Presenting Teamwork

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Impacting Pandemic Life Cycle and Mitigating its Toll on Society and Economy

Medico-Pharmaceutical Innovation

Socio-Sanitary Performance

Political Governance

Collective People Behavior

Supply Chain Performance
Society Provides Workforce to Supply Chains That Fulfill its Demands

- Healthcare Supply Chain
- Sustainment Supply Chain
- Entertainment Supply Chain
- Mobility Supply Chain
- Hospitality Supply Chain

Non-Exhaustive Set of Supply Chains
Key Pandemic Roles of the World’s Supply Chains

Support *Healthcare* efforts to fight the pandemic, facilitating people diagnosis, treatment and vaccination

Enhance *Economic* continuity and recovery capability

Secure population’s *Life* quality

Facilitate *Political* measures, notably for mitigation and containment
Supply Chain Readiness

Ensuring that the world’s supply chain is well poised to effectively, efficiently, equitably, and persistently respond to pandemic-induced demands and disruptions, whenever a pandemic is to occur in the future.

Supply Chain Response

All live decisions and actions taken to address pandemic-induced demands and disruptions, from early pandemic threat signal to pandemic recovery, so as to achieve goals in line with the four HELP roles.
Pandemic Demand Critical and Essential Products, Components and Materials

Core to fighting the pandemic disease

Core to society and economy survival and continuity

Criticals

Worldwide set of products and services

Essentials
Disruptive Pandemic Demand for Criticals

For the COVID-19 pandemic, there is, as of now:

• Unmet demand for over seven billion units of a vaccine that has yet to be discovered, tested, produced, and distributed.

• Very partially met demand for pandemic masks, one per person if reusable, or $X$ per not-isolated person per day if single-usage

• Highest PPE demand during the height of the pandemic and during early recovery

• Demand for PPE inversely related to the availability and exploitation of effective testing kits

Invasive ventilator demand in the U.S.A.

Change in demand type and magnitude occurs dynamically, geographically and over time, as the disease spreads across the globe.
Disruptive Pandemic Demand for Essentials

- Consumption of essentials is stable or boosted during pandemic
- Demand is strongly affected by precautious hoarding when mistrust in supply chain persistence

Customers Inventory
- Target 14 days when safe, 28 days when unsafe

Customers Consumption
- Peak: 150% Pre-Pandemic 1M/day

Supply Chain Inventory

Customers Demand

Sales

Production
- Pre-pandemic capacity: 1.2M/day, 1.3M/day at 130 & 1.7M/day at 170

Shortage
Pandemic Supply Chain Persistence: A perpetual Endeavour across 5 World States

Healthy
Localities and people around the world are essentially healthy, yet endure an evolving mix of illnesses, chronic diseases, and endemics;

Outbreak
Epidemiological threat signals in a locality

Epidemic
Fast large-scale widespread propagation of disease across regions & countries

Pandemic
Large-scale worldwide disease propagation

Recovery
Post-pandemic gradual yet bumpy return toward a healthy state
Robustness, Resilience and Antifragility of Critical & Essential Supply Chains

Q1: How to improve the robustness?
Q2: How to improve the resilience?
Q3: How to reach antifragility?
Causes of Critical and Essential Supply Chain Disruptions

Inability to scale enough to meet demand

Disease-affected workforce

Measures blocking flow of workforce & goods

Cumulative COVID-19 tests as of today in the U.S.A.

Only 0.14% of the US population has been tested (once)

Uncertainty forces authorities to enforce preventive measures

One Canadian plant had to close, with 900+ affected workers: one of two plant producing 70% of Canada’s beef meat

Domino effect on farmers and the population

COVID-19 pandemic takes toll on U.S. meat producers
Securing Healthy Critical and Essential Supply Chain Workforce

**Keep Workers Healthy**
- Provide PPEs to all workers
- Lay out, equip and operate to minimize disease contagion while being efficient
- Leverage tele-work
- Enforce pandemic protocols and procedures
- Put in place contagion detection and response methods
- Implement rapid-testing when risk is identified
- Exploit contact tracing, disease zone avoidance technologies

**Need Less Workers**
- Exploit automation, robotization, augmented reality

**Develop & Leverage Healthy Reserve Workers**

Ultimately, every work-capable person should:
- Have a portfolio of supply chain knowledge, skills and experience
- Have mapped roles she/he can take whenever her/his usual role becomes non-critical and non-essential,
- Be connected to a matching optimization platform where supply chain organizations express their need for workers
Enabling Pandemic Vector-Free Logistics

Logistics receives, unpacks, sorts, moves, stores, picks, packs, ships, transports, and delivers goods.

