SUPPLY CHAIN TRANSFORMATION AND INNOVATION FOR THE "NEW NORMAL" DURING COVID-19 TIMES

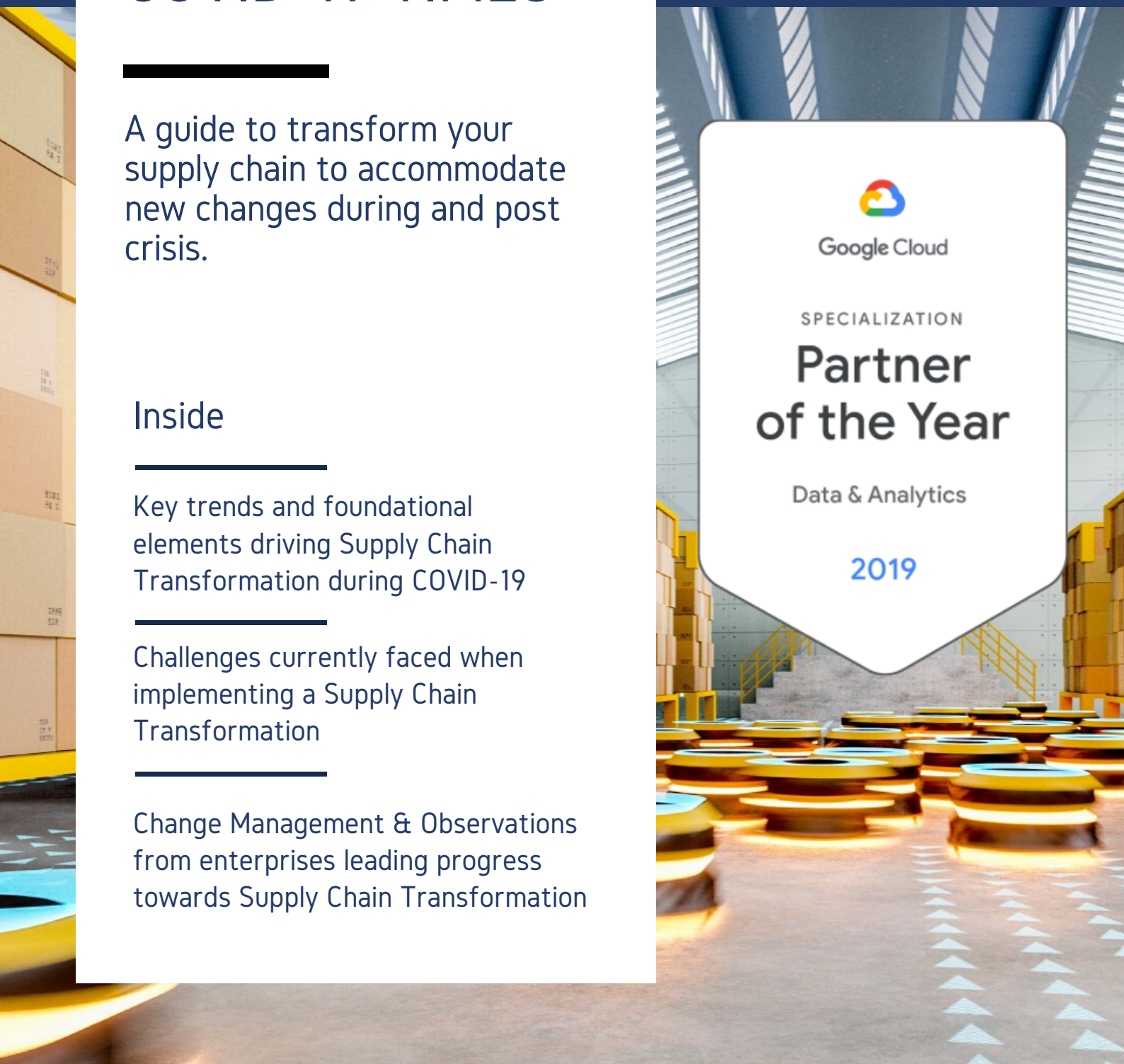
A guide to transform your supply chain to accommodate new changes during and post crisis.

