Deloitte.

ASSOCIATION FOR SUPPLY CHAIN MANAGEMENT

REVISION 6 – AUGUST 31, 2020

Digital Capabilities Model for Supply Networks

A Deloitte-ASCM Collaboration

Overview

Overview

Building a Digital Capabilities Model for Supply Networks

to address traditional challenges in a world disrupted by technological advances that are driving value for organizations

Traditional Challenges Remain …

- The bullwhip effect has been plaguing supply chain operations for millennia, magnifying variability from customer to supplier by up to 50 times
- Poor end-to-end visibility has led to buffers and safety stock at every stage in the supply chain, ending the quarter hockey stick effect
- Functional silos and misaligned incentives in organizations have decoupled planning and execution, causing unwarranted delays

… in a Changing World …

EXPANDING DEMAND
Humanity and economies continue to benefit.

- **$63T** Projected global consumption by 2025, jumping from **$38 trillion in 2010**
- **35M** Number of Americans now aged 65 or older, more than **10 times that of 1900**

NEW TECHNOLOGIES
The toolbox for innovation is growing.

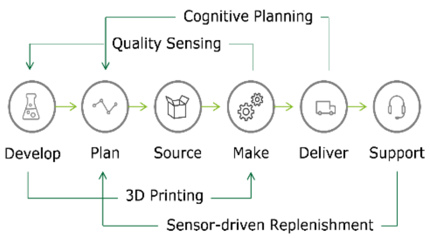
- Augmented and virtual reality
- The internet of things (IOT)
- Artificial intelligence
- Cloud computing

HYPER CONNECTIVITY
Human and machine ecosystems are on the rise.

- **30B** Number of objects expected to be connected to the IoT by 2020
- **5.5M** Number of new things that were connected to network infrastructure each day in 2016

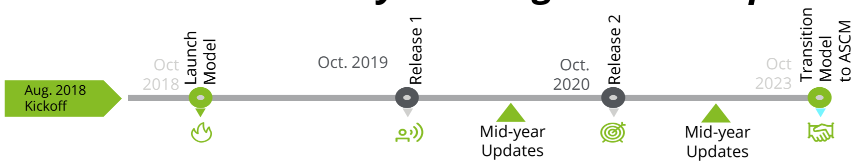
Traditional physical-digital boundaries are blurring.

… Demanding a Transformation …



DSNs allow us to move from sequential chains to concurrent networks.

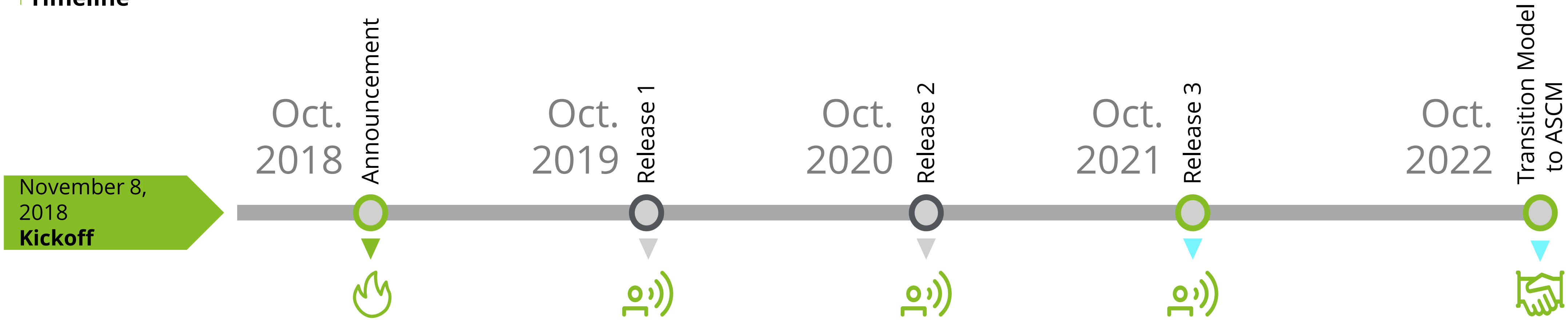
… Powered by a Strong Partnership



- Deloitte and ASCM will collaborate to define the next generation of a Supply Network Capability Model adapted to the digital era.
- The model will represent Capabilities that transcend physical-digital boundaries and include the people, processes and technologies needed to be competitive in the digital age.
- Deloitte and ASCM will incrementally develop and release components of the model over a five-year period

Timeline for the Collaboration between Deloitte and ASCM

Timeline



Possible future enhancements:

Absorb SCOR model into the DSN Capability Model

Level 2 Capability enhancements

Industry-specific pilots

Industry-specific releases

Level 2 Capability enhancements

Enterprise integration with finance, marketing and others

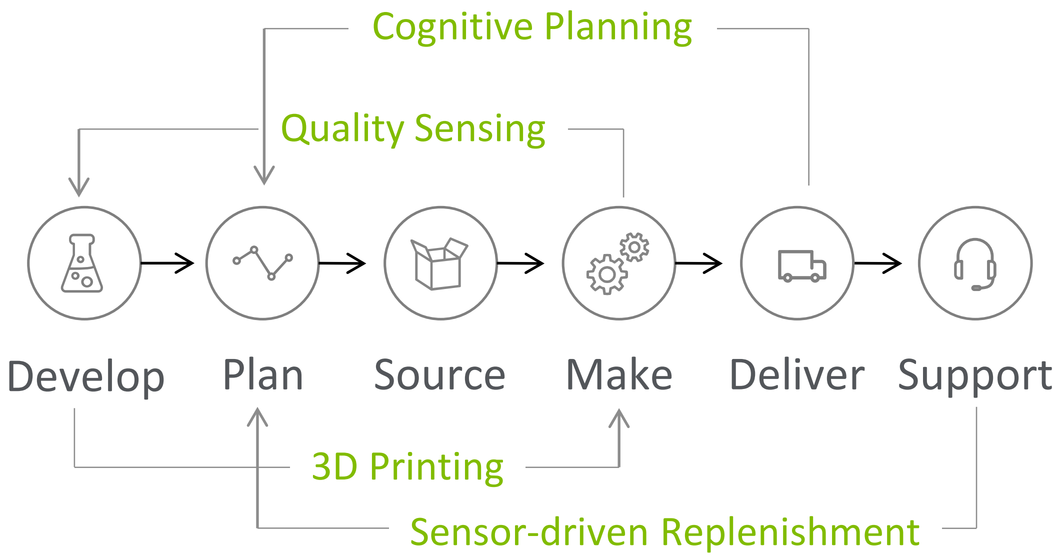
Final, controlled enhancements

OBJECTIVES

Changing Paradigms

The SCOR model served the industry well, but was not built to withstand todays disruptions calling for a new paradigm

Traditional Supply Chains



Supply Chain Operations Reference (SCOR)

A Process Decomposition based model to describe a traditional linear supply chain

Digital Supply Networks

Digital Capabilities Model for Supply Networks (DCM)

A model based on Capability Building Blocks

Overview

Level-1 and Level-2 Capabilities

Model Principles

- The model starts from level-1 Capabilities, which are depicted in the six nodes of the graphic on the left.
- Each Capability has close ties with every other Capability, as portrayed by the relationship lines.
- Every level-1 Capability has a series of level-2 Capabilities, which provide the exact content an organization needs to operate as a digital supply network.
- The model will described all level-1 and level-2 Capabilities in detail.

Content Elements for Level-1 and Level-2 Capabilities

The following content elements can be found for all Capabilities.

Level-1 Capability

- Capability definition and vision
- Overview of level-2 Capabilities
- Journey map
- Personas

Level-2 Capability

- Level-2 Capability overview page
- Relationships with other level-1 Capabilities
- Relationships with Digital Disciplines
- Capability maturity models (Internal Release)

From a Supply Chain to a Supply Network

A Different Way of Thinking …

Whole-Systems Thinking
Actively breaking down barriers between functions to enable a digital supply network with truly integrated processes between different business functions

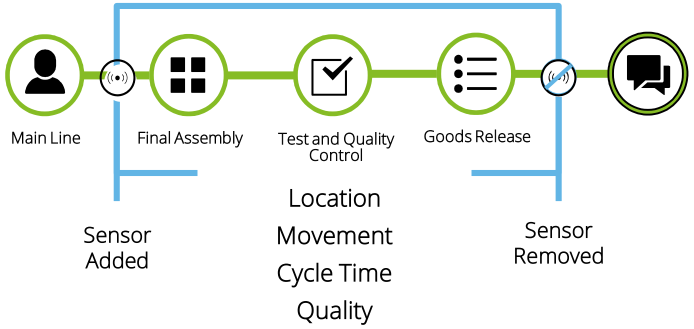
Enterprise Optimization
Going beyond silo-based optimization to drive end-to-end functional optimization connecting manufacturing operations to warehouse operations and transportation

Digitally Enabled
Correctly leveraging technology to collaborate inside of the organization, sharing one plan for record, and outside of the organization with customers and suppliers as one integrated digital supply network

… Unlocking new Capabilities

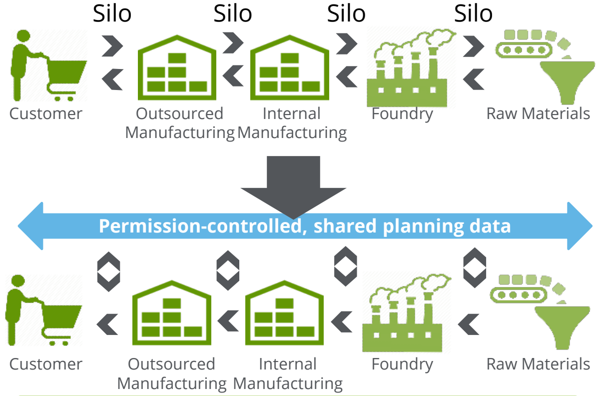
From smart factories

Location Beacons Provide Predictability.



through integrated valuechain planning

Shift from Sequential Planning …



… to Concurrent Planning.

to supplier collaboration

Digitally Shorten the Lines of Supply.

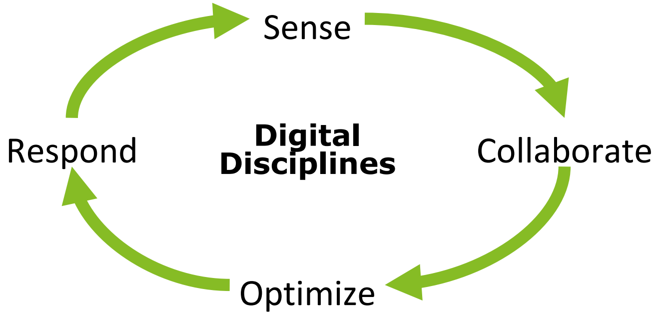
Sense multiple tiers upstream to understand supply capacity and disruptive events and predict their impact.

Improve collaboration by removing sources of verification and payment delays by implementing smart contracts that execute based on preapproved conditions.

Optimize inventory levels by using actual delivery performance data to dynamically adjust safety stock levels.

 |

Digital Disciplines



Digital Discipline	Description
Sense	In traditional supply chains, sensing often was equated to the activity of demand sensing. In the Digital Capabilities Model for Supply Networks, sensing is a much broader discipline, covering such critical aspects as supplier risk and performance, customer sentiment, factory performance, and employee satisfaction. Today's hyper-connectivity provides digital supply networks (DSNs) with the ability to identify and act on everything from demand drivers in driver-based forecasting models to supplier risks based on their systemic market performance or from one-off events, such as storms, that could impact shipments and deliveries.
Collaborate	The concept of collaboration is central to DSNs. Collaboration inside the organization, facilitated by improved data visibility as one source of the truth, and improved collaboration technologies, from phone to email to chat to corporate social media, allow a large organization to have the collaboration agility of a startup. Externally, although customers and their suppliers have always collaborated piecewise, DSNs take this steps further and enable concurrent and transparent engagement across multiple nodes in a network.
Optimize	Supply chains and networks serve the broader enterprise objective of optimizing performance, which entails some combination of short- and long-term balance of shareholder, customer and employee satisfaction. Once the domain of operations research departments that were one step removed from the actual operations, optimization capabilities, which are enabled by a range of computing, communication and storage technologies, now are embedded in the systems that are used daily by supply chain professionals as they perform their day-to-day responsibilities. And with today's computing power, augmented by artificial intelligence capabilities, optimization is no longer limited to portions of the supply chain, such as planning. Rather, we are beginning to see powerful examples of cross-domain optimization, such as material buys with inbound transportation and much tighter solve integrations between supply chain and financial goals.
Respond	Respond is about putting decisions into action. After a company senses a situation, collaborates with stakeholders and comes up with an optimal solution, it must execute on the decision. More and more, our digital and physical worlds are connected, and, with the literal click of a button, today's supply network professionals have the ability to turn a plan into a series of orders, work instructions or other actions that trigger operations on the physical product, software or service.

Overview

Deloitte.

Synchronized Planning

Synchronized Planning

Definition and vision

Definition: The Synchronized Planning Capability drives an organization to plan and align the entire value network to a set business strategy. This Capability ties the enterprise's strategic goals and financial objectives with its tactical and operational plans. This results in **an integrated business plan**, **improved cross-functional decision-making**, **enhanced customer service**, **an agile supply network**, **efficient resource usage** and **improved financial performance.**

Vision: Digital Supply Networks leverage Synchronized Planning to proactively predict and shape demand, position supply, source materials and services, respond to disruptions, plan finances, organize talent, allocate capacity, and schedule production for the overall network. The Capability ensures cross-functional collaboration and strategic synchronization across the entire value network to one desired outcome while adapting to changing market conditions and evolving customer needs.

Synchronized Planning

Overview of level-2 Capabilities

	Intelligent Demand Management	Responsive Demand-Supply Matching (RDSM)	Dynamic Flow Optimization	Enterprise Plan Reconciliation
Definition	The ability to **anticipate and shape** baseline **demand** and promotional lift using data science methods that account for historical demand cycles; trade promotions, including channel incentives and pricing changes; customer preferences; and economic and environmental factors	The ability to **sense demand exceptions, revenue opportunities and supply challenges through the orchestration of supply** across the network and prioritize the allocation of supply to best meet demand according to the business strategy	The ability to enable **material positioning and product flow** in the supply network to maximize **profitability**, margin and **service** through routing, procurement and inventory levers	The ability to **integrate strategic goals, financial objectives and tactical operation plans** seamlessly through cross-functional alignment
What's New	• A shift to faster demand-modeling techniques that continuously learn from forecast modifications and corrections based on past forecast performance and current business intelligence • Use of machine-learning techniques to identify difficult-to-find relationships between demand variables • Automation of demand-sensing techniques based on external data sources, such as point-of-sale, social chatter or weather data	• Real-time visibility into supply disruptions and unmet demand, allowing planners to respond with backup plans or alternate sources of supply • Automated decision-making and replanning capabilities enabled by scenario-planning capabilities that model demand-shaping opportunities, inventory rebalancing, alternate product allocation and even market opportunities	• Material flow based on transportation, replenishment and inventory trade-offs, optimized for the lowest total landed cost • Ability to set self-learning replenishment and inventory triggers maximizing profitability • Determine flow changes based on variability • optimized production schedules that consider network-wide capacity and inventory levels to reduce overall inventory levels and better serve customer demand.	• Scenario-planning assessment of options to fill gaps to the financial plan • Automated plan reconciliation tying dollar and unit plans at different hierarchy levels, such as sales by account, marketing by product category, or finance by profit and loss • Increased visibility into financial plan performance, as a measure of revenue, operating margin and asset efficiency, with a top-down and bottom-up view • Clear translation of unit-based plans to dollar-based forecasts

Synchronized Planning

Overview of level-2 Capabilities

	Portfolio Life Cycle Planning	Supply Network Design
Definition	The ability to **grow, sustain and optimize product portfolios**, including packaging and service, through measures of portfolio health, such as product productivity; supporting launch and phase-out roadmaps; and alignment with commercialization plans, including brand and packaging plans	The ability to design and rationalize the supply network, **optimizing for** the **required service level at the lowest total landed** cost. Also includes managing long-term capacity decisions based on strategic decisions and investment plans
What's New	• Identification of warning signals in product development life cycles driving an improved launch predictability • Improved efficiency in tracking launch signals and deploying contingencies through faster feedback loops • An ability to drive end-of-life planning using a productivity analysis approach that integrates productivity facts into commercial and brand strategy discussions	• A data-driven process for analyzing the impact of facility location based on customer service considerations, cost, geopolitical risks, tax incentives, and regulatory and customer preferences • Sustainability measures to monitor and correct the impact of transportation modes, facilities and suppliers

CAPABILITY DEFINITION

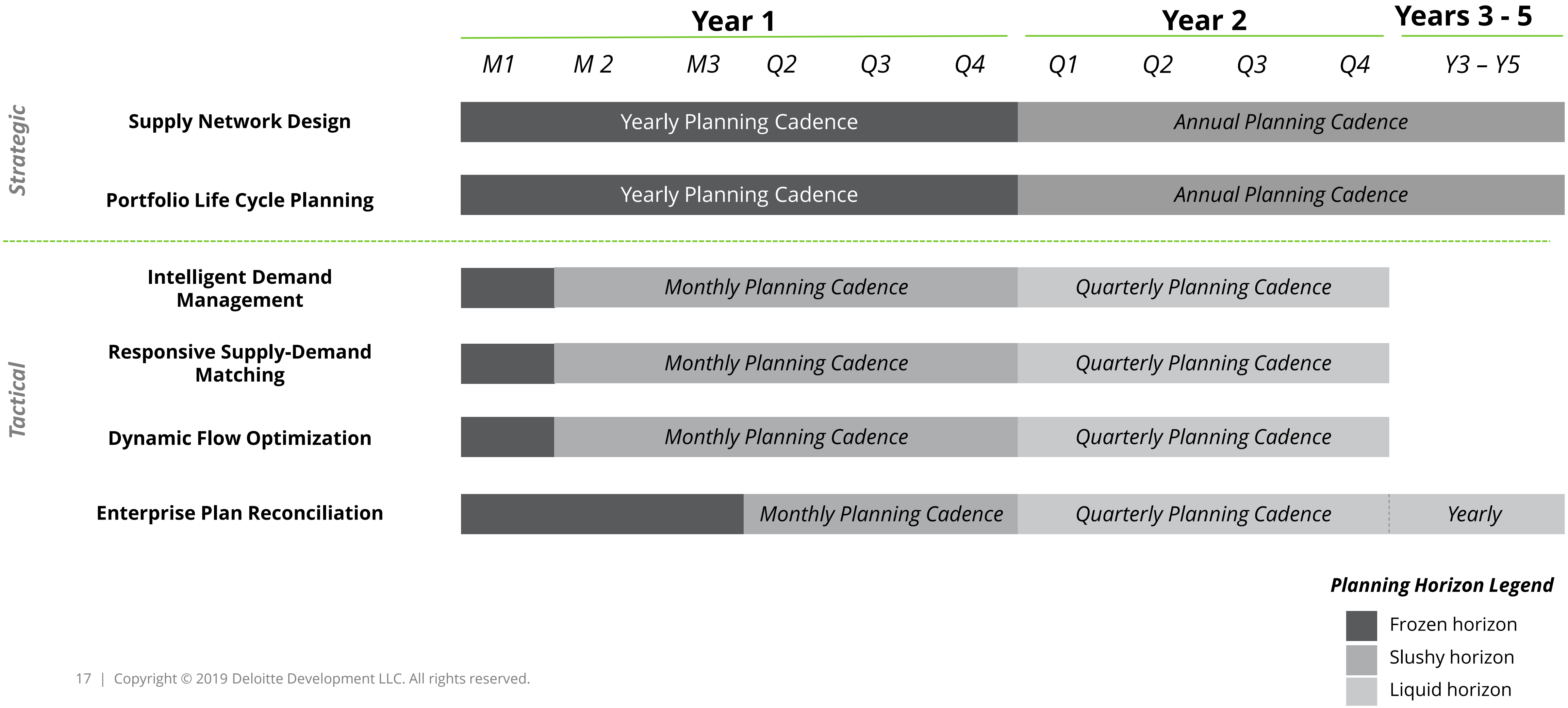
Synchronized Planning

Illustration

A supply network with a one-month lead time from supplying node to demand-planning node

