considering alternative futures, we obtain a surrogate measure of the current resilience of our study system as the likelihood of a change in system identity under clearly specified conditions, assumptions, drivers and perturbations. Although the details of individual case studies differ, the concept of identity provides a level of generality that can be used to compare the measure of resilience across cases. Our approach will also yield insights into the mechanisms of change and the potential consequences of different policy and management decisions, providing a level of decision support for each case study area.

In summary, there may be 5 ways to build resiliency that may possibly identify key steps, one can take to build a stronger supply chain and are listed as:

1. Optimize your supplier network.
2. Control costs.
3. Forecast demand more accurately.
4. Gain a fuller view of supply chains.
5. Manage inventory, supplier relationships and risk more effectively.

By considering the five above steps and leveraging the new technology of artificial intelligence in past decades, integrated with such a resilience system, we can solve our supply chain challenges by streamlining and safeguarding our supply chain that is possibly ruled by supply and demand [13].

Conclusions

A supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request driven by supply and demand. The supply chain includes the manufacturers, suppliers, transporters, warehouses, retailers, and customers themselves. Within each organization, such as the manufacturer, the supply chain includes all functions involved in receiving and filling a customer request. These services include but are not limited to new product development, marketing, operations, distribution, finance, and customer service.

For instance, a person walks into Publix wanting to buy some paper towels; there are two stages in this statement; the person wanting the paper towels and then going to Publix. The next stage in the supply chain is the supplies on the shelf, and they continue to come.

In today's competitive economic industries, companies are taking strategic steps to solidify a stern supply chain to ensure overall growth in target markets. Companies must have products readily available in order to stay in business and to stay relevant amongst consumers. In a world where millions of consumers make choices and control what they want to purchase and how often they want to do so, it strikes a need for more resources and productivity. Businesses are constantly evolving in an effort to become the leader in their industry to attract and appeal to as many people as possible.

Supply and demand are the key elements in establishing the ultimate value of a consumer product. Several influential factors can alter the demand and create changes in production by increasing or decreasing the overall supply. Seasons, trends, advertising, and availability provide a platform for businesses to act on the consumer market's needs.

Also, when it comes to the analysis of supply chain ruled by supply and demand, Supply chain professionals often use the PPI or CPI indices on contracts in an attempt to identify upward or downward pressure on supplier costs. During long-term contracts, there are economic and market forces that positively or negatively impact supplier costs.

As a final statement for the conclusion, we should state that using these indices, or other government data, is considered objective, not subjective criteria. By agreement, suppliers may raise, or lower contract prices based on the agreed-upon movement on the index, usually on a monthly, quarterly, or annual basis, and often within an agreed-upon percentage range. The key to this process is the ability to audit the price changes and maintain strong contract performance.

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