Inside

Key trends and foundational elements driving Supply Chain Transformation during COVID-19

Challenges currently faced when implementing a Supply Chain Transformation

Change Management & Observations from enterprises leading progress towards Supply Chain Transformation



DISCLAIMER

Pluto7 is a strategic premier partner with extensive expertise in solving supply chain problems for Fortune-500 enterprises across the globe. Recently, Pluto7 won the “2019 Global Google Cloud Specialization Partner of the Year Award for Data and Analytics”.

The author is also an advisor at the USC Marshall School of Business, having a clear understanding of the supply chain disruptions caused by COVID-19.

Additionally, Pluto7 has led hundreds of supply chain and customer experience transformation project engagements along with Google globally, bringing in the rich learnings included in this paper.

BACKGROUND

Most people today in the supply chain world would say that the COVID-19 scenario was unpredictable and hence the supply chain disruption seen once in 100 years. However, this is not completely true as if you talk to the CDC and WHO and various pandemic research organizations, scenarios like COVID-19 occurring in a given decade were highly predictable, supported by reasonable accuracy.

Governments and businesses may have not paid close attention to these scenarios until the probability of an actual occurrence turned into reality.

The majority of global supply chains have manufacturing as their core component. In some different situations, supply chains can exist as pure distribution supply chains. This paper is focused on the manufacturing aspects of your supply chain. If you want to read about end-to-end supply chain transformation, we have an additional white-paper which expands beyond manufacturing and talks about the Supply Chain Control Tower.

Manufacturing 4.0 is the name given to the supply chain transformation that is occuring in the manufacturing industry based on the confluence of cloud computing, artificial intelligence (AI) and machine learning (ML), internet of things (IOT) and cyber-physical systems. The earlier transitions in manufacturing started with the automation driven by the invention of the steam engine (1.0), followed with electricity driven automation (2.0) and computer systems (3.0)

By now the potential presented by the above mentioned advances and trends is getting well known amongst the supply chain leadership circles. However, most of the supply chain leaders are still struggling to fully comprehend the necessary transition to Manufacturing 4.0 as the impact of COVID-19 is not 100% quantified yet.

This paper provides key findings and potential solutions to help leaders in the supply chain accelerate their transition to the "new normal".

The following Figure 1 shows how supply chains and manufacturing processes have transitioned over time. This has been in motion for a few years now; however, COVID-19 has ignited the need to transform faster as unexpected disruptions are impacting how companies react to new demand patterns and how leaders make decisions.

What is Manufacturing 4.0

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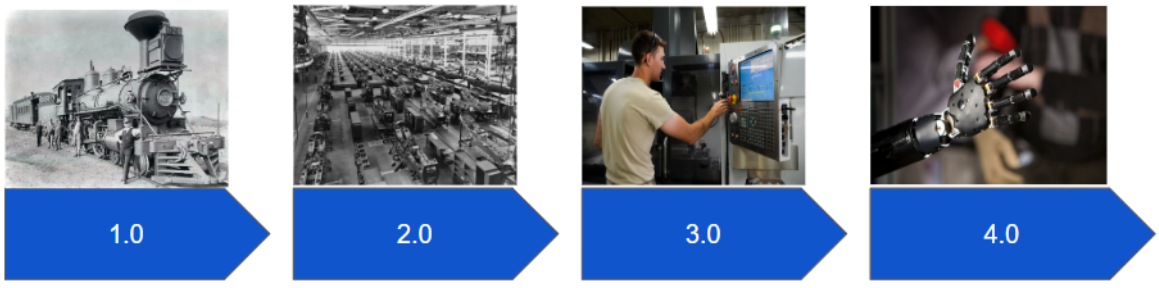
Manufacturing 4.0 is the name given for current trends in automation based on exchange of data in manufacturing technologies which includes the Internet of Things (IOT), cyber physical systems, cloud computing and cognitive computing (Artificial Intelligence and Machine Learning).

The figure below shows the transition of each Manufacturing Cycles through the past century till today



Mechanization, Water and Steam Power

Mass Production, Assembly Line and Electricity

Computer driven automation

Cyber Physical Systems, IOT and Ai-ML

KEY TRENDS AND FOUNDATIONAL ELEMENTS DRIVING SUPPLY CHAIN TRANSFORMATION DURING COVID-19 TIMES

Technology will be a key driver for Supply Chain transformation since the legacy technologies currently available have reached their limits when it comes to driving innovation. Some of these technologies are still in experimentation stage for most enterprises. The following are the key technologies that will drive Supply Chain Transformation:

Cloud Computing - Cloud computing, including hybrid platforms, provides the ability to capture, process and disseminate information at scale regardless of whether it is small or big data.