Note: *Planning horizons vary by industry and sector lead times.*

Rolling horizon map



Synchronized Planning

Capability maturity

Dimension	Ad-hoc	Typical	Advanced	Leading
Intelligent Demand Management	Organizations have aggregate product family forecasting, primarily from historical data, with limited data cleansing, demand classification and product-performance visibility.	Organizations have a detailed product family time series–based algorithmic forecast, with inconsistent historical cleansing, demand categorization, assumption tracking and driver monitoring.	Organizations employ top-down and bottom-up forecasts that integrate drivers across functions, with disaggregation down to products. Scenario analysis is limited.	Network forecasts are disaggregated to each network node and product; integrated across functions; and, on a cleansed data model, allow for scalable scenario analysis. Organizations incorporate advanced data science methods that consider non-traditional variables such as economic and environmental factors for forecasting.
Responsive Supply-Demand Matching	Independent silos react to demand with remediation planning that is controlled by each individual planner. Most organizations use a short planning horizon with a just-get-by approach.	A consensus-based demand and supply plan drives operations. Organizations have a limited ability to react to variance from consensus.	Robust processes are established to identify key business disruptions. Organizations have an ability to predict and sense failures and disruptions, allowing for quick, dynamic replanning and deployment. Planners are supported by a system-based what-if scenario-planning capability.	Organizations proactively resolve supply-demand mismatches through the use of system-generated alerts. System-generated recommendations for course of action with weighted pros and cons help assess risks and opportunities. Planner decisions are real-time, data enriched and fact based.
Dynamic Flow Optimization	Organizations have reactive order fulfillment that is based on orders from customers. Orders are fulfilled on a first come, first served basis without other considerations. There is no formal demand or flow prioritization, inventory positioning strategy or postponement strategy.	Normal replenishment is based on the requested delivery date for product and material flow. Organizations have limited capabilities to plan alternate locations or routes for products.	Organizations use a rules-based methodology to proactively position material and product inventory and have near-real-time visibility into inbound shipments. An alert-based mechanism indicates off-schedule shipments and the availability of alternate material and products.	Automated make and transfer recommendations position materials and products most profitably to proactively meet demand due dates through flexible shipment methods, inventory replenishment and production levers.

Synchronized Planning

Capability maturity

Dimension	Ad-hoc	Typical	Advanced	Leading
Enterprise Plan Reconciliation	There is a lack of data visibility and availability for modeling, which delays or prevents appropriate cost avoidance and mitigation. Plans are not reconciled. Organizations have a reactionary outlook for preventing supply shortages and enabling maximization of revenue.	Volume-based demand plans and supply capabilities are aligned. A financial plan is developed as an outcome of those two plans.	Organizations reconcile all financial, operating and demand-planning information. Profitability is driven through margin-maximizing demand and supply decisions.	Strategy drives decisions, which cascade down across all operations and finance activities. Organizations employ extended financial forecasting, governance of plan changes and reporting through top-down and bottom-up views. They also use automated reconciliation of certain plan elements, such as supply and demand.
Portfolio Life Cycle Planning	There is no stable environment for new product development or product discontinuation. Planning tends to be ineffective, communication is limited, and there is a lack of reaction-driven commercialization mechanisms.	Organizations have well-documented and -integrated product development and product discontinuation processes as well as clear visibility of cost, schedule, product quantity and product quality performance.	Organizations have established, robust metrics about products and processes. A predictable development process reduces time-to-market for new product development. Metrics support predicting the end of commercialized products' life cycles and reducing write-offs.	Organizations have cost-optimized product development and end-of-life processes with a focus on continuous process improvement. Innovative methods use data science to drive predictions of product performance.
Supply Network Design	Supply network nodes are in place from legacy demand and decisions. Organizations tend to have an incorrect amount of or incorrectly placed supply facilities.	Organizations have a reactive supply network with unnecessary buffer capacity in network nodes and hard-wired routes with limited flexibility.	Organizations have a responsive supply network aligned to supply chain and commercial strategy, with auto-resizing based on forecasted product flow needs in the network.	Nodes and channels are built or developed with service-level strategy and optimized for total landed cost across the value chain. Data science techniques suggest alternate network designs that planners can easily evaluate through real-time what-if scenario analyses and network simulations.

Synchronized Planning

Profile: Sarah, network planner

Overview

Sarah is a young professional with a few years of supply chain experience. She oversees the supply network for a consumer packaged goods product line and relies on technology and advanced analytics to indicate where she should focus resources to deliver an improved customer experience at the right cost.

Education

University of North Carolina

- Bachelor of Arts in business administration
  Major: Operations management
  Minor: Information systems management

Certifications

- APICS Certified in Supply Chain and Inventory Management

Experience

Current position

- Network planner for a $0.7 million product line

Sarah starts her day checking for any new alerts from a cloud-based application that uses advanced analytics and machine learning to identify issues that need human intervention. She evaluates the risks of potential supply disruptions and their impacts to the business and decides on the best course of action. For issues with higher impact, she leverages the easy-to-use scenario-planning tool to evaluate all her options and prepare a recommendation for the leadership team.

Previous positions

- Senior demand planner
- Sales intelligence analyst

Synchronized Planning

Profile: Sarah, network planner

	Arrival	Morning	Midday	Afternoon	End of Day
Before implementing the principles of Synchronized Planning, Sarah spent most of her time reacting to short-term supply network issues with limited visibility to upstream and downstream impacts.	Sarah arrives at work to find her inbox full of emails regarding the latest firefight. As she begins to plan her day, she receives a call from Sales. Sales says the forecast needs to be adjusted for SpudMart, the largest customer.	Sarah goes into the forecasting system to update the forecast based on her limited understanding of the factors impacting demand. She analyzes history but is not able to decipher many insights.	Just as Sarah is about to take her shot at adjusting the forecast, she receives a call from Operations stating that SpudMart oversold its forecast and orders are beginning to exceed current inventory levels.	Sarah knows that SpudMart is an important customer, so she calls Transportation to expedite inventory from another location. She doesn't have time to analyze the cost implications but asks Operations to work as quickly as possible.	In the afternoon, Sarah receives a call from Finance. The inventory movement apparently cost more than she expected. In addition, she learns that, because of her decision, another customer, WidgetMart, is now being shorted.
After implementing the principles of Synchronized Planning, Sarah focuses on resolving future exceptions before they arise. She works with a system-suggested proposal as a starting point and augments it with her experience and intuition to most profitably fulfill demand.	Sarah arrives at work, grabs a cup of coffee and reviews the exception report. In this report, she is able to specifically pinpoint future operational concerns throughout the supply network.	The report highlights SpudMart's forecast, which shows recent variance from plan. In addition, the system also senses a spike in point-of-sale volume at SpudMart and the high probability of insufficient inventory to meet demand. Sarah and her Finance counterpart run an in-system scenario analysis to pick a proposal to increase the forecast and relocate inventory from another location with potential excess, only minimally impacting contribution margin.	Sarah logs in to the commercialization and end-of-life dashboard. In this dashboard, she is able to collaborate with the Engineering and Design teams to understand upcoming launches. Simultaneously, she collaborates with other supply network team members to fully assess the health of recent product launches, including forecasts and financial performance. This collaboration helps ensure maximum portfolio margin capture.	In the afternoon, Sarah attends a briefing about the organization's latest supply network design efforts that affect her product line. She attends the meeting to provide quantitative supply network insight regarding a new distribution center that has been optimized based on total cost. Meeting attendees analyze the network holistically and decide that an upgraded distribution center in Atlanta would reduce total network landed cost and offer a payback of one year.	Sarah's last check of the day is to analyze financial performance of the products she manages, as supply, demand and financial plans all are seamlessly reconciled. Inventory levels in the network are automatically generated accurately based on demand, so Sarah is able leave the office an hour early and rest assured that inventory will be in the right position for execution for the next three months.

Intelligent Demand Management

Definition and objectives

Definition:

The ability to **anticipate and shape** baseline **demand** and promotional lift using data science methods that account for historical demand cycles; trade promotions, including channel incentives and pricing changes; customer preferences; and economic and environmental factors

Why Digital Supply Networks:

Traditionally, developing an enterprise-wide forecast is characterized by time-consuming, manual processes, such as aggregating and cleansing data, gathering feedback from business owners, and testing various hypotheses to inform decision-making. This decreases the pace at which decisions are made and reduces the organization's ability to develop accurate forecasts. In a digital supply network, the ability to anticipate demand is enhanced by the

- ability to use data science methods such as machine learning to **find new relationships between variables** and **parse large disparate data sets**
- ability to use an **automated demand-sensing approach to incorporate external and previously unconsidered data sources**, such as point-of-sale, social chatter and weather data
- ability to **continuously learn** based on **forecast modifications** and forecast performance in terms of forecast accuracy and forecast bias
- ability to generate **probabilistic range forecasts** that enable improved stock levels within the distribution network
- ability to **identify causal linkages** in the forecast error, allowing organizations to better understand and **quantify revenue loss** due to an incorrect forecast and associated drivers

Intelligent Demand Management

Definition and objectives

Drivers for Change:

- Traditional forecasting is disconnected, slow, reactive and a burden for organizations. Forecasting typically has high error rates and relies on rudimentary driver analyses, such as prior-year history.
- Organizations struggle to attract, retain and nurture the statistical and supply chain skills required for forecasting. Statistical models often poorly maintained because of this.
- Increasingly complex environments favor those who can rapidly adapt and identify early warning signs of inflections and forecast variances.

Example:

Leverage data science methods, such as machine learning, to recommend forecast adjustments that boost forecast accuracy and forecast value add*. In the past, planners would painstakingly adjust statistical baseline forecasts and manage consensus forecast overrides after manually tracking successful and unsuccessful forecast adjustments to detect the best periods to review candidates for overrides. However, automating this process with machine-learning capabilities takes away the manually intensive effort described above and, more importantly, guides the planners to adjust forecast. In this case, adjustments include where and by how much to adjust the forecasts and are completed by either raising or lowering the baseline statistical forecast. As a result, planners focus only on those products in the hierarchy and periods that would add the most value from their overrides.

*Forecast value add: The change in a forecasting performance metric, such as forecast accuracy, that can be attributed to a particular step, such as forecast adjustment in a consensus meeting, or participant, such as a planner, in the forecasting process.

Intelligent Demand Management

Relations with other level-1 Capabilities

Digital Development	Analogous forecasting or like analysis, diffusion modeling or base modeling, and composite curves are some of the common statistical techniques used to forecast new product demand. The key consideration for all of these techniques is to validate the level of innovation, market conditions and assumptions that are applicable to the type of new product, such as an original product, a product improvement, a line extension, a market extension or a new product category.
Dynamic Fulfilment	Customer behavior drives forecast improvements to help organizations proactively adjust fulfillment plans and product allocation. This improves inventory efficiency, lead time, working-capital utilization, transportation and delivery costs, and customer service levels.
Intelligent Supply	Changes in demand have an impact on component requirements and scheduling, which need to be communicated to suppliers through Intelligent Supply. Seamless transmission of demand plan changes to suppliers will reduce the risk of component shortages and help run the production execution process more predictably.
Smart Operations	As demand patterns and trends are sensed, the demand signal needs to be quickly translated to supply. This can take the form of potential changes to factory scheduling in order to meet reprioritized customer needs.
Connected Customer	Active collaboration with customers and customer service allows planners to understand the drivers behind a customer’s purchasing decisions. These drivers inform the planner’s demand forecast, especially demand lift from promotional activity; seasonality of demand; and changes in points or channels of purchase, such as store counts.

Intelligent Demand Management

Impact of digital disciplines

Sense	• Reduces the latency of sensing inflections in the demand by leveraging external data-gathering technologies. This enables early identification of disruptions and their potential effects on distribution and inventory targets.
Collaborate	• Enables more effective communication among the business, finance and planning functions so that stakeholders can spend more time making decisions and planning on contingencies based on forecast output. Enhanced forecast transmission to suppliers allows for improved external collaboration.
Optimize	• Improves forecast performance by optimizing the parameters of various forecasting algorithms used. Self-learning algorithms enable a scientific approach by using artificial intelligence judgments to improve decision-making precision and subtlety.
Respond	• Translates the demand signal to supply once demand patterns and trends are sensed. This can take the form of distribution targets at the distribution center, manufacturing and inventory targets, and supply requirements.

Intelligent Demand Management

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Synchronized Planning	Intelligent Demand Management	Forecast Error	Forecast Error	%	Yes	Service	Measures the difference for the forecast and actual value, for example as a percentage error	MAPE = (ABSOLUTE(Sum actuals - Sum of forecast) / Sum actuals) * 100%
Synchronized Planning	Intelligent Demand Management	Forecast Value Add		%	No	Service	Measures the change in forecast efficiency over time	Theil's Statistic: Sum (((F-A)/At-1)2) / Sum(((A-At-1)/At-1)2)
Synchronized Planning	Intelligent Demand Management	Sell-in Rate		%	No	Efficiency	Measures the rate and efficiency of selling in products into customer facing locations	# of units sold to customer facing channels / # of units in starting inventory
Synchronized Planning	Intelligent Demand Management	Sell-through Rate		%	No	Efficiency	Measures the rate and efficiency of selling products to the end customers	# of units sold to end customer / # of units in starting inventory in customer facing channel

Intelligent Demand Management

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Synchronized Planning	Intelligent Demand Management	Forecast Bias	Demand Bias	%	No	Service	Calculates the signed forecast error measuring consistent over/ under forecasting.	((Sum actuals - Sum of forecast) / Sum actuals) * 100%
Synchronized Planning	Intelligent Demand Management	Forecast Accuracy		%	Yes	Service	Measures the amount of error in a forecast compared to its actuals	Forecast accuracy = 1-MAPE
Synchronized Planning	Intelligent Demand Management	Forecast Volatility	Demand Variance / Coefficient of Variation (COV)	%	No	Service	Measures the percentage of variation around the arithmetic mean of a series and commonly used as a measure of volatility in demand to assess the predictability of a demand pattern, that is, how well it can be forecasted. If COV >1.0, it can be said that variations in demand are high, and thus, statistical techniques should not be applied without further review.	Coefficient of Variation = Standard Deviation / Mean

Intelligent Demand Management

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Synchronized Planning	Intelligent Demand Management	Tracking Signal		#	No	Efficiency	Tracking signal is used to measure persistent bias - either under-forecasting or over-forecasting	Ratio of the cumulative sum of forecast errors (the deviations between the estimated forecasts and the actual values) to the mean absolute deviation. Mean absolute deviation is ratio of the cumulative absolute sum of forecast errors (forecast & actual values) to the number of periods

Responsive Demand-Supply Matching (RDSM)

Definition and objectives

Definition:

The ability to **sense demand exceptions, revenue opportunities and supply challenges through the orchestration of supply** across the network and prioritize the allocation of supply to best meet demand according to the business strategy

Why Digital Supply Networks:

Today's planning processes are too slow to detect and respond to impending supply disruptions and capitalize on revenue opportunities. RDSM provides planning teams with monitoring signals on a real-time basis as a call to action and the tactical ability of exception planning, which can help achieve fulfillment of demand on time and in full. This Level 2 Capability includes automated decision-making in case of supply or demand disruptions, such as

- market share capture opportunities, such as a chance to fill a void left by a competitor with a supply disruption or a chance to adapt to some other type of market change
- revenue exceptions, such as demand-shaping that can be employed when a company is short to target
- order exceptions, for example an order in danger of being delayed
- inventory shortfalls, including insufficient or obsolete inventory
- working capital exceptions, such as excess inventory that leads to higher working capital.

Responsive Demand-Supply Matching (RDSM)

Definition and objectives

Drivers for Change:

- Products and services are increasingly customized and delivered when and where the customers want them.
- Different supply responses exist for micro-customer segments.
- Cycle times are shorter, which, in turn requires workflow automation and shifting the role of the planner to a more strategic focus.

Example:

If the commercial, or demand, side of an organization has identified a significant revenue opportunity not previously planned for, the supply side of the house will do its best to quickly source the supply needed. Similarly, if the supply side identifies sudden and unexpected excess inventory of a certain product, the commercial side of the house needs to quickly put together sales programs to drive sales.

Responsive Demand-Supply Matching (RDSM)

Relations with other level-1 Capabilities

Digital Development	RDSM utilizes Digital Development to proactively identify root cause product defects and recall risks. It also identifies real-time opportunities for fast new product and promotional item introduction by leveraging Digital Development to increase speed to market.
Dynamic Fulfilment	Sensors on connected shelves track inventory and its perishability in real time. Inventory levels are automatically transmitting demand signals using point-of-sale data and advanced analytics. Routing and delivery schedules update to react to real-time changes in demand.
Intelligent Supply	Supplier networks are integrated with demand-planning forecasts. Real-time information exchange with suppliers allows companies to react to shifts in the marketplace, including requirements changes, optimized inventory level updates, demand changes and more.
Smart Operations	Smart Operations is the Capability to influence production based on in-market signals. This offers real-time visibility into a production site’s ability to react to changes in supply and demand within the time horizon.
Connected Customer	Companies need to respond to always-connected customers.