At each step, the people, the equipment, the products can become vectors propagating the pandemic.

A key challenge is to shift toward vector-free logistics, whereas the overall multi-party logistics system in a large territory, and ultimately all around the world, is designed, engineered, implemented, operated and managed to be vector-free while not being encumbered into inefficiency, rigidity and unsustainability.

- **Product & Equipment Decontamination**
- **Worker Protection**
- **Modular Containerization**
- **Robotization & Automation**
- **Autonomous Transport**

- **Touchless Operations & Digitalization**
- **Physical Internet principles, protocols and interfaces**
- **Customer Collaboration**
Sustaining Transportation of Pandemic 
Critical and Essential Freight

Two major challenges

1. The transport system may have to operate with reduced capacity (vehicles and/or hubs)
2. The transportation system has to adjust to and handle huge changes and fluctuations in demand.

Short haul / last-mile

Shelter-in-place measures induce more home delivery 
Delivery is for small quantities to many different locations 
Fewer opportunities for consolidation 
Need for sizeable numbers of small vehicles

Long-Haul

Crippling capacity drops induces setting pandemic lanes and hubs 
and ensuring they will be persistently open 
Passenger aircrafts are repurposed for cargo, adding fast capacity

International

Crucial to remain active, as few countries can operate more than 
a few weeks without imports of some essentials and criticals 
The drop in container shipments affects the clockwork lanes and ports
Enhancing Pandemic Demand Management
Authoritative Approaches

Rationing
Limiting each client to a maximum purchasing rate of a product

Allocation
Limiting each store or fulfillment center, to a supply function of its served market

To be done over an entire territory
To be done encompassing multi-companies
To be supported by systems ensuring transparent fairness
To be dynamically managed taking into account product demand & availability
Enhancing Pandemic Demand Management

People-Centric Participative Approaches

Supply chain visibility accessible to the population
- Easier to find needed products
- Proactive in seeking substitutions

Personalized household inventory management tools
- Avoid hoarding essentials and criticals unnecessarily
- Better planning of needed demand
- Automated replenishment from online vendors

Stimulating incentives for people contained at home to self-make products
- Improving cooking skills and to experiment with new web sourced recipes
- Switch demand from finished products to components and materials
Pandemic Supply Chain Visibility, Predictive and Prescriptive Modeling

Provide live, reliable broad-scope, large-scale, deep visibility, prediction and prescription capabilities to essential and critical supply chains

Highly valuable: helps take better decisions, with facts and not only presumptions and argumentations

Complex to set up and maintain
Legislation
Confidentiality, Anonymity, Trustability
Competitive protectionism
Data exchange and repository
Digital system interoperability
Distributed access and interface
Visualization and analytics
Artificial intelligence, Optimization, Simulation Modeling

Readied in advance, should be easy to plug and use
Pandemic Supply Chain: Autonomy and Availability Mindsets

Seeking autonomy
How much of the demand can be fulfilled persistently by supply chains contained within the territory, and for how long, through a combination of stockpiled inventory and production capacity?

Seeking availability
How much of the demand in a territory can be robustly fulfilled, and for how long, by smartly leveraging all reliable worldwide sources capable of producing them and/or providing them from stockpiles, and delivering them reliably.

Ways to enhance both autonomy and availability
- Increase readiness by adding production capacity within the territory and/or buying in advance and stockpiling essential and critical products
- Accept satisfactory yet not preferred product substitutions
- Encourage and incentivize far greater local production of essential and critical products, near locations where they are to be needed
- Smart dynamic deployment of critical and essential products within territory

Smartly balancing autonomy and availability
Let us open the discussion!