Enterprises are no longer tied down by infrastructure limitations -- they can redirect the resources to focus more on solutions that can deliver business benefits instead of worrying about infrastructure. During these challenging times, E-commerce supply chain infrastructures were tested to their limits, especially in the essential goods space during the first few weeks of COVID-19.

Artificial Intelligence and Machine Learning (AI-ML) - AI and ML are being adopted in many enterprises as real business benefits are observed from solutions that leverage these technologies. Examples are AI and ML for forecasting, as well as predictive preventive maintenance.

Additionally, AI and ML with robotics is becoming an essential part of manufacturing production, storage or distribution centers. Currently, customers are seeing how AI can help in many ways when labor becomes unavailable. E.g. Using AI to finding information in a logistics document and loading it into the system to drive further process automation.

I**nternet of Things (IoT)-** Internet of Things devices that capture and transmit data over the internet are slowly becoming prevalent in the industry either in the form of being installed on products as part of standard equipment (example refrigerators and similar appliances used in households) or used in the manufacturing process. These devices along with capabilities such as IoT on-the-edge help capture data which can then be collected using the cloud computing capabilities.

On the other hand, IoT helps drive automation of tasks by leveraging cognitive analytics based on AI and ML techniques.

Your labor availability can be unpredictable over the coming 12 months, therefore, it is good to see where these IoT devices can start helping in giving you insights into business progress.

Cyber physical systems (Robotics and embedded AI-ML and more) - represents the integration of all of the above technologies which will have physical systems driven by AI, working in automated coordination with each other. E.g. Autonomous movement of material from receipt into storage (warehouses) to transfer to production lines (raw material and component) to finished goods being stored before transfer to the next location.

For your own employee safety and to handle situations where lesser labor is available, it is important to have these technologies as part of your plan in your supply chain at various nodes.

CHALLENGES CURRENTLY FACED WHEN IMPLEMENTING A SUPPLY CHAIN TRANSFORMATION DURING UNCERTAIN TIMES

Today, we are dealing with times where there is a higher level of emotional impact across all people around the world, and some of these people play a role in your supply chain nodes regardless of their level and responsibilities. During uncertain times, people tend to resist or adapt slower to new environments and lifestyles, therefore, it is relevant to acknowledge the emotional situation and be empathetic before introducing a change.