Responsive Demand-Supply Matching (RDSM)

Impact of digital disciplines

Sense	• Senses demand in real time at the point of sale to the end consumer and cascading reactions throughout the supply network • Actively senses the health of supplier relationships and sets up programs that improve supplier health. This includes financial terms, order policies, and transportation and freight requirements. • Monitors the condition of in-service equipment to determine when maintenance should be performed and the associated components should be ordered. This also is known as predictive maintenance.
Collaborate	• Coordinates other supply network abilities and business functions to operate in a synchronized manner • Integrates supplier operational processes with the business to proactively respond to business demands in the supply network
Optimize	• Reconciles demand and supply plans at a tactical level and optimize levels of production based on a total cost perspective, taking into account all demand opportunities and pricing strategies • Makes operational decisions based on profitability, including relative customer and product profitability, and lead-time sensitivity of customers
Respond	• Uses business events such as demand or pricing changes to help the company make quick, informed decisions through considering what-if alternatives • Automatically evaluates scenarios from multiple angles, including profitability, market-share impact, cost to serve, asset availability and others, and recommends the best course of action

Responsive Demand Supply Matching (RDSM)

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Synchronized Planning	Responsive Demand-Supply Matching	Adherence to Service Level Agreement		%		Service	Outlines the actual delivery date of the customer order relative to the Service Level Agreement (SLA) standards established with the customer. Note that the SLA is typically based on market expected lead time standards for particular channels and products.	(No. of Orders Delivered within SLA Time ÷ No. of Total Scheduled Orders) * 100
Synchronized Planning	Responsive Demand-Supply Matching	Adherence to Customer's Requested Date		%		Service	Outlines the actual delivery date of the customer order (based on INCO terms) relative to the customer requested date.	(No. of Orders Scheduled to Customer Request Date ÷ No. of Total Orders Scheduled) * 100
Synchronized Planning	Responsive Demand-Supply Matching	Customer Backorder Rate		%		Efficiency	Measures number of customer order lines that have not been fulfilled by the expected delivery date.	(Number of Customer Orders Delayed due to Backorder / Total Number of Customer Orders Placed) * 100

Responsive Demand Supply Matching (RDSM)

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Synchronized Planning	Responsive Demand-Supply Matching	Total Supply Shortage		#	No	Service	Measures the condition where the quantity demanded is greater than the quantity supplied. This is the measure across the entire network.	Shortage = Quantity demanded (Qd) - Quantity supplied (Qs)
Synchronized Planning	Responsive Demand-Supply Matching	Turn-Earn Index		#	No	Efficiency	Measure of the combination of gross margin and inventory turnover; logic behind this metric is to keep high inventory turnover for SKUs or brands generating low margins and satisfy medium to low ITR for a high margin SKU	Inventory Turnover * (Gross Margin %) * 100
Synchronized Planning	Responsive Demand-Supply Matching	Adherence to Original Promise Date		%		Efficiency	Outlines the actual delivery date of the customer order relative to the original promise date.	(No. of Orders Delivered by Promise Date ÷ No. of Total Orders Delivered) * 100

Responsive Demand Supply Matching (RDSM)

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Synchronized Planning	Responsive Demand-Supply Matching	Supply Network Cost Variance		$	No	Cost	Measure of supply network cost versus actual cost of operating the network	Cost (period n) - Cost (period n-1) Budgeted cost - Actual Cost
Synchronized Planning	Responsive Demand-Supply Matching	Supply Plan Variance		%	No	Service	Measures the difference between an expected supply value and the actual supply value. Supply plan variance can be related to manufacturing, Purchase or transit quantity.	Supply Plan Variance = Absolute(Scheduled Production Quantity - Actual Production Quantity) / Scheduled Production Quantity
Synchronized Planning	Responsive Demand-Supply Matching	Total Supply Network Landed Cost (per business category)		$	Yes	Cost	Measures the costs to source a single item shipped in a container up to the moment it is received by customer	((Sum actuals - Sum of forecast) / Sum actuals) * 100%

Responsive Demand Supply Matching (RDSM)

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Synchronized Planning	Responsive Demand-Supply Matching	Scrap Write Off		$	Yes	Cost	Calculates the inventory that would not be able to generate any value due to any salvage or scrap value. Scrap is written off when it is determined that there is no further use of the inventory.	Average Selling Price of SKU/Material - Depreciation Costs
Synchronized Planning	Responsive Demand-Supply Matching	Slow Moving Inventory		$	No	Cost	Measure of inventory which has not shipped in a certain time due to little customer demand.	Sum of the monetary value of inventory that has not moved in a warehouse after a set time period (e.g. items with no movement in the in the past 6 months)
Synchronized Planning	Responsive Demand-Supply Matching	Supplier Lead Time		Time	Yes	Service	Measures how long it takes from when a supplier receives order to when it is received	Supplier Lead time = Time an order is placed to a supplier - time the goods are received

Responsive Demand Supply Matching (RDSM)

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Synchronized Planning	Responsive Demand-Supply Matching	On Time In Full (OTIF)	OTIF	%	Yes	Service	Measures the percentage of orders delivered on-time, in full. Components include all items and quantities on-time using customer's definition of on-time and complete documentation. (packing slips, bills of lading, invoices)	(Number of orders filled in full and delivered on-time/Total number of orders)*100%
Synchronized Planning	Responsive Demand-Supply Matching	Production Rate		#/Time	No	Efficiency	Measure of the production rate is the amount of time taken to produce one unit of a good.	Quantity / Production Time per Machine
Synchronized Planning	Responsive Demand-Supply Matching	Production Schedule Adherence		%	Yes	Service	Measures the variance of Actual production to Scheduled production	1-ABSOLUTE(scheduled-produced)/Scheduled

Responsive Demand Supply Matching (RDSM)

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Synchronized Planning	Responsive Demand-Supply Matching	Excess Inventory		$	Yes	Cost	Measure of inventory in excess of safety stock, cycle stock and buffer stock	Inventory - safety stock - cycle stock - buffer stock
Synchronized Planning	Responsive Demand-Supply Matching	Manufacturing Lead Time		Time	Yes	Service	Measure of the total amount of time it takes to make a product at a plant.	Manufacturing Lead Time = Time the material is requested from the plant - Time the material is received
Synchronized Planning	Responsive Demand-Supply Matching	Obsolete Inventory		$	No	Cost	Obsolete inventory is a term that refers to inventory that is at the end of its product life cycle. This inventory has not been sold or used for a long period of time and is not expected to be sold in the future.	Sum of monetary value of inventory at the end of its shelf life / product lifecycle that requires a write-off or write-down

Responsive Demand Supply Matching (RDSM)

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Synchronized Planning	Responsive Demand-Supply Matching	Constraint Resource Availability (raw material, semi-finished material, equipment/machine availability)	Supply Availability	%	Yes	Service	Measure of the availability of the constraint resource	Total Resource Capacity - Constraint Resource Utilization
Synchronized Planning	Responsive Demand-Supply Matching	Distribution Rate		#/Time	No	Efficiency	Measure of the amount of time taken to distribute one unit of a good.	Quantity / Distribution Time per Node
Synchronized Planning	Responsive Demand-Supply Matching	Distribution Schedule Adherence		%	Yes	Service	Measures the schedule adherence between qty of scheduled distribution & qty of actual distribution	Distribution Schedule Adherence = Actual Distribution qty/Planned distribution qty

Responsive Demand Supply Matching (RDSM)

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Synchronized Planning	Responsive Demand-Supply Matching	Order Fulfillment Lead Time	In-Transit Lead Time	Time	Yes	Service	Measures the average actual cycle time to fulfill customer orders	Total Cumulative lead time (From cutting order to fulfillment)
Synchronized Planning	Responsive Demand-Supply Matching	Average Aged Inventory	Days Sales in Inventory	$, #, Lb	Yes	Cost	Average number of days it takes for a firm to sell off inventory	Average cost of inventory at its present level/COGS X 360
Synchronized Planning	Responsive Demand-Supply Matching	Allocation Profitability		%	Yes	Profitability	Measure of total profitability (e.g. projected net margin) from the allocation of supply to demand. This measure allows to simulate the impact to profitability by switching allocation of demand to supply across channels and accounts	((Forecasted revenue – Cost of Goods Sold - Estimated total supply network landed cost including Estimated Overhead Costs and SG&A) / Forecasted Revenue)

Dynamic Flow Optimization

Definition and objectives

Definition:

The ability to enable **material positioning and product flow** in the supply network to maximize **profitability**, margin and **service** through routing, procurement and inventory levers

Why Digital Supply Networks:

Digital supply networks leverage Dynamic Flow Optimization to look beyond traditional supply network optimization, focusing on additional elements such as

- product flow selection that is based on trade-offs among of transportation, replenishment, inventory and cycle stock to determine the lowest total landed cost
- setting self-learning replenishment and intelligent inventory triggers through stochastic optimization that considers seasonality and capacity constraints
- optimized inventory levels, which determine where and in what quantity inventory should be held in the supply network to achieve the required availability at each node
- optimized production schedules that consider network-wide capacity and inventory levels to reduce overall inventory levels and better serve customer demand.

Dynamic Flow Optimization

Definition and objectives

Drivers for Change:

- Product personalization results in stock keeping unit proliferation and increased inventory.
- Limited visibility into inventory categories, such as safety stock, cycle stock or quality hold, by location results in service challenges.
- Increased commoditization drives significant pressure to reduce working capital and inventory.
- Suboptimal supply planning abilities lead to excess inventory and frequent stockouts. Using a one-size-fits-all approach to setting stock targets for all products leads to high inventory levels and high obsolescence costs.
- Traditional supply network planning generally exhibits limited scenario management and sensitivity analysis to holistically explore the overall supply network, alternate service levels and alternate stocking locations.

Example:

Companies have started to implement enterprise-to-enterprise inventory and production network optimization and simulation tools that result in optimized production for unique demand scenarios, such as force majeure of a competitor, and consider constraints such as finished goods and raw material prices and production and logistics constraints.

Dynamic Flow Optimization

Relations with other level-1 Capabilities

Digital Development	Collaborative product development ensures attributes such as packaging and country-specific language requirements allow for smooth material and product flow in the network.
Dynamic Fulfilment	Dynamic Flow Optimization implies a close alignment with routing optimization based on dynamic shipping and delivery points can change based on product flow strategy and market conditions.
Intelligent Supply	Visibility into material categories, sourcing rules, supplier networks and supplier performance allows for effective strategic sourcing and category management.
Smart Operations	Changes in product-flow strategy are instantaneously communicated to manufacturing facilities, which can quickly react to new conditions, requirements and constraints.
Connected Customer	A closer connection with the customer drives proactive management and understanding of where customer product needs can help reduce excess or insufficient inventory amounts during new product introductions and discontinuations.

Dynamic Flow Optimization

Impact of digital disciplines

Sense	• Senses real-time changes in the market place and adjusts inventory levels accordingly in each node of the supply network. • Risks to the product flow are sensed and based on external sources of information, such as oil prices, regulation and others.
Collaborate	• Enables better communication with customers through cross-functional visibility of changes and disruptions in the product flow
Optimize	• Keeps optimization at the core of this Level 2 Capability . Optimization is instrumental in generating a plan that adheres to modeled constraints and optimal allocation of supply to demand. This allows companies to pursue business objectives such as profit optimization, load balancing, target resource utilization and product mix optimization.
Respond	• Optimizes product flow so that a company can more efficiently respond to customer challenges and requests by reducing overall response time and doing it in the most cost-effective manner

Dynamic Flow Optimization

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Synchronized Planning	Dynamic Flow Optimization	Turn-Earn Index		#	No	Efficiency	Measure of the combination of gross margin and inventory turnover; logic behind this metric is to keep high inventory turnover for SKUs or brands generating low margins and satisfy medium to low ITR for a high margin SKU	Inventory Turnover * (Gross Margin %) * 100
Synchronized Planning	Dynamic Flow Optimization	Stock Transfer Orders (STOs) Not Released per Plan		#	No	Efficiency	Measure of the # of STOs not converted to outbound delivery as per the planned delivery date for fulfillment execution, as a percentage of total STOs	Number of STOs not converted to outbound delivery / Total STOs (as per the planned delivery date for fulfillment execution)
Synchronized Planning	Dynamic Flow Optimization	Logistic Cost Performance		%	No	Cost	Measure of logistics (warehousing and transportation) cost as % of sales	Total cost to manage logistics and warehousing/Total Sales * 100

Dynamic Flow Optimization

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Synchronized Planning	Dynamic Flow Optimization	Average Aged Inventory	Days Sales in Inventory	$, #, Lb	Yes	Cost	Average number of days it takes for a firm to sell off inventory	Average cost of inventory at its present level/COGS X 360
Synchronized Planning	Dynamic Flow Optimization	Excess Inventory		#	Yes	Cost	Measure of inventory in excess of safety stock, cycle stock and buffer stock	Inventory - safety stock - cycle stock - buffer stock
Synchronized Planning	Dynamic Flow Optimization	Inventory Turns		#	Yes	Efficiency	Calculates the number of times the inventory is sold or replaced in a year	(COGs / Average inventory) or (Sales / Inventory)
Synchronized Planning	Dynamic Flow Optimization	Obsolete Inventory		$	No	Cost	Obsolete inventory is a term that refers to inventory that is at the end of its product life cycle. This inventory has not been sold or used for a long period of time and is not expected to be sold in the future.	Sum of monetary value of inventory at the end of its shelf life / product lifecycle that requires a write-off or write-down
Synchronized Planning	Dynamic Flow Optimization	Order Fill Rate (OTIF)	OTIF	%	Yes	Service	Measures the percentage of orders delivered on-time, in full. Components include all items and quantities on-time using customer’s definition of on-time and complete documentation. (packing slips, bills of lading, invoices)	(Number of orders filled in full and delivered on-time/Total number of orders)*100%
Synchronized Planning	Dynamic Flow Optimization	Slow Moving Inventory		$	No	Cost	Measure of inventory which has not shipped in a certain time due to little customer demand.	Sum of the monetary value of inventory that has not moved in a warehouse after a set time period (e.g. items with no movement in the in the past 6 months)

Dynamic Flow Optimization

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Synchronized Planning	Dynamic Flow Optimization	Expedited Redistribution Costs		$	Yes	Cost	Measures the additional transportation and handling costs over and above the standard negotiated costs for a specific route/activity to meet promised delivery dates.	[Shipping & Handling costs at peak] - [Negotiated Shipping & Handling Costs]
Synchronized Planning	Dynamic Flow Optimization	Inventory Quality Ratio		%	No	Quality	Measures the quality of the inventory at any given product/location, as well as provide a clear visibility on issues and opportunities	IQR = ([Unrestricted Inventory on hands within Target] + [Quality Inspection inventory] + [in transit]) / [Total Inventory] , where [Total Inventory] = [Unrestricted Inventory on hands within inventory target] + [Quality Inspection inventory] + [Unrestricted Inventory above inventory target] + [Blocked Inventory]
Synchronized Planning	Dynamic Flow Optimization	Total Supply Shortage (by Node)		#	No	Service	Measures the amount of demand over and above the available supply in the given planning period	Demand in a period for a node - (Available / Sellable Stock + In-transit + Planned Work Orders)

Enterprise Plan Reconciliation

Definition and objectives

Definition:

The ability to **integrate strategic goals, financial objectives and tactical operation plans** seamlessly through cross-functional alignment

Why Digital Supply Networks:

Different functions plan at different levels, such as sales by account, marketing by product category, finance by product line and others. Today, strategic goals often are not aligned to financial, commercial and operational plans and do not involve an extreme amount latency and manual labor to reconcile. Ultimately, this leads to decisions being made in siloed functional areas with a short-term focus. The focus of this Level 2 Capability is to

- ensure that strategy drives business decisions
- align finance and operations with strategic goals, creating a singular vision and one source of truth
- allow instantaneous updates across different plans through concurrent planning
- establish an effective governance model that replaces superfluous, disconnected functional meetings.

Enterprise Plan Reconciliation

Definition and objectives

Drivers for Change:

- Where organizations are used to running separate business planning processes for supply chain, sales and marketing, and finance, the differences in the processes result in suboptimal decision-making.
- Traditionally, organizations fail to align operational planning, budgeting and forecasting effectively with corporate strategy.
- Increased cost pressures and shrinking margins demand more growth analysis and a deeper understanding of profitability per client or product.

Example:

Assume that the strategic imperative for an organization is to deliver growth from innovation. In this case, the focus for the Enterprise Plan Reconciliation Level 2 Capability should be on ensuring that all functions work together to deliver this objective, improving the innovation process and ensuring that it is seamlessly integrated with the reconciliation process. Through Enterprise Plan Reconciliation, the organization can answer the following questions:

- When do we look at the portfolio of new product development (NPD) projects as a whole?
- How do we make go, kill or hold decisions?
- How do we forecast NPD projects, and how do these forecasts vary as projects move through the innovation funnel?

Through these efforts, the organization ultimately validates actions in a cross-functional setting and can course correct through dynamically reconciled customer and product profits and losses.

Enterprise Plan Reconciliation

Relations with other level-1 Capabilities

Digital Development	The product development team provides details about the future direction of the product portfolio, including new products, additions to the product lines, product improvements or upgrades, repositioning of current products, and end-of-life rationalization for older products. The reconciliation begins with a brand or product strategy that must align with an organization's strategic direction, and each new product must relate directly to at least one business strategy. Once the new product passes the business case stage, aggregate resources or constraints and timing needed to support the pipeline are evaluated.
Dynamic Fulfilment	Reconciliation needs to be viewed in aggregate across the transportation modes, including air, rail, barge, truckload and less- than-truckload. The Level 2 Capability would facilitate cross-functional communication when modeling what-if scenarios to help evaluate additional costs, such as bulk truck upcharges and expediting fees, versus making customer cuts.
Intelligent Supply	Reconciliation of plans with suppliers can provide early visibility to suppliers regarding changes in demand and purchase schedules and offer buyers visibility into shipping schedules and changes.
Smart Operations	Reconciled plans will need to be sent to the factories to support demand and optimized service levels. Financial and strategic decisions about where and when production will happen and how much will be produced will cascade to smart factories.
Connected Customer	This Capability does not deliver any direct impact on Enterprise Plan Reconciliation.