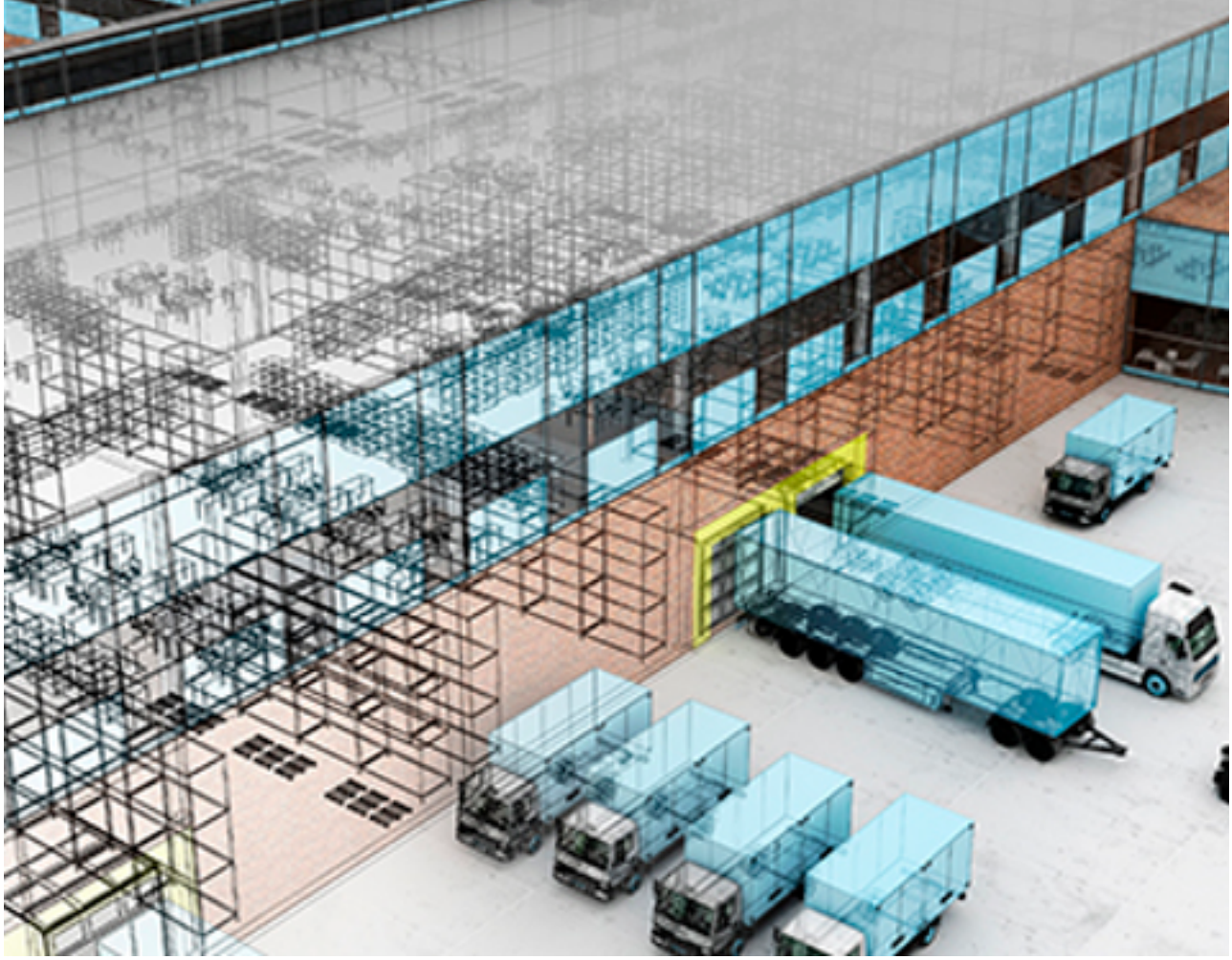
Based on discussions with a representative set of industry leaders part of a Gartner focus group on Supply Chain Transformation, as well as observations from enterprises that have mentioned a desire to transition to Supply Chain Transformation, the following observations stood out:

- **Lot of new technology choices and lack of familiarity with the same**. As a result, many manufacturing leaders feel that launching a Supply Chain Transformation strategy is a complicated process as it requires an extra investment in resources, especially time. E.g. At the surface all cloud platforms appear the same, but when you look closer and verify against research reports from Gartner and Forrester, it will be apparent that certain cloud providers like Google Cloud are known for having the best AI and predictive analytics which are critical for your rapid scenario planning with machine learning.

- **Unable to determine ROI**. Without having too many reference points to align themselves to, many executives and leaders in the industry feel like they are unable to achieve a positive ROI from Supply Chain Transformation related initiatives. As a consequence, it might be challenging to get the support needed while ensuring funding. According to our industry and technical experiences, ROI and profitability depend on the complexity of the problem and the solution. Our recommendation is to ensure that the problem scope is broken into smaller parts such that their respective solutions can be assembled together.

- **Worried about Change Management.** Any technology change requires proper change management for desired adoption within the organization. With so many emerging and disruptive concepts and technologies, most executives and leaders feel that they are not well prepared to deal with this challenge. Most of these concerns stem from the realization that upskilling of the workforce has to be done but with no precedences on successful methods to achieve the same. Collaboration and analytics continue to become a critical part of the human workforce as Digital-Twins with AI can potentially help leaders make better decisions. AI will appear less as a technology but more as an alternative to our brain through our natural interactions in our work with speech, visuals and more.

- **Cultural, Ethical and related concerns.** Concerns related to cultural aspects are on the minds of many executives and leaders as technologies stretch perceptions arising from cultural norms. Concerns range from unemployment, human and artificial intelligence interactions, avoiding/controlling mistakes made by AI-ML to security (example how to prevent malicious use of AI-ML). During these times of unprecedented market fluctuations where enterprises are forced to make hard cuts of labor forces, introducing changes while balancing them with ethical concerns is important. AI **does not** replace humans in many cases, it augments human capabilities.



OBSERVATIONS FROM ENTERPRISES LEADING PROGRESS TOWARDS SUPPLY CHAIN TRANSFORMATION

The enterprises that are on the leading edge of embarking on Supply Chain Transformation have demonstrated the following characteristics.