Enterprise Plan Reconciliation

Impact of digital disciplines

Sense	• Requires a defined strategic dashboard with control measures of performance that serve as leading indicators for key segments of the business and that are at the intersection of economic influence and efficiency. The Sense control system must enable companies to exploit unexpected opportunities by increasing the deviation from the plan, whenever this creates economic value.
Collaborate	• Utilizes a centralized decision support team with a wide business view and the ability to work cross-functionally to review reconciliation issues at the enterprise level. Historically the reconciliation step in the traditional sales and operations planning process was a supply chain–led process, and the leader of reconciliation step often was the supply chain leader because he or she was the most committed to making the process work. In addition, the focus of reconciliation was supply and demand balancing. In the context of value-based outcomes, this is no longer appropriate.
Optimize	• Uses varied optimized scenarios across revenue growth, operating margins and asset efficiency. In the digital paradigm, we envision a scenario-planning system that recommends resolution levers in response to specific exception situations to reconcile discrepancies with an optimized operational and financial plan.
Respond	• Incorporates a set of tactics for reconciling external issues, such as economic and geopolitical factors that could impact a business, into the predictive analytics that guide an organization’s operational and strategic plans

Enterprise Plan Reconciliation

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Synchronized Planning	Enterprise Plan Reconciliation	Price Realization	Net Price Realization	%	No	Revenue	Measure of the amount of margin retained by selling as close to target price as possible	Sum(all discounts, credits, rebates, coupons) / List price
Synchronized Planning	Enterprise Plan Reconciliation	Slow Moving Inventory		$	No	Cost	Measure of inventory which has not shipped in a certain time due to little customer demand.	Sum of the monetary value of inventory that has not moved in a warehouse after a set time period (e.g. items with no movement in the in the past 6 months)
Synchronized Planning	Enterprise Plan Reconciliation	Supplier Quality Index		#	Yes	Quality	Measures supplier quality and performance to enterprise plan	Plan vs actual of supply quality (as a function of product, packaging and timeliness)
Synchronized Planning	Enterprise Plan Reconciliation	Total Network Landed Cost (per business category)		$	Yes	Cost	Measures the costs to source a single item shipped in a container up to the moment it is received by customer	Sum of actual costs
Synchronized Planning	Enterprise Plan Reconciliation	Cash to Cash Cycle Time		Time	Yes	Efficiency	The time it takes for an investment made to flow back into a company after it has been spent for raw materials	Inventory Days of Supply + Days Sales Outstanding - Days Payable Outstanding

Enterprise Plan Reconciliation

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Synchronized Planning	Enterprise Plan Reconciliation	Days Payable Outstanding		Time	Yes	Efficiency	Measure of the number of days taken to pay suppliers	(Accounts payable / Cost of goods sold in period) * Days in period
Synchronized Planning	Enterprise Plan Reconciliation	Days Sales Outstanding		Time	Yes	Efficiency	Measure of time when a sales if made until cash for it is received from customers	(Gross accounts receivable / gross annual sales) in days
Synchronized Planning	Enterprise Plan Reconciliation	COGS			Yes	Cost	The Cost associated with buyer raw materials and producing finished goods	Direct Material costs + Direct Labor costs + Indirect Costs related to making product
Synchronized Planning	Enterprise Plan Reconciliation	Cost Variance		$	No	Cost	Measure of planned cost versus actual cost of supply network operations	(Planned supply network cost - actual supply network cost) / actual supply network cost
Synchronized Planning	Enterprise Plan Reconciliation	Obsolete Inventory		$	No	Cost	Obsolete inventory is a term that refers to inventory that is at the end of its product life cycle. This inventory has not been sold or used for a long period of time and is not expected to be sold in the future.	Sum of monetary value of inventory at the end of its shelf life / product lifecycle that requires a write-off or write-down

Enterprise Plan Reconciliation

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Synchronized Planning	Enterprise Plan Reconciliation	Days Forward Coverage	DFC, Days / Weeks of Supply	Time	Yes	Service	Measure of coverage of demand using latest period-ending inventory supply assuming that demand will follow forecast	Depletion of sellable inventory over forecast period
Synchronized Planning	Enterprise Plan Reconciliation	COGS as % of Revenue		%	Yes	Cost	Measure of the cost associated with buying raw materials and producing finished goods. Includes direct costs (labor, materials) and indirect costs	(Direct material + Direct labor + Overhead) / Revenue
Synchronized Planning	Enterprise Plan Reconciliation	Net Revenue		$	Yes	Revenue	Measures revenue minus discounts & returns	Revenue - Discounts - Returns
Synchronized Planning	Enterprise Plan Reconciliation	Return on Working Capital			Yes	Cost	Measures the magnitude of investment relative to a company's working capital position versus the revenue generated from a supply chain	(Supply Chain Revenue - Total Supply Chain Management Costs) / (Inventory + Accounts Receivable - Account Payable)
Synchronized Planning	Enterprise Plan Reconciliation	Supply Network Capital Budget vs. Expenditures		$	No	Cost	Measures the comparison between planned capital and actual investments	Capital Budget - Capital Expenditures

Portfolio Life Cycle Planning

Definition and objectives

Definition:

The ability to **grow, sustain and optimize product portfolios**, including packaging and service, through measures of portfolio health, such as product productivity; supporting launch and phase-out roadmaps; and alignment with commercialization plans, including brand and packaging plans

Why Digital Supply Networks:

Many industries plan **new products** in a siloed fashion. Commercialization tends to be completed by the marketing organization and then handed to supply chain for manufacturing and shipment to customers.

- Synchronized Planning will involve end-to-end functions early on in the product development stages in order to proactively identify early-warning signals and improve speed to market. During commercialization, fast feedback loops will improve the efficiency in tracking signals and contingency planning.

End of life cycle products often realize a reduction in revenue and increased write-offs for both finished goods and raw materials, including ingredients and packaging.

- Portfolio performance as a measure of productivity, such as a revenue increase through sales, integrates productivity facts into commercial and brand strategy discussions to inform innovation goals. This results in more visibility into consumption data and better cross-functional alignment between commercial plans and supply chain execution, which will empower industries to maximize revenue and reduce write-off costs.

Portfolio Life Cycle Planning

Definition and objectives

Drivers for Change:

- The increased customer expectations of today's business environment call for improved launch predictability.
- Shorter product life cycles demand a faster speed to market in most industries.
- Increasing pressure on margins makes it necessary to focus on revenue maximization.
- With the increased velocity in product transitions, there is a focus on reducing write-offs at the end of a product's life cycle.

Example:

After a product was evaluated by the business and determined to no longer be meeting the in-market performance the company required, the marketing, sales and supply chain teams collaborated to create an end-of-life product plan. Marketing was able to appropriately ramp down and shut off advertising, sales proactively communicated with customers to determine discontinuation dates, and supply chain was able to determine remaining customer demand in order to plan final production runs and minimize ingredient, packaging and finished goods write-offs.

Portfolio Life Cycle Planning

Relations with other level-1 Capabilities

Digital Development	The Digital Development team shares vital insights into the status of all items progressing through the stage-gate process to proactively identify capability gaps and set up planning systems with all relevant material, production and financial information to fully understand the new product's impact on supply chain and finance. During Portfolio Life Cycle Planning, the organization builds a full understanding of product profitability throughout the development life cycle to determine rationalization candidates. The project portfolio is continuously analyzed to maximize business value through ideation to commercialization. Projects with high net present value are prioritized.
Dynamic Fulfilment	Network fulfillment and cost-to-serve strategies are discussed throughout the product commercialization process. Cost of fulfillment is a key metric for understanding project profitability.
Intelligent Supply	To compensate for the high uncertainty in demand for new products, flexible contracts can be designed with suppliers, which allow, to some degree, raising or lowering the order quantities by a certain percentage after a certain number of weeks post-launch. Near real-time views of the costs and benefits of introducing or discontinuing a product to the supply chain. Discontinuation and introduction strategies are clearly aligned with the supply chain, reducing costs and increasing the effectiveness of new product introductions
Smart Operations	A real-time, accurate demand signal feeds the manufacturing process to closely align production with product launches and culls. This, in turn, reduces obsolete inventory created from botched discontinuations and increases the success of new product launches.
Connected Customer	Customer trends are analyzed by the commercial team to align a portfolio with these trends. Additionally, the commercial team is focused on staying ahead of trends, while the operations team is focused on reducing time-to-market in order to better capitalize on market movements.

Portfolio Life Cycle Planning

Impact of digital disciplines

Sense	• Uses external information sources from current and potential customers to inform new product planning. New product planning should not solely rely on internal information sources and judgment. • Conducts different types of testing with customers throughout the new product development process, depending on the form of the product and the testing objective, whether concept testing, product use testing or market testing. • Senses market trends and makes cogent portfolio adjustments based on what is going on in the marketplace. • Uses demand sensing of emerging trends to help enable the product development cycle to get ahead of trends and therefore increase product launch profitability.
Collaborate	• Coordinates end-of-life planning among multiple functions throughout the organization to maximize the profitability of products while also minimizing the negative financial impacts. For example, operations and product development must be closely aligned in order to successfully launch a new product. They must align on items such as the demand and supply plan to ensure critical launch elements, such as timing and volume, are correct.
Optimize	• Optimizes the cadence and process for evaluating current product offerings and market demands, rather than updating the portfolio based on reactionary market changes. This enables companies to react more quickly to changing customer preferences. Additionally, optimizing the portfolio based on maximizing margins can help enable a more efficient portfolio given organizational constraints.
Respond	• Uses better structured processes and portfolio optimization tools to empower companies to respond seamlessly to changing market conditions. Additionally, better management of end-of-life planning and commercialization can reduce the burden on the supply network, allowing for a better response to customer needs.

Portfolio Life Cycle Planning

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Synchronized Planning	Portfolio Lifecycle Planning	Phase Out Product Weekly/Monthly volume		#	No	Efficiency	Measure of the volume of products that are being discontinued and introduced. Used to assess overall portfolio health.	Phase Out: Volume of Discontinued Products / Total Volume Phase In: Volume of New Products / Total Volume
Synchronized Planning	Portfolio Lifecycle Planning	Price Realization / Net Price		$	No	Innovation	Calculates the amount of margin retained by selling as close to target price as possible	List price - (all discounts, credits, rebates, coupons)
Synchronized Planning	Portfolio Lifecycle Planning	Dwell Time by Product Stage		Time unit (e.g. days or weeks)		Efficiency	Measure of product dwell time in each stage gate e.g. prototype, testing, production, launch or portfolio status e.g. new, extensions, or renovation	Number of days in stage
Synchronized Planning	Portfolio Lifecycle Planning	Launch Performance		#,%		Innovation	Measures how successful a product launch is (actual sales greater/less than expected)	Actual quantity / Expected quantity

Portfolio Life Cycle Planning

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Synchronized Planning	Portfolio Lifecycle Planning	New Product Forecast Error		%	No	Innovation	Measures the Forecast Error (MAPE) for new product portfolio	See forecast error calculation (MAPE). Apply formula to new products
Synchronized Planning	Portfolio Lifecycle Planning	New Product Fill Rate		%	No	Innovation	Measure of the order fill rate for new products	(Number of orders filled in full and delivered on-time/Total number of orders)*100%
Synchronized Planning	Portfolio Lifecycle Planning	New Product Lead Time		Time	No	Innovation	Measures the duration of an average product to develop new products from concept to launch	Average lead time of products, form development to launch, a specified horizon
Synchronized Planning	Portfolio Lifecycle Planning	New Product Weekly/Monthly volume		#	No	Innovation	Measure of absolute volume of new product demand (lbs, kgs, cases, etc). New products are typically defined as products launched in the last 30,60, or 90 days	Aggregated New Product volume over specified horizon
Synchronized Planning	Portfolio Lifecycle Planning	On-Time Product Launch Rate		%	No	Innovation	Measures the percentage of new products that are launched on time. Usually measured over the FY horizon	Projects Launched On-Time / Total Project Launched

Supply Network Design

Definition and objectives

Definition:

The ability to design and rationalize the supply network, **optimizing for** the **required service level at the lowest total landed cost.** Also includes managing long-term capacity decisions based on strategic decisions and investment plans

Why Digital Supply Networks:

This Level 2 Capability can help companies customize product assortment and make stocking decisions that fulfill customer needs, thereby driving service levels at minimal inventory holding cost.

Supply Network Design includes a data-driven process for analyzing the impact of facility placement based on customer service considerations, cost,
geopolitical risks, tax incentives, and regulatory and customer preferences. It also helps determine the following:

- How many nodes or distribution centers (DCs) should there be?
- Where should my next DC be opened, if needed?
- When should additional DCs be opened?
- What products should be regionalized? Where should centralized products reside?
- What are the freight benefits of expanding? What are the inventory costs of expanding?

Supply Network Design also allows for modeling of greenhouse gas emissions associated with transportation modes, facilities and suppliers.

Supply Network Design

Definition and objectives

Drivers for Change:

- Mergers and acquisitions need to leverage assets across multiple companies in order to improve utilization metrics.
- Global sourcing leads to more complex supply networks and the need to reassess the locations of consolidation centers, maximize agility and resilience, and gain the ability to serve multiple customers without compromising service levels.
- The current sub-optimal distance between customers and warehouse locations needs to be addressed.
- New markets and products and growing volumes are creating a need to expand manufacturing warehouses or open new locations.

Example:

A consumer products manufacturer is evaluating how to increase distribution of its recently trending product lines. As part of this, it needs to investigate how to increase supply through its distribution networks and boost production at its manufacturing locations. Further, the company is investigating partnering with new contract manufacturers closer to the point of distribution for packaging and logistics benefits.

The company conducts a comprehensive supply network assessment that targets lowering total landed cost and increasing service levels for its primary target markets. Its Supply Network Design solution uses data science techniques to study external data and find the best opportunities. The solution determines that a mix of contract packaging partnerships, two additional distribution nodes and one new production line will be the most beneficial option and will generate a net present value of $3 million over five years.

Supply Network Design

Relations with other level-1 Capabilities

Digital Development	Capital investment decisions are based on strategic product roadmaps and considerations, such as a new generation of products or co-developed products that will be built in a certain qualified location.
Dynamic Fulfilment	Optimized distribution networks deliver desired customer lead times, determine the degree of centralization of distribution centers, and enable a flexible network of fulfillment points that can be dynamically adjusted to flex capacity up or down on short notice.
Intelligent Supply	The Intelligent Supply organization will evaluate a supplier network base and determine the optimal number of suppliers needed in each category to realize a lean supply network.
Smart Operations	Manufacturing network evolution enables companies to redesign their footprints using a market-driven goal to better align costs and working capital with increasing expectations for customer service and corporate social responsibility.
Connected Customer	Customer-facing sales representatives can define retail store clusters by using quantitative data, such as sales data, product data and store characteristics, and qualitative data, such as a market analysis. Intelligent, customer-centric product assortments can then be driven by each defined store cluster.

Supply Network Design

Impact of digital disciplines

Sense	• Analyzes the costs and capacities in the current individual networks and compares them with the combined cost of each baseline
Collaborate	• Collaborates with partners, including suppliers and contract manufacturers, in designing supply networks to ensure that the full network is considered
Optimize	• Determines the optimal combined network by conducting various scenario runs and sensitivity tests and analyzes top network alternatives
Respond	• Proposes various network configurations, including the costs and benefits of each configuration

Supply Network Design

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Synchronized Planning	Supply Network Design	Alternate Network Routes		%	No	Efficiency	Measures the amount of alternate routes to total routes for specific demand channels to determine how flexible the product path is in the network	(Number of Alternate Routes) / (Total Routes in Demand Channel)*100
Synchronized Planning	Supply Network Design	Supply Network Lead Time		Time	Yes	Service	Measures the duration of time from when a customer places an order to when it is ready for delivery	Supply Network Lead Time = Time from placement of order - Time of delivery
Synchronized Planning	Supply Network Design	Network Path Touches		#	No	Efficiency	Measures the number of stops for an item (raw material to finished good) before the final product reaches the customer	Count of Node Links
Synchronized Planning	Supply Network Design	Reverse Logistics		Time	Yes	Efficiency	Measure of time associated with Return Processes	Identify need for Return + Coordinate and Schedule Return + Return Transit time + Receive Return Product Time + Verify and Transfer Return Product Time

Supply Network Design

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Synchronized Planning	Supply Network Design	Node Make Cycle Time		Time	Yes	Efficiency	Measure of time from start till finish to make a sellable finished good	Finalize Production Engineering Cycle Time + Scheduled Production Activities Cycle Time + Issue Material/Product Cycle Time + Produce and Test Cycle Time + Package Cycle Time + Stage Finished Product Cycle Time + Release Finished Product to Deliver Cycle Time
Synchronized Planning	Supply Network Design	Node Source Cycle Time		Time	Yes	Efficiency	Measure of time from order to receive a sellable finished good	Identify Sources of Supply Cycle Time + Select Supplier and Negotiate Cycle Time + Schedule Product Deliveries Cycle Time + Receive Product Cycle Time + Verify Product Cycle Time + Transfer Product Cycle Time + Authorize Supplier Payment Cycle Time

Supply Network Design

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Synchronized Planning	Supply Network Design	Mode of Transport Utilization		%	Yes	Efficiency	Measures how well ship/trucks/other modes of transport are being utilized for shipments	Pounds of product shipped by mode of transport / transport max hold in pounds
Synchronized Planning	Supply Network Design	Network and Node Utilization		%	Yes	Efficiency	Measure of (actual time used) / (total available time)	(Actual Run Time + Setup Time) / Total Time
Synchronized Planning	Supply Network Design	Demand Volume Growth Year over Year		%	No	Service	Measure of the percentage change in volume from one year to the next	(〖Yr〗_n Volume - 〖Yr〗_(n-1) Volume)/(〖Yr〗_(n-1) Volume)
Synchronized Planning	Supply Network Design	Expedited Shipment Upgrade Costs		$	Yes	Cost	Measures the total dollars spent towards expediting shipments	Dollars spent towards expedited shipment from node to node
Synchronized Planning	Supply Network Design	Network and Node Capacity		#/Time	Yes	Efficiency	Measures the amount of traffic that a network is handling at any given time	Node Utilization (Run Time) across the Supply Chain Network
Synchronized Planning	Supply Network Design	Network and Node Throughput		#/Time	No	Efficiency	Measures the rate of material outputted by a node based on the size of the facility/plant	Output / Size (sq. ft)
Synchronized Planning	Supply Network Design	Node Productivity		#/Time	Yes	Efficiency	Measures the rate of material outputted by a node based on the size of the facility/plant	Output / Size (sq. ft)
Synchronized Planning	Supply Network Design	Node to Node Link Lead Time		#	Yes	Service	Measure of the amount of time it takes to get from one node to another	Lead Time between Nodes (e.g., Supplier to Plant to Hub to End Customer)

Deloitte.

Connected Customer

Connected Customer

Definition and vision

Definition: The Connected Customer Capability allows companies to augment traditional transactional interactions to achieve effective and integrated **customer engagement** throughout the customer, product and service life cycles, from acquisition to service.

Vision: Leveraging the benefits of hyper-connectivity and digitalization, Connected Customer drives lower cost to serve, enhanced predictability of customer needs, increased customer satisfaction and loyalty, and greater lifetime customer value. Connected Customer amplifies the impact of traditional front-end applications with back-end operations data enhanced by real-time signal sensing, location awareness, artificial intelligence–driven decision-making and predictive issue resolution.

Connected Customer Vision

Overview of level-2 Capabilities

	Self-Service	Customized Experience	Customer Issue Management	Intelligent Product Tracking
Definition	The strategic ability to support the customer's ability to obtain and interact with product- or service-related information and resolve product or service issues on his or her own, thereby minimizing or deferring human interaction. Aided by artificial intelligence tools such as chatbots and learned preferences, Self-Service enables a seamless, highly-personalized and data-driven experience across physical and virtual channels from acquisition to service, resulting in higher rates of both issue resolution and customer satisfaction in a cost-effective manner.	The strategic ability in which an organization leverages its digital supply network to better communicate with, engage and retain customers across multiple channels, formats and device types as well as to enable targeted, data-driven actions tailored to customer experiences en-masse from transaction to service	The strategic methodology, process and tools in place to empower first-line and higher-tier customer service representatives to resolve issues and intelligently process feedback in response to customer- or product-related issues. The goal of Customer Issue Management is to minimize operational costs as well as organizational and reputational risk while establishing brand loyalty.	The ability to ethically track, trace and monitor physical and digital product data in real time from when a product leaves manufacturing through the end of the product's life cycle. This Level 2 Capability provides enterprises with key product health, usage and proximity insights to inform internal strategic and tactical product-related decisions. Intelligent tracking is enabled through internet of things (IOT) sensors and remote monitoring systems to improve the product's useful life and reduce the cost and complexity of total asset management.
What's New	• Leveraging of real-time supply network data to provide accurate product information, inventory availability, substitution recommendations, and availability and shipping dates on demand across all physical and virtual channels available in the omnichannel portfolio • Use of artificial intelligence and learning software to remedy customer issues with minimal human interaction • Customer feedback and response ratings that drive improved effectiveness metrics across virtual channels to enable reinforced system learning	• An increased focus by customers on the ease and speed of transactions that forces organizations to make dynamic adjustments based on the latest supply network and customer data. • Deployment of artificial intelligence to analyze data from internet of things devices and other sources efficiently and at scale to truly understand customer behavior during and after transaction activities	• Digital applications and virtual assistants that allow customers to share their issues in real time and organizations to process, prioritize and respond to these issues • Real-time supply network data availability that gives customer service representatives the ability to identify potential bottlenecks in manufacturing, sales and marketing, and product design and offer customers more informed options to facilitate more successful resolutions	• Interconnected networks alongside embedded smart sensor technology that improves time- and proximity-based tracking, which generate events in real time to trigger product-related actions • Cloud-based IOT tracking systems that collect, store and analyze product and asset data, providing enterprises with an actionable platform for predictive and automated decision-making • Real-time service tracking with clear communication with customers that drives value beyond the physical product

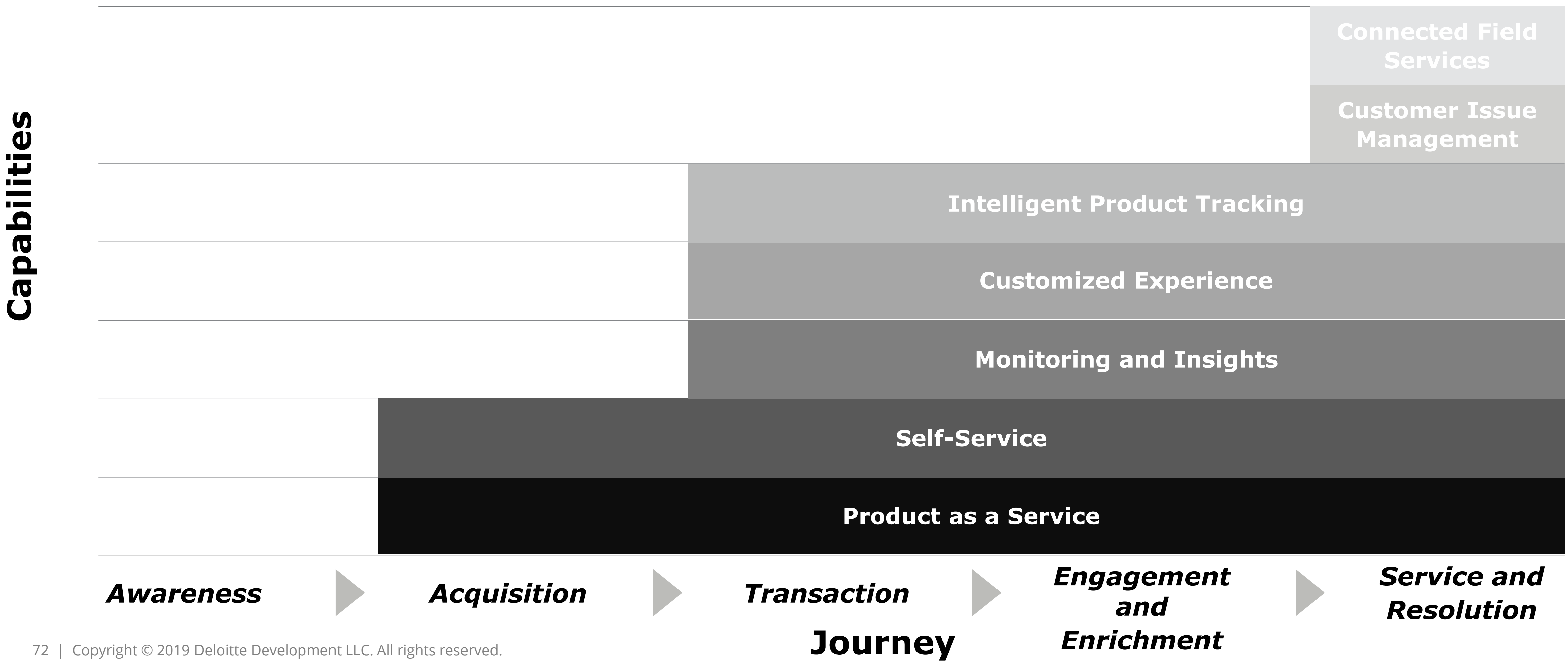
Connected Customer Vision

Overview of level-2 Capabilities

	Monitoring and Insights	Product as a Service (PaaS)	Connected Field Services
Definition	The ability to seamlessly tie products to the customer experience through the ethical collection of real-time product data in order to drive customer success in the use of the product or service and improve customer satisfaction. This Level 2 Capability enables identification of customer lifestyle and consumption patterns; failure modes and effects; maintenance preferences; and proactive notification opportunities across the customer journey, from awareness to service.	The ability to transform business models from acquisition to service and help cater to additional customers through new avenues of engagement and revenue. PaaS includes innovative bundling of products and services into recurring subscription and flexible-consumption offerings.	A holistic approach for managing end-to-end customer service activities off-site through proactive monitoring of assets, remote engagement and other preventative measures and on premise through mobile connected devices, customer and issue analysis tools, and work order automation processes. Connected Field Services enables enterprises and their customers to better manage risks and reduce downtime while lowering total labor costs and cost of service and providing greater chances for cross-selling to increase revenues.
What's New	• Digital supply networks that link real-time product usage with customer data to provide a contextual and more complete view of the product-customer interaction • Internet of things sensing capabilities and machine learning that offer rich data interaction that enables companies to identify product usage patterns, monitor product health and provide predictive maintenance	• Subscriptions and flexible consumption business models that focus on building long-term customer relationships and maximizing customer lifetime value while allowing businesses to generate recurring revenues through different venues, including products, services and data. • The use of connected devices, advanced technologies, and wireless data sharing and storing capabilities to enable real-time data analysis and detailed usage pattern visibility, allowing businesses to minimize costs and reduce constraints on the supply network	• Mobile platforms, internet of things sensor-driven technology and cloud capabilities that enable proactive issue notification to minimize downtime • Labor productivity improvement through the integration of customer appointments, ticketing and orders; employee scheduling and route optimizations; worker activity management; service parts inventory; and other back-office functions

Connected Customer Capabilities

Journey map



Connected Customer

Capability maturity

Dimension	Ad-hoc	Typical	Advanced	Leading
Self-Service	Limited Self-Service abilities exist through basic frequently asked questions lists or user manuals. More complex service requests are addressed by a traditional service desk. Customer service representatives (CSRs) have limited visibility into customer data to support issue resolution. Supply network data is not incorporated in resolution.	Issue resolution incorporates customer preferences and basic supply network data to provide some Self-Service customization. Technologies such as chatbots may be used to expedite customer service, but human assistance often is required for complex requests.	Omnichannel supply network visibility, continuous improvement and data analytics enable a closed-loop Self-Service cycle in which real data and response ratings are leveraged to generate and monitor Self-Service recommendations. Robust triage routes a more limited set of critical requests to CSRs and engineers.	Customer service elements leverage artificial intelligence (AI) and cognitive automation, including digital assistants, to automate and better personalize most customer interactions and predict potential service needs. Response feedback and ratings reinforce system learning. CSRs and engineers are dedicated to high-value interactions.
Customized Experience	Data collection happens sporadically, and the same customer engagement strategy is used across all channels. The supply network is detached from the customer, and, as a result, customer engagement is performed through a single channel.	The company offers personalized experiences based on data-driven customer segmentation and engagement channels. A feedback loop is established to ensure supply continuity and increased flexibility through real-time monitoring.	Advanced analytics and machine-learning algorithms are used to extract insights based on customer preferences. Real-time alerts, such as push notifications, maximize customer engagement while customizing fulfillment and distribution channels.	AI algorithms analyze customer behavior and help shape personalized experiences across the most granular customer segments. The supply network can automatically adjust design, manufacturing and supply parameters to ensure the highest level of customer satisfaction.
Customer Issue Management	Manual efforts are in place to resolve customer issues, and thus, issue resolution is perceived as a service-and-resolve-only capability. Customer service interactions do not shape the supply network strategy.	Data analytics is applied to customer data to better understand root causes of feedback and to provide trending analysis on specific product categories, customer segments and geographies.	Data analytics is deployed to analyze and correlate customer feedback to supply network parameters, allowing the CSR to be more proactive and focus on issues where higher touchpoints are needed.	The majority of customer issues are resolved automatically with the help of AI and cognitive automation, including digital assistants. CSRs empowered by digital supply network data provide high-quality customer service experiences.

Connected Customer

Capability maturity

Dimension	Ad-hoc	Typical	Advanced	Leading
Intelligent Product Tracking	Post-manufacturing tracking of physical and software products is manual and paper based, resulting in limited to no visibility of product whereabouts after the point-of-sale transaction with the customer occurs.	Bar code scanners, radio frequency identification technology, GPS, Bluetooth and other product-tracking tools are used to identify product whereabouts. Inventory management capabilities provide enhanced visibility through the enterprise's downstream supply network.	Product location and usage are tracked in real time from completion of manufacturing through distribution and fulfillment to the end of the product's life, denoting transactional ownership changes across internal and external enterprises, including transportation services, distribution centers, third-party logistics providers and stores.	Connected platforms and devices across an enterprise's supply network are used to automatically track product and asset location, usage, and health, triggering automated actionable upstream responses, such as ordering and replenishment, and providing deep product insights that can drive supply network and product-specific strategic decisions.
Monitoring and Insights	Collection of customer transactional data at the point of sale is limited, resulting in limited to non-existent post-transaction data.	Product usage data is collected manually through basic channels, including emails, surveys and phone calls, and data analytics is employed to help understand consumption patterns at a broad product group level. This provides some insights for sales and marketing.	Advanced analytics is conducted on combined customer issue and servicing data. This provides insights into product maintenance requirements and product failures.	Internet of things sensing capabilities and machine learning are used to collect and identify lifestyle and consumption patterns while leveraging digital supply network data to enable better customer awareness; acquisition; and engagement opportunities, including cross-selling and upselling.
Product as a Service	Products are sold in a single transaction, and no recurring revenue stream associated with the product exists beyond traditional service or maintenance. Customer value capture is limited by static data and basic analytical capabilities.	A traditional revenue model prevails, but basic as-a-service offerings also exist. Some products or services are sold for a recurrent fixed fee. The operating model and processes partially support a subscription model but are not optimized for subscription offerings. Customer value is driven by both customers and providers. High-level analytics is introduced through preliminary uses of technology.	A flexible subscription model uses customer preferences and usage data to manage base rates, tiers and bundles. Differentiated operating models and processes enable both traditional production and as-a-service offerings. Customer value is driven by providers as advanced technologies are used to close data gaps in advanced analytics.	Advanced subscription offerings are supported by robust bundling and pricing. Monetization opportunities are maximized, and complex offerings are effectively managed. Customer value directly drives the integration of advanced technologies that synchronously provide closed-loop data analytics.

Connected Customer

Capability maturity

Dimension	Ad-hoc	Typical	Advanced	Leading
Connected Field Services	Service team members have limited to no mobile data service, which increases the time to respond to service calls. Service team members are not always equipped with the proper tools to complete a service job, which results in significant labor and resource inefficiencies downstream.	A paperless process offers near-real-time customer data and provides increased visibility for better workforce orchestration and supply and demand planning for service issues that may arise.	Integrated ecosystems optimize the workday, as the use of real-time tools and insights provide more personalized customer service with optimized back-end processes and shorter resolution times.	Preventative management and preemptive initiation of customer service is achieved by utilizing robust tools and data analytics to provide successful service the first time while also driving ancillary sales, thus increasing technician productivity as well as service revenues.

Connected Customer

Profile: McKenzie, field service manager

Overview

McKenzie manages technicians who perform on-site installation, maintenance and repair services for end customers and enterprises. Her primary responsibilities include managing and scheduling labor, handling service contracts, and training new hires to use the company's technology platforms in order to provide great service.

Education

Texas State University

- Bachelor of Science in technology management

Experience

Current position

- Field service manager

McKenzie oversees each day's workload by using real-time dashboards and integrated applications that enable her to assign work and communicate with field technicians. This mobile connectivity reduces the need for technicians to frequently come into the office. McKenzie only intervenes in service requests when the technician on site cannot handle the request and escalates the issue to her. She also provides input into strategic decisions associated with budgeting, hiring, strategic training and other business functions.

Previous position

- Field service technician

Connected Customer

Profile: McKenzie, field services manager

	Awareness	Acquisition	Transaction	Engagement and Enrichment	Service and Resolution
Before implementing the principles of Connected Customer, McKenzie's service center would only respond to a call from an end customer if maintenance was required.	A customer calls the service center to report a maintenance issue he currently is experiencing with one of the company's products. Because a repair is needed, a field technician is deployed to service the product.	The service center leader checks the schedule and manually assigns McKenzie to travel to a site to perform maintenance based on her first availability.	McKenzie arrives on site, inspects and identifies the issue, and communicates to the customer about whether or not to proceed with the repair.	McKenzie uses tribal knowledge to inform the customer about potential mitigation strategies.	McKenzie performs maintenance on site if the right tools and parts are in her inventory.
After implementing the principles of Connected Customer, McKenzie's service center engages customers prior to required maintenance to proactively provide service suggestions.	The service center is alerted to a challenging maintenance issue before the customer even knows about the problem. McKenzie engages the customer to discuss potential issues the customer might be experiencing with the product.	The service center leader uses applications to understand which field technician has the right tools and availability to perform the service.	McKenzie arrives on site, inspects and identifies the complex issue, and communicates with the customer about whether or not to proceed with the repair.	McKenzie uses real-time applications to provide the customer with details about potential mitigation strategies.	McKenzie performs maintenance on site because she has the necessary parts and tools to perform the service already on hand.

Connected Customer

End Customer: Abel Shapiro, New York, N.Y.

Overview

Abel is a resident of New York City who lives a connected and on-demand lifestyle. He works in a technology startup as a software programmer and uses a lot of subscription services to fulfill his daily needs. He appreciates services that support his always-on lifestyle and is willing to try services that make his life better.

Education

University of Michigan

- Master of Science in computer engineering

Michigan State University

- Bachelor of Science in electrical engineering

Experience

Scenario 1
Abel drives a Ford Edge 2016 and usually forgets to do the routine maintenance. He recently missed out on his 5,000- mile oil change, and his vehicle broke down during a trip to State College, Pa. To avoid this situation in the future, Abel would have loved to have some internet of things technology in his vehicle that could automatically sense the vehicle's condition and send him a reminder to perform routine maintenance before he takes the vehicle for a long drive.

Scenario 2
Abel is a compulsive shopper and buys more than he needs. During a recent cleanup of his garage, he found things that he had bought a couple of years back but had never used. He is wondering if there could be a tool that could automatically remember all his assets and depreciate them based on their expected life to help guide his future buying decisions.

Connected Customer

End Customer: Abel Shapiro, New York, N.Y.

	Awareness	Acquisition	Transaction	Engagement and Enrichment	Service and Resolution
Before the sports apparel store adopted the principles of Connected Customer, Abel was able to buy a fitness-monitoring device online. However, it was an impersonal shopping experience.	While shopping online, Abel continuously visits a sports apparel website that tracks his visits.	After sensing Abel's interest in purchasing a fitness-monitoring device available through the sports apparel company, the website automatically offers him a 10% off coupon in exchange for his email address.	Abel completes the transaction using the 10% discount and returns his attention to work.	Abel occasionally returns to the sports apparel website to review similar offerings, but he does not have a strong intention to buy anything.	Abel brings his fitness-monitoring device to a brick-and-mortar sports apparel store for servicing after one year and three months.
When the online store leverages the Connected Customer ideology, Abel receives a personalized virtual experience and long-term customer value.	While shopping online, Abel continuously visits a sports apparel website that uses artificial intelligence to recognize his search habits and moves his most-searched-for item, a fitness-monitoring device, from a central distribution center to a local warehouse that supports his area.	After determining that Abel is interested in purchasing the fitness-monitoring device, the website sends him a pop-up notification that informs him that he is eligible for expedited shipping.	As Abel is about to complete the transaction, his attention is drawn to a ribbon at the top of the webpage that gives him cross-buy and upsell opportunities related to his and similar users' search preferences.	After three months, Abel receives a new charger for his device free of charge and is sent an email with an opportunity to upgrade his device in two years at a discount.	After one year, Abel receives an email notification that his device may have a service issue within the next three to five months. He is then mailed a free package to use to send the device back to the supplier for repairs, with a guarantee that the device will be returned within one week.

Self-Service

Definition and objectives

Definition:

The strategic ability to support the customer's ability to obtain and interact with product- or service-related information and resolve product or service issues on his or her own, thereby minimizing or deferring human interaction. Aided by artificial intelligence tools such as chatbots and learned preferences, Self-Service enables a seamless, highly-personalized and data-driven experience across physical and virtual channels from acquisition to service, resulting in higher rates of both issue resolution and customer satisfaction in a cost-effective manner.