Foundational Thinking
Enterprises that have seriously started looking at putting together strategies for Supply Chain Transformation are following a process of thinking through the foundational elements and validating them as they go down the path to 4.0. Examples are companies like Cisco, AB InBev (Budweiser) and so on.

This is critical since some of the technology elements such AI and ML, IoT, and cyber physical systems are relatively new in enterprise settings. Conducting proof of concepts or prototyping to prove out feasibility and doing

Be ready to iterate
When dealing with new technologies and especially highly disruptive combinations provided by AI/ML and cloud computing, not every proof of concept will be a success (approximately 90% though will be successful provided guidance from right people and partners are involved).

Understanding failures early on and fast is an important element of being successful by learning and taking corrective actions. E.g. As you go into a proof of concept it may become obvious that the data is not enough to feed an ML model. As a consequence, achieving the required accuracy for business might be complex. During this situation it is recommended to think deeper on why the data does not exist in the first place. Understanding the constraints that led to the failure is important for future planning and experimentations.

Actively eliminate organizational obstacles
Transitioning to next generation manufacturing solutions involves business functions and technology functions. In addition to the regular Information Technology function with large dependency on Manufacturing Technology now the activities span not only the traditional business and Information Technology (IT) functions but in addition the Manufacturing Engineering (ME) function which in most enterprises overlooks the Manufacturing Technologies 2.

In most enterprises these functions may not move in coordination. Lot of times this is because of differing incentives. For example IT may be too focused on cost reduction, ME may be conservative and resistant to change due to pressures of keeping Manufacturing Systems running without disruption.

Leading companies make it a priority for their IT organizations and Manufacturing Engineering organizations to have incentives to drive innovation to overcome these types of barriers.

If this type of collaboration is not in place, successful proof-of-concepts or experimentations may be not further considered for production/deployment. This topic came up a lot during a recent discussion amongst a select group of companies that were asked about their experiences of transitioning to Supply Chain Transformation.

PREPARE FOR CHANGE MANAGEMENT (CULTURAL AND OTHER ASPECTS TO ADDRESS)

Behind every successful technology transition there is always a well managed change management. However recognizing the extreme disruptive nature of the technologies involved in next generation manufacturing systems (E.g. AI-ML, IOT, Cyber Physical systems) the following topics need to be planned for or have mitigations in place.

Cultural aspects

With the COVID-19 scenario being so unique, the cultures of various enterprises are being put to test in many ways. Culture is what people do when no one is watching them and we have a scenario when the majority of the workforce is now working remote for these few weeks.

While a culture that strives for perfection may be a good thing, when driving innovation it is actually an impediment. Focus first on understanding how the technology can help even though it may be imperfect. Strive for perfection only after getting a few wins accomplished with the new technology.

Human nature is such that worrying about will “I be replaced by machine?” should be assumed. Appropriate communication to alleviate these fears should be planned for especially around up-skilling. Leading companies are already planning for training including coordinating with universities and schools to help up-skilling of local workforce as well as means of generating future workforce.

As an example GE appliances have established a program with the local schools in Kentucky for upskilling of their workforce. The more receptive the workforce becomes to data and analytics driven solutions the more effective the enterprise will be. Ensuring that the interaction between man and machine is in harmony is this important.

Collaboration among functions.
As mentioned above, the topics that came up a lot in Supply Chain Transformation discussions were collaboration between different functions. Prioritizing initiatives that are seen as corporate over a department initiative usually becomes a sensitive issue. Preparing for breaking down these barriers by ensuring that incentives are aligned across organizations is important.

Ethical concerns.
Security of information being stored on the cloud is still a concern among some leaders in the industry. Taking steps to keep reinforcing the compliance of the public cloud providers. (example GCP or Google Cloud Platform). Related security and other standards are important and should not be underestimated.

Why should I change?:
Even if the company already has a well-run manufacturing plant in a low cost region, looking at the profitability impact of new capabilities provided by Supply Chain Transformation should be reviewed before concluding that no change is necessary. The KPI levels or values pre COVID-19 crisis may not be acceptable anymore with the new normal.

RECOMMENDATIONS

Based on the above the following are the recommendations for the enterprises planning their journey for transitioning to Supply Chain Transformation.

- **Focus on trends and foundational elements**
    - Avoid getting into boiling the ocean issues, not knowing where to start, focus on going about understanding each of the trends and foundational elements driving Supply Chain Transformation. Learn from those experiences and use them to refine the roadmap. Have a 30-60-90 day plan during the COVID-19 and plan ahead for the following 12 months.
    - Experiments are recommended for getting familiar with AI and ML, usage of IOT devices and data by leveraging cloud computing and cyber physical systems. Align it with the process and data and do not see AI and ML as an independent magic wand.
- **Leverage experimentation**
    - The best approach to understanding new technologies is to undertake experiments to get a better understanding of the same. The learnings from these experimental initiatives can help build ROI as well as prepare for Change Management. Define the problem statement and the ROI of the experiment so that it is manageable.

- To ensure that these experiments can help you lead down the path for a successful roadmap it is critical to get assistance from partners that can help. These partners should have both the industry and technology knowledge and can help set up the experimental initiatives for success. Ensure that the team does mainly planning for long extreme scenarios like COVID-19 due to recency effects.

- **Plan for Change Management**

  - Use the knowledge gained from understanding the new technologies and trends to build a good plan for change management. A good change management plan should address all elements, including cultural, ethical, compliance and other considerations related to these new technologies and trends. Balance emotional aspects of humans during the time of crisis as now everyone will have a balanced view to accept change, which is hard even in a normal scenario.

  - Taking the success of the experiments to actual production pilots and then adoption to broader areas within the organization. The fear of the new technologies such as AI and ML should be actively managed and mitigated. Explicitly communicating plans for up-skilling of the workforce will instill confidence in the stakeholders and workforce.

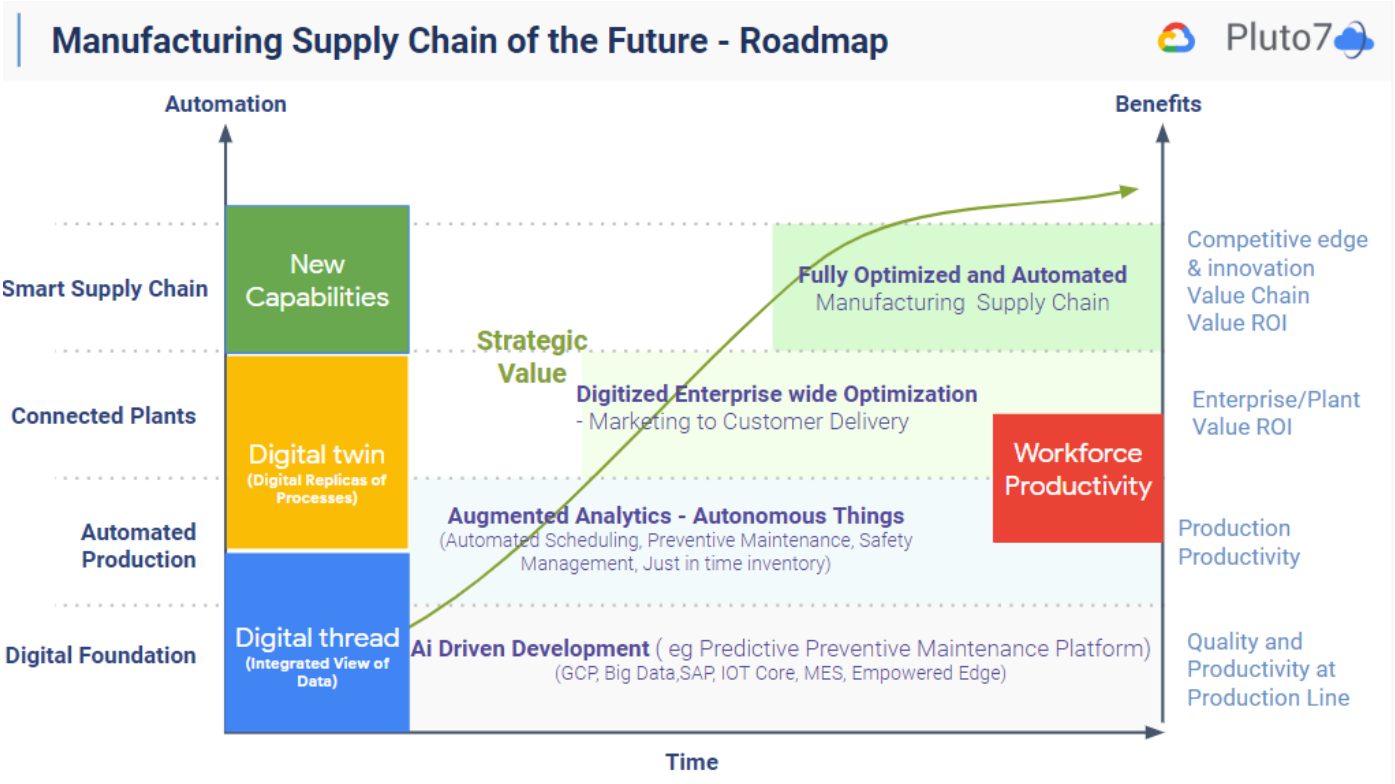
- **Avoid striving for efficiencies and perfection right away**