Why Digital Supply Networks:

Traditionally, self-service was limited to finding basic answers through a product's frequently asked questions list or user manual. In the context of digital supply networks, next-generation Self-Service involves two key evolutions. Firstly, companies will leverage real-time supply network data to provide accurate product catalog information, inventory availability, substitution recommendations, and availability and shipping dates on-demand across all physical and virtual channels in the omnichannel portfolio. Secondly, a new focus will be put on strategically using artificial intelligence– and technology-driven elements to quickly remedy common customer problems, thereby minimizing or deferring human interaction. These key evolutions will

- delight customers and create meaningful impressions that drive customer loyalty and support demand stability
- maintain or improve customer engagement, even during traditional black holes in the customer life cycle
- reduce resolution times at lower overall cost
- improve abilities to satisfy enterprise and end customer resupply, upselling and cross-selling needs.

Self-Service

Definition and objectives

Drivers for Change:

- Advancements in artificial intelligence (AI) technologies allow a larger share of customer problems to be handled by the customers themselves with greater speed and scope. Customer feedback and response ratings drive improved effectiveness metrics across virtual channels to drive learning and reinforce the Self-Service component.
- Constant customer access through the internet of things (IOT), third-party customer data, and an ever-increasing number of virtual channels and platforms will foster data-driven, personalized, self-serviced engagement.
- More effective technology infrastructures enable real-time data availability and data synchronization across the omnichannel portfolio.

Example:

Nuance Communications, a leader in customer engagement, partnered with a large electronics company to provide AI-driven chat support and digital customer engagement services across all channels. AI-based customer services drove down operating costs and improved customer satisfaction and first-time issue resolution for all of the customers' critical decision points across channels. Nuance also developed an AI-chatbot named Wendy for a midsize communication services provider. Wendy improved first-time issue resolution by 19%, and customer problems now are resolved 72% of the time after Wendy's first engagement with them. Nuance is working to next integrate all AI support services with IOT sensors so that the customer support software can analyze a device's sensor in real time to diagnose and solve customer needs through automatic and touch-free servicing to provide opportunities such as automated resupply or service requests.

Self-Service

Relations with other level-1 Capabilities

Digital Development	During product development, the organization collects service request information to understand unmet customer needs throughout the customer life cycle and help drive feature prioritization, product improvements and greater insight.
Dynamic Fulfillment	In Dynamic Fulfillment, the organization predicts customer needs based on logged interactions and user data collected across channels in order to trigger automatic replenishment to best meet customer preferences.
Intelligent Supply	The Intelligent Supply function maintains root causes of customer complaints and compliments in order to both hold vendors accountable for supply-related disappointment or satisfaction and to accelerate the process of satisfying customer supply-related service or resupply needs.
Smart Operations	The Smart Operations function improves visibility into customer needs and predicts the most likely customer purchase scenarios to influence pre-make production decisions.
Synchronized Planning	The Synchronized Planning function verifies customer satisfaction targets set during the planning process and facilitates improved planning decisions to satisfy customer requests.

Self-Service

Impact of digital disciplines

Sense	• Predicts customer needs through both customer data and interactions across the omnichannel portfolio to automate service
Collaborate	• Co-develops strategies with customers to allow for enhanced service and preferential engagement options by using insights and feedback gathered throughout the customer life cycle
Optimize	• Develops artificial intelligence– and human-led customer service offerings that maximize both customer satisfaction and issue resolution at a lower overall cost
Respond	• Creates a cross-channel feedback loop that can quickly identify gaps in customer engagement or provide opportunities for further enrichment and better service • Adapts strategies to improve customer satisfaction and lower spend by leveraging all supply network functions

Self-Service

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Connected Customer	Self-Service	Self-Service Success Rate		%	No	Service	Percentage of a customer's inquiry or issue that was handled by self-service channels without being escalated to a human agent. This is to measure that the customer received the answers they are looking for in an efficient and easy manner, and to reduce the number of calls/contacts routed to human agents. Service channel can include FAQs, knowledge base.	Number of customer inquiries/issues resolved through self service (not routed to human agents) / total number of customer inquiries/issues
Connected Customer	Self-Service	Total Cost Per Self Service Contact		$	No	Service	Measures total combined cost per self service contact, including staffing costs, self-service tool costs, self-service content development costs, etc.	Total cost of standing up and maintaining self-service / total # of self service contacts
Connected Customer	Self-Service	Self-Service Fulfillment Speed		Time	No	Efficiency	Length of time it takes to conclude a self-service transaction from request initiation to completion. Another measurement is self-service response speed - which measures the amount of time it takes to respond to a request.	Time duration to complete the request.
Connected Customer	Self-Service	Self-Service Conversion Rate		%	No	Service	Number of self-service interactions that lead to a sale	Total number of sales through self-service channels / Total number of self service interactions
Connected Customer	Self-Service	Customer Satisfaction	CSAT	%	No	Service	Measures how customers are satisfied by their experience using self-service channels, including usability, efficiency.	Number of satisfied customers / Number of feedbacks received

Customized Experience

Definition and objectives

Definition:

The strategic ability in which an organization leverages its digital supply network to better communicate with, engage and retain customers across multiple channels, formats and device types as well as to enable targeted, data-driven actions tailored to customer experiences en-masse from transaction to service

Why Digital Supply Networks:

The practice of knowing customers by name, remembering their preferences and tailoring the communication strategy based on intuition was successful in the past, but it is not scalable in today's data-driven era. A digital supply network leverages data from digital tools, tailors the customer experience and delivers it in an authentic manner — incorporating manufacturing, production and commercial aspects. This enables companies to deliver personalized experiences that resonate deeply with each customer and helps sellers predict what advertisements, products, features and services customers will be most interested in.

A connected supply network allows organizations to further enrich experiences and generate revenue through

- dynamic pricing and content, which orchestrates the interplay among inventory considerations, product design and profitability, shipping preferences, and competitor pricing while increasing the ease and speed of transaction
- customized journeys that use artificial intelligence to analyze digital footprints efficiently and at-scale to better understand customer behavior beyond purchasing history, demographics and modeling across customer segments.

Customized Experience

Definition and objectives

Drivers for Change:

- Customers increasingly are expecting a hyper-now, hyper-custom experience. Customers are no longer just the recipients of a product or service, but they are engaged across its life cycle, including being part of the design, in the case of hyper-customized products.
- Companies are expanding their product portfolios and gaining the ability to add or remove features at minimal cost in little to no time. This inspires customers to want to update to the latest products and services.
- Increased competition coupled with low-switching costs further necessitate a shift towards personalization.

Example:

Today's Customized Experience is not just about the consumer's attributes; it is about understanding behavioral patterns and providing targeted content. For instance, a fashion retailer can offer a virtual reality shopping experience in which customers can easily try on new clothes and accessories as an image overlay to see how the item would look on them. The company also can deploy tracking mechanisms to detect the customers' eye movements and wearable devices that can trace heart and brain signals in order to deliver suggestions based on the behavioral profile, inventory availability and supply flexibility. The customer can then order on the spot, and a machine-learning algorithm will optimize the supply network to deliver the product either to the store or to the customer's desired address in the most efficient, cost-effective way. A personalized shopping experience coupled with internet of things devices enable the digital supply network to operate in a connected, efficient and always-on manner, delivering substantial cost-reduction and revenue-generation opportunities.

Customized Experience

Relations with other level-1 Capabilities

Digital Development	The Digital Development function simplifies and personalizes product design and shifts the development mindset toward a customer-led, data-driven approach. Deep neural networks provide insights from customer data and transform the design process.
Dynamic Fulfillment	The Dynamic Fulfillment function creates individualized fulfillment channels based on priority customer segments and geographies through the use of systematic product tracking.
Intelligent Supply	The Intelligent Supply function enables smart cross-buy and resupply scheduling based on customer preferences and source material to cater to individualized products, with a focus on flexible, low-cost raw materials
Smart Operations	The Smart Operations function uses advanced, scalable technologies, such as 3D printing, to produce customized products in a reliable, fast and cost-effective way. These technologies provide fast and inexpensive design alterations because of their nimble manufacturing cycles.
Synchronized Planning	The Synchronized Planning function enables end-to-end customer planning and engagement with personalized supply and demand balancing.

Customized Experience

Impact of digital disciplines

Sense	• Goes beyond what defines the product to consider product performance, the environment the product will operate in and how the customer will use the product. Behavioral customer sensing is necessary to create and predict what the customer needs.
Collaborate	• Uses cross-functional collaboration with commercial, manufacturing and design functions, among others, to utilize exponential technologies to process and translate volumes of raw machine data into formats that are optimal for human interaction, such as recommendations for a consumer to consider a similar product
Optimize	• Optimizes product and content development by analyzing product data to tap into the power of relationships between data points gathered along the value network
Respond	• Responds to ever-increasing competition by meeting changing customer preferences and focusing on a personalized experience across the supply network

Customized Experience

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Connected Customer	Customized Experience	Customer lifetime value		$	No	Service	Measures the total amount of money a customer is expected to spend in your business, or on your products, during their lifetime.	1. Low Maturity: (Average value of a purchase) * (Number of purchase / period of time) * (Number of expected length of relationship in period of time) 2. High Maturity: Artificial intelligence model that takes into account multiple data sources (e.g., purchase history, make/break parameters for each customer, such as price breaks / discounts) and predicts the expected customer cashflow as well as the probability of a customer discontinuing the relationship (ties to customer churn)
Connected Customer	Customized Experience	Customer Satisfaction	CSAT	%	No	Service	CSAT tracks how satisfied customers are with your organization’s products and/or services.	Number of satisfied customers (e.g., 4 and 5 ratings) / Number of survey responses / reviews) x 100 = % of satisfied customers
Connected Customer	Customized Experience	Customer Churn (Does it fit here? what are its leading indicators?).	Customer Attrition	%	No	Service	Tracks when a customer chooses to stop using the products or services (e.g. declining repeat purchases, reduced purchase amounts as well as predictive capabilities)	Deep learning model which takes into account multiple data points (e.g., purchase history, time spent on website) and predicts the probability of a customer to stop using the product or services.

Customized Experience

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Connected Customer	Customized Experience	Conversion Rate (if tailoring well, conversion rate should be higher)		%	No	Service	Measures how many customers redeemed deals and offers that were specifically tailored for them, and ignores conversions for any offers or sales that were pushed en masse to the entire customer base.	(Number of purchases (or clicks) / total number of communicated offers / messages) x 100
Connected Customer	Customized Experience	Sentiment Score (propensity to recommend?) is this the same as Net promoter score?		#	No	Service	Sentiment analysis provides the most direct insight into customers' attitudes, emotions and opinions. While sentiment analysis reveals exactly how customers are responding to a specific brand, it also discloses their thoughts about topics that are important to them.	Machine learning model that uses custom and open-source dictionaries to understand human language (from complaints, feedback, social media) and automatically assigns a sentiment score as well as semantic analysis.

Customer Issue Management

Definition and objectives

Definition:

The strategic methodology, process and tools in place to empower first-line and higher-tier customer service representatives (CSRs) to resolve issues and intelligently process feedback in response to customer- or product-related issues. The goal of Customer Issue Management is to minimize operational costs as well as organizational and reputational risk while establishing brand loyalty.

Why Digital Supply Networks:

Customer feedback data traditionally is extracted from emails, letters and call center logs, but it is not always fed back into the rest of the supply network processes. In most cases, this data is in an unstructured format and requires cumbersome, manual efforts to extract meaningful insights. This leads to inconsistencies in issue resolution and reduced effectiveness. A connected supply network brings together CSRs, digital applications and virtual assistants that communicate with customers about issues in real time and collect data for the organization so that issues can be processed, prioritized and addressed on a larger scale. Some methods of Customer Issue Management include

- proactive issue management, in which better-informed CSRs leverage real-time supply network data to proactively identify potential bottlenecks in manufacturing, sales and marketing, product design, and transportation and distribution and make adjustments to fulfill customer needs in a timely manner, such as by updating the shipping method or delivery date because of bad weather conditions
- feedback prioritization, in which automated workflows are tailored to the customer based on operational, marketing and financial parameters, such as purchasing history or the release of a new product or service
- mapping feedback about product quality issues to manufacturing and design issues while enabling human-centered design.

Customer Issue Management

Definition and objectives

Drivers for Change:

- Increasingly customized products, services and software are delivered when and where the customers desires.
- Expanding purchasing and return options, which are driven by the customer's desire to quickly make purchases, replace items and resolve issues, require a flexible supply network that can be optimized in real time.
- Rising customer expectations coupled with the instant-response mentality require workflow automation and for customer service representatives to be able to use the right data to quickly and effectively respond to feedback. This is also known as first-call resolution and instant prioritization.

Example:

An organization can utilize tools to extract information from customer reviews and feedback posted on multiple channels, including social media, email and call center logs. Artificial intelligence (AI) and machine-learning algorithms can automatically categorize feedback, prioritize it based on relative importance, and either automatically resolve issues in real time or assign them to a customer service representative for further investigation, allowing for a seamless human-machine interaction. As a result, employees now are engaged in more strategic issue-resolution tasks and are freed from mundane categorization processes. In addition, human expert knowledge coupled with AI and advanced analytics allows for the identification of design and manufacturing issues based on quality thresholds and production information.

Customer Issue Management

Relations with other level-1 Capabilities

Digital Development	The Digital Development function collects valuable insights based on customer feedback and translates the information into input for the product design process.
Dynamic Fulfillment	Risk-based fulfillment, which considers issue volume and trending in its predictive model, results in a more efficient supply network and intelligent resupply.
Intelligent Supply	The Intelligent Supply function maintains root causes of customer feedback and provides visibility into potential supplier and external manufacturing and logistics issues.
Smart Operations	The Smart Operations function influences production based on customer feedback and manufacturing issues. A real-time data feed from sales to production that uses information from internet of things devices provides the opportunity to adjust designs and cater to customer preferences.
Synchronized Planning	Emerging relationship

Customer Issue Management

Impact of digital disciplines

Sense	• Uses machine-learning algorithms to rank issues as high, medium or low priority and recommends possible solution mechanisms to streamline resolution and enhance the customer experience
Collaborate	• Integrates issue insights into fulfillment, product development and commercial operations to proactively identify potential issues, including incorrect shipments and stockouts, and minimize incoming issue volume
Optimize	• Uses digital capabilities to transform issue management from a reactive operation to an integral business enabler. Artificial intelligence analyzes customer feedback and draws insights that can optimize product development, supply network operations and commercial operations.
Respond	• Supports a business during unfavorable events, such as stockouts, product recalls and unfavorable market adoption, by offering what-if alternatives and an ability to adjust analysis parameters. This helps company leaders make quick, informed decisions. Customer service representatives are trained, empowered and equipped with the tools to provide quick and effective resolution and response.

Customer Issue Management

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Connected Customer	Customer Issue Management	Number of new issues logged each day		#	No	Service	This is a measure of the process input and the demand for support services from the customers. It is important to track not only the average number of issues logged during a period but also the specifics of when the request was received. This will help determine staffing needs, working hours and gain a better understanding of your customers' behavior.	Number of issues logged daily / avg number of daily incoming issues (normalized)
Connected Customer	Customer Issue Management	Number of issues resolved each day		#	No	Efficiency	This is a measure of the process output and the most-simple indicator of the capacity of the support function. If the number of issues resolved each day is consistently less than the number of new issues that are coming in, it may indicate that the organization is developing a backlog of work which could cause customer issues to be delayed.	Number of issues resolved daily / avg number of issues resolved daily (normalized, shows how well you are doing compared to the avg)
Connected Customer	Customer Issue Management	Effort spent on each issue	Active Time	Time	No	Efficiency	Measuring the active time spent working on issues can provide two important insights. It can help the organization understand how much capacity it has for resolving customer issues, so the organization can know when training and/or additional hiring is needed. It can also provide a baseline for setting expectations with customers on how long it will take to address issues.	Connected Customer

 |

Customer Issue Management

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Connected Customer	Customer Issue Management	Response / Resolution time	Time to Engage / Resolution	Time	No	Efficiency	The time that elapses between the customer alerting the organization that they need assistance and the support team member actively engaging with the customer and finally resolving the issue (technically two different metrics).	Average time spent resolving an issue from time of notification to time of resolution
Connected Customer	Customer Issue Management	Number of escalation requests		#	No	Quality	This metric is both an indicator of customer sentiment as well as support team member effectiveness.	Number of escalation requests / total number of issues

Intelligent Product Tracking

Definition and objectives

Definition:

The ability to ethically track, trace and monitor physical and digital product data in real time from when a product leaves manufacturing through the end of the product's life cycle. This Level 2 Capability provides enterprises with key product health, usage and proximity insights to inform internal strategic and tactical product-related decisions. Intelligent tracking is enabled through internet of things sensors and remote monitoring systems to improve the product's useful life and reduce the cost and complexity of total asset management.

Why Digital Supply Networks:

Today, assets and products typically are tracked through a company's supply network by using active or passive radio frequency identification technology, bar codes and quick-response codes, Bluetooth, and GPS, all of which primarily track product location and usage. With sensor technology becoming more advanced, the use of embedded smart sensors and interconnected platforms is becoming more prevalent in various industries. These technologies

- improve time- and proximity-based tracking
- generate events and trigger specific actions, such as starting steps to avoid downtime and lags, triggering replenishment upstream, and initiating service requests, in real time to support enterprises and end customer requirements
- track product whereabouts as product ownership changes hands from manufacturing to distribution to a third-party logistics provider to a store to the customer
- collect, store and analyze product and asset data, providing enterprises with a platform for predictive and automated decision-making to drive long-term customer value.

Intelligent Product Tracking

Definition and objectives

Drivers for Change:

- The size and cost of sensors as well as the cost of communication devices, storage solutions and processor technology are decreasing.
- Enhanced internet of things (IOT) technology capabilities are available in various functional areas.
- There is a heavier operational focus on preventing loss and theft and reducing the amount of damaged assets within the supply network.
- Cloud-based IOT tracking systems create a competitive advantage to hold internal and external stakeholders accountable.
- Real-time service tracking, along with clear communication to the customers, drives the value proposition beyond physical products.

Example:

Intel's Castle Canyon IOT solution leverages smart sensor tags and cloud connectivity to monitor specific physical parameters, such as temperature, light exposure, location and tilt of key assets, as part of its connected logistics platform. This yields cost savings because the company can move away from time- and usage-based maintenance to more concise, condition-based predictive maintenance, which means issues are only fixed as needed.