  - When working with new technologies it is best to focus first on getting the technology basics right, develop familiarity with it before trying to get everything in the initial deployment.

  - Focus on getting the use case(s) solved with the new technology or trend and measure the initial success or lack of obtained. Use the learnings to refine over time to further gain efficiencies in each use case. E.g. Selecting your first use case and implementing Predictive Maintenance successfully will help identify ROI at a granular level to then evaluate how to make progress towards a predictive maintenance platform.

- **Simplify Everything**
  - Look at components as process, data, systems, and people in harmony, not independently. Data is the outcome of a process which is a series of steps in a business function to achieve business goals that need active decision making. ML and AI is just a lot of math using the data to help you make better decisions. Simplify your message on data.

- Exponential technologies are hard for most people to comprehend. E.g. Cloud, ML are exponential technologies. Simplify your description of these technologies so that everyone understands it.
- Simplify your journey with an actionable plan that the enterprise sees themselves championing it and which they know is achievable and helps them progress as a business function and as their own career.
- Scenario planning at all levels in your supply chain network which includes vendors, partners and suppliers is key to assess your business impact during supply chain disruptions. Ensure that you bring in the data into one place so that scenario planning is even possible. Centralizing data in a cloud like Google Cloud is a good logical step. This is shown in Figure 2 below:



Recommended Reading

[Manufacturing Industry Scenarios in 2023: Find the Right Things to Do, and Do Them Faster and Better]

[Control Tower Solutions with Google Cloud]

[Manufacturing Industry Scenario 2023: Drive Innovation With Data]

[Manufacturing Industries Digitalization Primer for 2019]

[Predicts 2018: Industrie 4.0 and Advanced Manufacturing]

[The Importance of OT Integration for Industrie 4.0]

[Digitizing supply chain operations with machine learning, analytics, and the Internet of Things]

Acronym Key and Glossary Terms

Manufacturing 4.0	The latest manufacturing industrial cycle, previous ones being powered by steam engine, electricity and computer technology respectively
Ai	Artificial Intelligence
ML	Machine Learning
IOT	Internet of Things
GCP	Google Cloud Platform
ROI	Return on Investment
MT	Manufacturing Technology
IT	Information Technology
ME	Manufacturing Engineering
KPI	Key Performance Indicator
Digital Thread	Digital platform that helps consolidate data and provide 360 view of an entity
Digital Twin	Digital replication of a process that is done by human beings or combination of human beings and automation

Evidence

The analysis and advice provided in this document are built from constant scanning of the market, as well as the aggregation of analyst experience and ongoing interactions with end users and technology and service providers. We have used a range of sources, including:

- Pluto7 customer inquiries and briefings with end users and service providers, in particular with Pluto7.
- Discussions between Pluto7 analysts with expertise in change management.
- References to Gartner Papers and discussions with Gartner Analysts
  - From Predicts 2018 for Manufacturing 4.0
  - From The Importance of OT Integration for Industries 4.0

Note :

People who have helped with their valuable insight and discussions

- Jen Bennett - Office of the CTO (Manufacturing Industry) - Google
- Adam Spunberg - Director of Tech Supply and Innovation - ABinBev
- Ben Lavoie - Senior Director of Tech Supply and Innovation - ABinBev
- Charles Tisdell - Director of Tech Supply and Innovation - ABinBev
- Greame Cochrane - Director - ABinBev
- Matthew O'Connor - Office of the CTO - Google
- Chris Armbruster - Gartner (Focus panel chair on Mfg 4.0 Group Discussion at Live Americas 2019)
- Kate Lyubimova - Gartner (Focus panel chair on Mfg 4.0 Group Discussion at Live Americas 2019)