Intelligent Product Tracking

Relations with other level-1 Capabilities

Digital Development	The Digital Development function enables enterprises and end customers to understand patterns with asset defects, recalls, theft, and commercial and consumer spending and may guide decisions about whether or not to expand into new product markets or capitalize on existing product lines to fulfill the needs of a changing consumer base.
Dynamic Fulfillment	The Dynamic Fulfillment function provides the ability for sensors on warehouse shelves or on an enterprise's premises to provide direct signals that trigger automatic replenishment, thus limiting product stockouts.
Intelligent Supply	The Intelligent Supply function allows for materials to be tracked at a granular level, enabling enterprises to calculate performance statistics and planning parameters, thus reducing overall inventory levels and increasing a company's agility in responding to customer demand.
Smart Operations	The Smart Operations function enhances monitoring and accuracy of assembly progression, trends and status, enabling manufacturers to proactively influence upstream production priorities to keep assembly lines producing based on their desired cadences and ensuring that enterprise assets are operating at optimal capacity.
Synchronized Planning	The Synchronized Planning function tracks and records various data points for a product, which are stored and analyzed for patterns to assist in upstream planning activities.

Intelligent Product Tracking

Impact of digital disciplines

Sense	• Analyzes an enterprise's product attributes in real time, thereby influencing downstream inventory management decisions
Collaborate	• Enables close monitoring of product health. This can trigger various collaborative efforts across the supply network in real time, such as greater planning during peak customer demand times, more precise maintenance schedules for defective assets, alerts to customer service for product replacements and more.
Optimize	• Leverages data collected through tracking technology and customer-centric cloud platforms to instill machine learning and predictive analytics to further optimize the business decisions made throughout an enterprise's network and shorten lead times to end customers, thus increasing overall customer satisfaction
Respond	• Enhances strategic decision-making regarding inventory management and network design to optimize a supply network's inventory placement for enhanced supply and demand planning, thus reducing transportation costs and limiting stockouts and lag time from manufacturing to the end customer

Intelligent Product Tracking

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Connected Customer	Intelligent Product Tracking	Product or Service Downtime		Time	No	Efficiency	There are 2 aspects to this metric - both measure the efficiency of the product. (1) Total Product Downtime: This measures the total amount of time that a specific product is inoperable due to scheduled or unexpected maintenance. (2) Frequency of Product Downtime: This measures the number of times that the product is down in a given timeframe (i.e. month, year) due to scheduled or unexpected maintenance. A traditional efficiency metric that combines these two components would be Overall Equipment Effectiveness (OEE)	(1) Total Product Downtime: total amount of time (i.e. # of hours) that the product is down / unavailable (2) Frequency of Product Downtime: # of times product is down or unavailable / time period (i.e. week / month) (3) OEE = availability * performance * quality
Connected Customer	Intelligent Product Tracking	Rate of Unexpected Maintenance Costs		$		Quality	Amount of dollars spent on unpredicted maintenance. Higher dollar amount indicates issues with product quality.	Total unplanned $s spent on repairing a product or service
Connected Customer	Intelligent Product Tracking	Product location accuracy rate		%		Service	Accuracy of location tracking for a product.	# of accurate location signals / total number of location signals for a product over specified time period

Intelligent Product Tracking

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Connected Customer	Intelligent Product Tracking	Product Usage Rate		#/Time		Service	There are 3 aspects to this metric - all related to customer engagement. (1) Frequency: This measures how frequently customers are using the product in a given time period. The more engaging and useful the product is, the more frequently customers would use the product. (2) Duration: This measures how long the customers are using the product each time. The more satisfied the customers are, the longer they would interact with the product during each usage. (3) Mode: This refers to the mode or feature used by the customer at a particular time to identify and differentiate the most valuable features of the product	(1) Frequency: # of times the product is turned on / time period (i.e. week / month / year) (2) Duration: average length of time (i.e. minutes) the product is on per each usage (3) Mode: the mode or feature being used at a particular time (when relevant)
Connected Customer	Intelligent Product Tracking	Defects Rate or Crash Rate by Mode		#/Time		Quality	This metric measures the number of defects that have been reported by customers. Many product defects being reported indicate quality or design issues with the product.	[Number of defects or crashes reported for the product or service by failure mode] / Total # days

Intelligent Product Tracking

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Connected Customer	Intelligent Product Tracking	Out of Threshold Event Rate (Product Health)	Product Health	#/Time		Quality	This metric measures the amount of time the product is not operating within expected limits of a health parameter (i.e. product temperature higher than expected). Relevant health parameters are dependent on the product. Examples of health parameters include: temperature, mileage, (web)page response time Higher # indicates issues with product quality and/or design.	# of times product or service not operating within defined limits of a health parameter / total time in-use

 |

Monitoring and Insights

Definition and objectives

Definition:

The ability to seamlessly tie products to the customer experience through the ethical collection of real-time product data in order to drive customer success in the use of the product or service and improve customer satisfaction. This Level 2 Capability enables identification of customer lifestyle and consumption patterns; failure modes and effects; maintenance preferences; and proactive notification opportunities across the customer journey, from awareness to service.

Why Digital Supply Networks:

Although customer data traditionally is derived from the transactional data generated at the point of sale, real-time product usage data typically is non-existent. Digital supply networks link real-time product usage with customer data, providing a contextual and more complete view of the product-customer interaction and of the customer lifestyle. Aided by internet of things sensing capabilities and machine learning, this rich interaction data enables companies to

- deliver a more effective customer experience
- identify product usage patterns and monitor product health
- automate replenishment orders
- provide predictive maintenance notifications and service suggestions
- optimize aftermarket parts inventories
- influence new product development.

Monitoring and Insights

Definition and objectives

Drivers for Change:

- Increasing volumes of unstructured customer and product data from disparate sources result in data overload.
- Advancements in internet of things–enabled products make low-cost, real-time product monitoring possible.
- Customers expect a hyper-now, hyper-custom experience.

Example:

By using real-time product data from connected devices, such as connected washing machines, cars or televisions, machine-learning models can notify the customer of failure risks and offer customized remedial measures, such as automatically creating a replenishment order for the at-risk part or helping the customer schedule a maintenance appointment. Failure avoidance that takes into consideration customer-specific preferences will likely result in a better customer experience and reduce costs for both the customer and the service or product provider.

Monitoring and Insights

Relations with other level-1 Capabilities

Digital Development	The Digital Development function collects and provides rich usage data, information about failure modes and effects, and qualitative or quantitative feedback regarding product features to influence the product's design.
Dynamic Fulfillment	The Dynamic Fulfillment Function triggers automatic replenishment based on consumption patterns and enables predictive maintenance notifications and service suggestions.
Intelligent Supply	The Intelligent Supply Function provides detailed quality and usage information to inform vendor selection decisions.
Smart Operations	The Smart Operations function influences production mix and production order prioritization decisions through real-time consumption monitoring. It also provides feedback about product quality.
Synchronized Planning	The Synchronized Planning function enables a tighter link among customer demand, supply, and optimization of finished goods and aftermarket inventory levels through real-time consumption monitoring and failure mode information.

Monitoring and Insights

Impact of digital disciplines

Sense	• Monitors customer usage patterns to sense changes in consumption behaviors and proactively predict failures and issues in order to better serve the customer
Collaborate	• Develops proactive customer engagement models for prescriptive customer experiences
Optimize	• Develops predictive supply network strategies to optimize supply network performance based on the data collected from customers
Respond	• Supports advanced detection of failure points to avoid customer issues and improve customer response times and service levels

Monitoring & Insights

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Connected Customer	Monitoring and Insights	Product Design Contribution Rate		%	No	Quality	Measures product improvement areas gathered through direct monitoring of product usage/health	Total number of improvement areas gathered via product monitoring / total number of product improvements
Connected Customer	Monitoring and Insights	Self-Replenishment Subscription Rate		%	No	Service	Measures the number of customers that subscribes to self-replenishment service for the product, which measures the success / reliability of self-replenishment	Total number of self-replenishment subscriptions / total number of products sold
Connected Customer	Monitoring and Insights	Parts Unavailable Incidents		%	No	Service	Measures number of times parts to service the product is unavailable when needed. This measures the success of monitoring product health and plan supply chain accordingly.	# of times needed part is unavailable

Product as a Service (PaaS)

Definition and objectives

Definition:

The ability to transform business models from acquisition to service and cater to additional customers through new avenues of engagement and revenue. PaaS includes innovative bundling of products and services into recurring subscription and flexible-consumption offerings.

Why Digital Supply Networks:

Traditionally, business models focus on a single customer transaction and fail to optimize for long-term customer value. In a digital supply network, PaaS supports an alternative business model that offers services supported by products, with the objective of building long-term customer relationships and maximizing customer lifetime value. This help companies

- create recurring revenue and implement new sales models, such as freemium, tiered-service offerings and pay as you go
- generate new channels for revenue through elevated versions of existing products and services and data visibility
- shift certain costs from capital expenses to operational expenses
- increase customer loyalty and engagement beyond the initial product purchase and create better aftermarket experiences
- reduce constraints on the supply network through greater visibility to consumption patterns.

Product as a Service (PaaS)

Definition and objectives

Drivers for Change:

- Customer preferences are shifting toward pay-as-you-go and consumption-driven pricing models.
- There is an increased focus on improving customer experience by developing innovative customer engagement models.
- Companies have an improved ability to follow the customer beyond the point of sale and to monitor subscription activities.

Example:

Many personal styling service companies, along with their big-name affiliations, are offering subscription-based clothing lines to their customers. Some currently operate on a model where customers pay a fixed styling fee for each order and then, after reviewing the clothing sent to them, pay for any items they decide to keep. Others operate on a rental-based model with similar fixed subscription fees and customers paying for how many items they rent and how long they are rented. Such services not only increase customer loyalty and connectedness and provide a hassle-free customer experience but also seek long-term recurring revenue and an opportunity to market peripheral and extended services.

Product as a Service (PaaS)

Relations with other level-1 Capabilities

Digital Development	The Digital Development function provides real-time subscriber data and information about usage patterns of products, services and features that can help determine future product designs.
Dynamic Fulfillment	The Dynamic Fulfillment function triggers self-balancing fulfillment options based on forecasted usage patterns determined by subscriber behaviors.
Intelligent Supply	The Intelligent Supply function provides real-time subscriber information to enable a more predictive and flexible supply.
Smart Operations	The Smart Operations function influences production mix and production order prioritization decisions through real-time consumption monitoring. It also provides feedback about product quality.
Synchronized Planning	The Synchronized Planning function enables a tighter link among customer demand, supply, and optimization of finished goods and aftermarket inventories through real-time consumption monitoring and failure mode information.

Product as a Service (PaaS)

Impact of digital disciplines

Sense	• Develops a better understanding of customer needs by staying close to the customer via subscription models
Collaborate	• Develops real-time innovative solutions and offerings or promotions for customers based on their usage patterns and improved feedback loops
Optimize	• Utilizes artificial intelligence to develop innovative customer interaction solutions for an always-on service experience
Respond	• Reduces service failure rates by monitoring customer experiences in real time and proactively resolving issues

Product as a Service (PaaS)

DCM		**KPIs**						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Connected Customer	Product-as-a-Service	Net Monthly Recurring Revenue Growth Rate	MRR Growth Rate	%	No	Cost	Measures the month over month percentage increase in net MRR. Closely ties to Customer Churn / Retention Rates (Customer Satisfaction)	[(Net Revenue CM) - (Net Revenue CM - 1)] / (Net Revenue CM - 1) * 100
Connected Customer	Product-as-a-Service	Average Customer Acquisition Costs Per Account	Average CAC Per Account	$	No	Service	Measures the $ amount required to acquire each customer. Can be used to calculate CAC Payback Rate (the amount of time it takes to earn the CAC back). To accurately measure this, the challenge lies in the ability to exclude stagnant accounts, dummy / trial accounts, multiple accounts for 1 unique user / customers, etc.	(Total CAC) / (Total Accounts)
Connected Customer	Product-as-a-Service	Average Revenue Per Account	ARRA	$	No	Cost	Measures the revenue generated per account, calculated periodically (monthly / yearly / weekly). To accurately measure this, the challenge lies in the ability to exclude stagnant accounts, dummy / trial accounts, multiple accounts for 1 unique user / customers, etc.	(Total CM MRR) / (Total Accounts)

Product as a Service (PaaS)

DCM		**KPIs**						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Connected Customer	Product-as-a-Service	Gross Revenue Expansion Rate	Gross MRR Expansion Rate	%	No	Cost	Measures the percentage of revenue gained due to add-ons, upsells or cross-sells estimating the total revenue increase to the company each month. Can be combined with Gross MRR Churn Rate to measure "MRR Retention Rate"	(Total CM MRR Expansion) / (Total CM MRR) * 100
Connected Customer	Product-as-a-Service	Gross Revenue Churn Rate	Gross MRR Churn Rate	%	No	Cost	Measures the percentage of revenue lost due to cancellation or downgrades estimating the total loss to the company each month. Can be combined with Gross MRR Expansion Rate to measure "MR Retention Rate"	(Total CM MRR Churn) / (Total CM MRR) * 100

Product-as-a-Service (PaaS)

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Connected Customer	Product-as-a-Service	Lifetime Customer Value	LCV	$	No	Service	Measures the total amount of money a customer is expected to spend in your business, or on your products, during their lifetime.	1. Low Maturity: (Average value of a purchase) * (Number of purchase / period of time) * (Number of expected length of relationship in period of time) 2. High Maturity: Artificial intelligence model that takes into account multiple data sources (e.g., purchase history, make/break parameters for each customer, such as price breaks / discounts) and predicts the expected customer cashflow as well as the probability of a customer discontinuing the relationship (ties to customer churn)

Connected Field Services

Definition and objectives

Definition:

A holistic approach for managing end-to-end customer service activities off-site through proactive monitoring of assets, remote engagement and other preventative measures and on premise through mobile connected devices, customer and issue analysis tools, and work order automation processes. Connected Field Services enables enterprises and their customers to better manage risks and reduce downtime while lowering total labor costs and cost of service and providing greater chances for cross-selling to increase revenues.

Why Digital Supply Networks:

Traditionally, field services was considered to be a costly, but necessary, post-sales service with limited potential for generating new business. It usually was operated in a silo as a lower-priority arm with limited investment in technology. Today, Connected Field Services has become a key differentiator in maintaining ongoing customer relationships. Leading enterprises now have a suite of tools including mobile platforms, internet of things sensor–driven technology and cloud capabilities, optimizing real-time management of customer, workforce, service and back-office integration. Connected Field Services also enables remote and preventive maintenance to limit unneeded on-premise service requests. Field technicians are provided with critical customer insights that help ensure they are fully equipped to provide the best service as well as promote ancillary products or services that may not have originally been sought by the customer. Connected Field Services management provides key benefits that further enhance overall customer life cycle value, such as

- an increased ability to sell premium support services by offering predictive or managed services to customers
- a reduction in unplanned downtime due to data-driven preventive maintenance
- increased first-time fix rates and reduced time to fix due to automation and optimization of people and parts
- improvements to product design by cycling asset and work order data into the research and development process.

Connected Field Services

Definition and objectives

Drivers for Change:

- Internet of things technology and cloud-computing capabilities are becoming less costly and allow for better tracking of product health and usage patterns.
- Companies are focusing on reducing service costs while improving customer service relationships.
- A more connected marketplace is demanding higher-productivity service and emphasizing first-time fix rates.
- Service and maintenance methodology is changing from reactive to proactive.

Example:

Verizon Connect introduces a new, innovative enterprise software known as Workforce, a full-scale one-stop solution for operations and fleet managers that can help them plan, monitor shipments, dispatch service agents, capture data and communicate with customers more closely. Verizon Connect enables better management of customer service, cutting down on overall labor time for technicians in both the field and the back office and enhancing customer satisfaction.

Connected Field Services

Relations with other level-1 Capabilities

Digital Development	The Digital Development function produces unique insights into an enterprise's quality, reliability and failure rates as well as about the real-world usage of products the company designs, builds, sells and services.
Dynamic Fulfillment	The Dynamic Fulfillment function provides preemptive replenishment of tools and parts needed to perform adequate service based on real-time customer needs during field calls.
Intelligent Supply	The Intelligent Supply function logs real-time inventory usage data in the field, thus reducing overall safety stock inventory levels through optimized reorder points for replacement tools and parts by upstream suppliers and manufacturers.
Smart Operations	The Smart Operations function identifies areas to enhance factory quality based on data analysis gathered from service requests, thereby providing more reliable products to end customers and enterprises and increasing customer satisfaction.
Synchronized Planning	The Synchronized Planning function enables real-time planning for customer-owned equipment and parts that are in need of repair or replacement to ensure that replacement parts are always in stock for the customer.

Connected Field Services

Impact of digital disciplines

Sense	• Provides field technicians with insights from customer product and service request data and internet of things technology to develop a deeper understanding of what customer issues are reoccurring more frequently. This enables the company to better predict and prevent issues and address them in a quicker manner.
Collaborate	• Engages manufacturers and suppliers to quickly react to changing demands when equipment defects are identified and replacement parts are needed, ensuring field technicians are always prepared with the necessary equipment to perform the job
Optimize	• Utilizes machine learning and predictive analytics to produce preemptive processes and triggers aimed at addressing issues remotely and increasing proactive behavior within the field prior to major equipment malfunctions
Respond	• Develops and executes human and technology strategies to reduce risk after purchase through the initiation and education of predictable service repairs provided by the right technicians at the right time with the right equipment, thereby optimizing the customer experience

Connected Field Services

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Connected Customer	Connected Field Services	First-time-fix-rate	FTFR	%	No	Efficiency	Measures the percentage of time a technician is able to fix the issue the first time, without need for additional expertise, information, or parts. The metric also closely ties to Customer Satisfaction and cost reduction.	(Total # of first time fixes in a given time) / (Total # of fixes in a given time) * 100
Connected Customer	Connected Field Services	Average Response Time		Time	No	Efficiency	Measures the average amount of time it takes to dispatch services to customers	(Total dispatch time) / (Total # of service requests)
Connected Customer	Connected Field Services	Mean-time-to-Repair OR to-Complete	MTTR or MTTC	Time	No	Efficiency	Measures the time to repair / service a product OR for a business to complete the entire repair / service cycle	(Total time to repair OR complete service) / (Total # of service requests)
Connected Customer	Connected Field Services	Uptime	Contract Uptime	Time	No	Quality	Measures the problem-free operational time of a product / service	Uptime
Connected Customer	Connected Field Services	Service Contract Attach Rate		%	No	Service	Measures the percentage of additional maintenance services purchased compared to all purchases	(Total # of maintenance services purchases in a given time period) / (Total # of purchases in a given time period)
Connected Customer	Connected Field Services	Cost Per Incident		$	Yes	Cost	Measures the amount capital or spending associated with (field service) issues resolution.	(Total Field Service Costs, in a given time period)/(Total Number of incident, in a given time period)

Deloitte.

Smart Operations

Smart Operations

Definition and vision

Definition: The Smart Operations Capability is a highly responsive, adaptive, digitized and connected function integrated into the digital supply network that synchronizes all aspects of production and operations. Smart Operations drives significant performance and safety improvements in production and similar functions, such as quality and maintenance, repair and overhaul.

Vision: The Smart Operations Capability augments human intelligence with machine intelligence and human physical capability with machine capability to drive and sustain step-change improvements in operational performance and safety.

Smart Operations

Overview of level-2 Capabilities

	Dynamic Operations Sensing	Augmented Workforce	Digital Process Twin	Operations Command Center
Definition	The ability to capture real-time operational data using **connected machines** and **suites of sensors**, including mechanical, electrical, ambient and location sensors, and stream live operational performance metrics to the Digital Process Twin to allow instantaneous optimization of operations and asset performance	The ability to **enhance worker safety, productivity, capability and performance** by delivering task-specific information directly to the point of use via augmented interfaces, collaborati ve robots and image recognition to support the worker and **minimize waste**	The ability to aggregate data from products, processes and enterprise systems to create **real-time digital models** of what has transpired, is transpiring and might transpire in the physical operations or network. The Digital Process Twin **contextualizes input data** and serves as a **single source of truth** for other Level 2 Capabilities .	The ability to provide **real-time visibility into operations performance** and **identify deviations from standards** by applying data science methods to the Digital Process Twin and other enterprise systems across the production ecosystem. Role-based dashboards and alerts enable **simulation and instantaneous intervention** when an anomaly or a risk is detected.
What's New	• Novel sensor technologies that enable deeper insights • Sensors becoming cheaper and smarter • Cloud data allows more affordable and flexible storage on-demand	• Emerging technologies that enhance human abilities • Real-time information that is fed and collected • Improved safety and productivity	• Data collection and storage improvements • Advanced process modeling and simulation tools • Near ubiquity of 3D models for industrial assets	• Powerful data science and reliable process data • Enhanced human-machine interfaces • Increased connectivity between enterprise systems

 |

Smart Operations

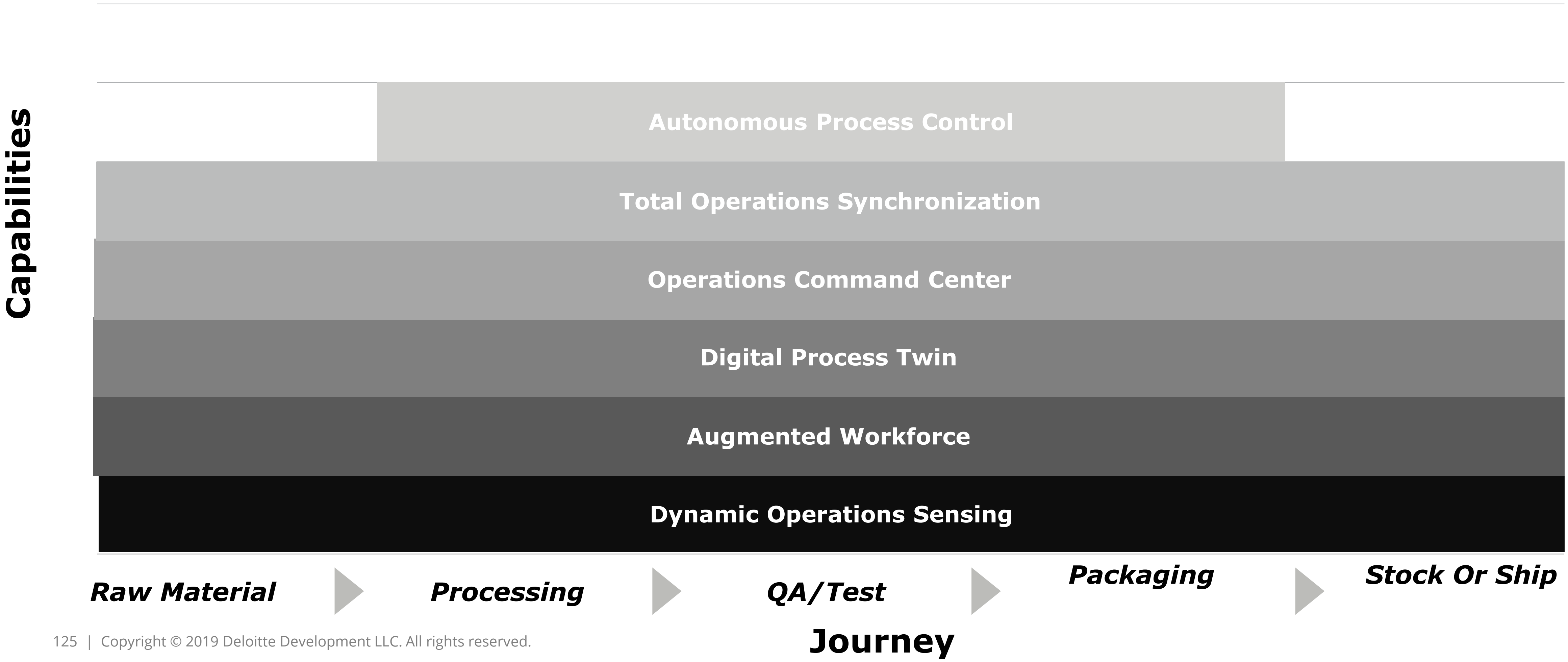
Overview of level-2 Capabilities

	Total Operations Synchronization	Autonomous Process Control
Definition	The ability to continuously **schedule and allocate scarce resources** to optimally execute production and operational activities based on Operations Command Center insights to increase visibility and coordination of machines, people and processes across the network.	The ability to drive real-time process control and adjustment by responding to local issues and opportunities through feedback or feed-forward mechanisms to **autonomously correct problems**
What's New	• Increased connectivity across operations ecosystems • Continuous autonomous line balancing	• Advancements in edge computing and data science • Real-time data streaming and latency improvements • Increased connectivity of industrial assets

CAPABILITY DEFINITION

Smart Operations

Journey map



 |

Smart Operations

Capability maturity

Dimension	Ad-hoc	Typical	Advanced	Leading
Dynamic Operations Sensing	Data collection is fragmented and limited to critical assets. Data is gathered on a firefighting basis, leading to siloed and ad-hoc decision-making.	Most of the assets and some critical processes are enabled to generate and transmit data but not in near-real-time.	Reliable and near-real-time data is gathered from most assets and processes. The remaining gaps are not mission critical.	Operations sensing is conducted in real time on all assets and all processes with high frequency and quantity, enabling fully automated monitoring.
Augmented Workforce	The workforce still is completing manual, repetitive tasks. Augmentation is under consideration, but underlying enablers, including data sources, are not in place.	Basic collaborative robots and interfaces are beginning to be deployed but with significant human intervention and manual monitoring.	Augmented interfaces and collaborative robots are implemented throughout the organization, and many repetitive tasks are automated. Automation plays a role in strategy.	Nearly all repetitive tasks are automated. Artificial intelligence drives decision-making, exceeding human capacity in driving efficiency. Automation is a cornerstone of strategic planning.
Digital Process Twin	Simple models are created for critical assets and processes only. Models are one-offs, and organizations do not have any simulation ability.	Strong models are created for critical assets and processes, while simple models are created for others. Simulation requires manual effort and has gaps.	Strong models are created for most assets and processes. Simulation of most processes is done through manual effort.	Strong models are created for all assets and processes. Simulation of all processes is continuous and automatic.

Smart Operations

Capability maturity

Dimension	Ad-hoc	Typical	Advanced	Leading
Operations Command Center	Only a small number of key performance indicators in the Digital Process Twin are monitored, typically in order to generate alerts based on manually set limits. Use of visualization tools is limited.	Most key performance indicators in the Digital Process Twin are monitored in order to generate alerts based on automatically updated statistical process controls. Alerts are communicated via a generalized dashboard.	All key performance indicators in the Digital Process Twin and some key data in connected enterprise systems are monitored using advanced analytics to identify potential failures. Alerts are communicated via function-specific dashboards.	All key performance indicators in the Digital Process Twin and all key data in connected enterprise systems are monitored using predictive analytics to identify potential failures. This provides feedback and instructions to assets and staff. Alerts are tailored to users.
Total Operations Synchronization	Scarce resources, including tools, materials and third-party components, are scheduled and allocated based on warnings from the Operations Command Center (OCC), but specific redistribution plans must be created manually.	Scarce resources are scheduled and allocated based on redistribution recommendations that are automatically generated from OCC alerts.	Scarce resources are scheduled and automatically allocated based on alerts from the OCC without operator intervention.	Scarce resources are scheduled and automatically allocated based on insights from across the supply network.
Autonomous Process Control	Human operators manually adjust process inputs, such as temperature, duration and rotations per minute, based on out-of-limit warnings from the OCC.	Human operators manually adjust process inputs according to recommended actions that are automatically generated based on OCC alerts.	The OCC independently provides feedback and feed-forward information to correct issues and makes improvements.	The OCC automatically adjusts process inputs based on insights from across the supply network.

Smart Operations

Profile: Thomas, Operations Command Center director

Overview

Thomas is an experienced leader proficient in juggling the needs of the moment with foresight and insight to shape and later execute the long-term supply network strategies that align to the overall enterprise strategy.

Education

George Washington University

- MBA with concentrations in finance and management

Rutgers University

- Bachelor of Science in industrial and systems engineering

Experience

Current Position

- Operations Command Center director

Thomas manages factory performance in real time. He only needs to intervene and make course-correction decisions when an anomaly is detected within a process or an exception is created by an external force. He also intervenes when an automated system is not able to manage the complexity of an anomaly.

Thomas also works with the Digital Process Twin engineering manager to identify potential risks and opportunities and make forward-looking decisions based on scenario results.

Previous position

- Digital process twin engineering manager

Smart Operations

Profile: Thomas, Operations Command Center director

	Arrival	Morning	Midday	Afternoon	End Of Day
Before implementing the principles of Smart Operations, Thomas was only focused on local operations and used static tools to manage the Operations Command Center.	Thomas begins to pour over the reports from the industrial engineering and operations teams that are in his email inbox.	Thomas attends a daily status meeting with managers from across the factory. Today they discuss a machine that went down overnight and how quickly they can get it back online. Thomas establishes her priorities and decides on an action plan.	Thomas receives a call from the material-handling team notifying him that the shipment of a key sub-component for the product currently running on two production lines in Illinois has not arrived. He calls an emergency meeting to discuss the situation.	With a plan in place, the team in Ohio begins to make adjustments, as does the team in Illinois. As second shift arrives, Thomas realizes he can't get out of the plant on time and has to stay to help manage the crisis.	Thomas has remained during second shift to help coordinate the response. Before he leaves, he sends a flurry of emails to his staff in hopes that they will help address the issues.
After implementing the principles of Smart Operations, Thomas has a global perspective and the dynamic tools to manage the Operations Command Center.	Thomas logs in to the command center app to check the status of operations. He then connects with his counterparts in Illinois, Istanbul and India to coordinate across the network.	Thomas begins to juggle real-time monitoring of exceptions provided by each production line while coordinating with Homer, the Digital Process Twin manager, to proactively prepare for a late delivery to a facility in Illinois by running scenarios to optimize a response across both facilities.	With a plan in place to draw down their buffer supply to make up for the shortfall in Illinois, Thomas glances at a screen in the command center to confirm that two lines were switched over during the lunch break and video conferences with the with the Command Center in Illinois to confirm that they have prepared their lines to produce the next highest priority product	Conferring with the directors elsewhere as well as their Digital Process Twin engineering mangers, Thomas identifies an opportunity to automate the response in case an identical scenario arises again.	Having finished a 30-minute jog with his dog, Thomas checks his smartwatch and is relieved to see that there are no open tier-1 or tier-2 exceptions and that the factory network is continuing to run smoothly. He heads home from the park to have dinner with his family.

Smart Operations

Profile: Ross, material manager

Overview

Ross is a newly promoted material manager at a tier-2 automotive supplier. He began as a supply planner and is well versed in procurement but unexperienced in managing a team spread across several sites. His previous experience with the Operations Command Center was key in his promotion.

Education

Clemson University

- Bachelor of Science in industrial and systems engineering

Deloitte Training Program

- Operations Command Center Accelerator

Experience

Current Position

- Material manager

Ross is responsible for managing the portion of the Operations Command Center that controls inventory and purchasing procedures of raw materials and other supplies for a group of factories. His goal is to monitor and optimize the quality and use of materials in order to meet production requirements while maintaining low costs. A supply planner and a data scientist report to Ross and help manage Operations Command Center notifications.

Previous Positions

- Supply planner

Smart Operations

Profile: Ross, material manager

	Arrival	Morning	Midday	Afternoon	End Of Day
Before implementing the principles of Smart Operations, Ross has to handle materials issues manually and on a case by case basis.	Ross enters his daily morning production meeting. He is immediately informed by the night shift manager that some products failed final quality assurance testing. He thinks they may have used one or more batches of bad raw material. Ross needs to lead a root cause corrective action analysis.	Ross sends a series of emails to operatives in the hopes of tracking down the source of the defective inventory and products. Ross and his team members, who have been pulled from their daily routines to address the crisis, successfully identify the source.	Ross finally receives the quality assurance report describing what went wrong with the batch. Other batches need to be tested for the same defect. Ross manually identifies the batches that need to be recalled. Unfortunately, several batches were used, and some finished products will need to be scrapped.	Ross spends the afternoon finalizing the containment of the defective inventory. Ross records the amount of inventory that has been affected so that it can be replaced to maintain the planned production rate.	Ross is aware of the financial strain this defect in raw material will cause the factory. He spends the rest of the day writing scrap tickets. He drafts a report about the day's events for leadership's awareness and so the supplier can take corrective action in the future.
After implementing the principles of Smart Operations, Ross has greater visibility into individual and related materials issues and receives automated assistance from the Operations Command Center to isolate, mitigate and resolve problems.	Ross logs in to the company Operations Command Center (OCC) web portal at his home office and begins reviewing night shift reports from each factory in his group. One factory reports that a batch of bad material was detected. The Advanced Process Control (APC) could not correct the issue, so the Total Operations Synchronization system quarantined and replaced the material.	Ross opens an interactive analytics model of the OCC that uses machine learning and human intuition to find patterns. He quickly locates another batch that is likely defective. He sends a short report along with the data to the supplier and signs a purchase order for a new shipment. The OCC updates the supplier's scorecard with the defects.	Ross oversees that the OCC provides accurate feed-forward instructions to modify downstream processes to still use the defective material. Some of the material can be successfully altered and reused.	With limited loss of material, work in the factory continues as usual. The results are used to generate a new set of countermeasures for APC to use in the future. Ross ensures that the in-transit raw material is redirected for defect testing and rework before it ever reaches the factory.	A final report from the OCC comes through about target inventory levels. The OCC has identified that several key components used at each factory are not optimally distributed. One facility has 98% of the stock, and the others have routine shortages. Ross approves the OCC suggestion to rebalance the material.

Smart Operations

Profile: Rachel, hybrid machinist

Overview

Rachel is a newly graduated machinist proficient in the operation of hybrid machining centers, or machines that both remove and add material with processes like CNC milling and laser fusion deposition, respectively. Rachel is comfortable with digital systems and has an intuitive understanding of machines. However, she lacks deep experience in manufacturing operations.

Education

Orange County Community College

- Associate degree in computer-integrated manufacturing

Experience

Current position

- Hybrid machinist

Rachel is responsible for the programming, set up, operation and maintenance of hybrid machining centers. She take computer-aided design models from the engineering group and creates programs to produce the needed parts.

Previous position

- Student

Smart Operations

Profile: Rachel, hybrid machinist

	Arrival	Morning	Midday	Afternoon	End Of Day
Before implementing the principles of Smart Operations, Rachel had to prioritize her work manually and could only address machine issues after they damaged several parts.	Rachel runs the warm-up program on her three-axis CNC milling machine. She proceeds to pull work orders and establishes a schedule for the rest of the week using her own prioritization technique.	Rachel proceeds to acquire the raw material she will need. She pulls the tools from her crib and settles into her workstation. She obtains and installs her fixtures.	Rachel runs the first piece and delivers it to the quality assurance (QA) team for inspection. She will break for lunch and work on other tasks until the QA team gives her the results of the inspection.	Rachel receives approval from the QA team early in the afternoon. She starts to run the first 100 of 300 parts. She carefully inspects certain parts to monitor the quality of her process.	Rachel was making good progress until a tool in the machine broke. She spent a large portion of her afternoon replacing the tool. Once the machine was operational again, she inspected the finished parts and found that some were damaged by the broken tool. She must scrap some parts and finish the job tomorrow.
After implementing the principles of Smart Operations, automation tools help Rachel optimize her manufacturing production and quickly address machine issues before they become a larger problem.	When Rachel arrives, the Operations Command Center has generated all needed work orders and optimally scheduled them for the entire week. Additionally her machining center has already processed the first order. Material-handling robots begin to deliver the tools and material she will need.	She is ready to run the first part in her five-axis, fixtureless CNC machine within minutes. In-process quality inspection provides immediate approval to continue the job. With everything ready, she begins running the first 100 of 300 pieces. While the machine is running, she starts programming the next job.	With the first 100 pieces done, Rachel adds more raw material to the machine's staging area. Because the machine is restocked and ready to produce the next 100 parts, Rachel breaks for lunch.	After returning from lunch, Rachel runs the last 100 pieces, but a tool breaks at piece number 50. The machine automatically switches to a new tool, 3D scans the part, generates corrective action and prompts Rachel for approval. Rachel uses augmented reality (AR) goggles to inspect the part and approve the repair.	Rachel runs the last 50 pieces in the afternoon. While the machine is running, she adds the tool breakage to the project management database. As the pieces finish, Rachel closes the work order and ends the day by completing an immersive AR training for a new tool that she will use next month.

Dynamic Operations Sensing

Definition and objectives

Definition:

The ability to capture real-time operational data using **connected machines** and **suites of sensors**, including mechanical, electrical, ambient and location sensors, and stream live operational performance metrics to the Digital Process Twin to allow instantaneous optimization of operations and asset performance

Why Digital Supply Networks:

There are numerous variables and inputs in any operational environment. Today many of those variables are not monitored, collected or communicated in any meaningful way either because of lack of connectivity or lack of technical ability to measure. The introduction of new connected machinery and the improved affordability of new, smarter sensors and data storage options provide additional lines of sight into mechanical, electrical, ambient and location data at a scale not previously possible. Dynamic Operations Sensing allows this data to be collected in a centralized way, both locally and in the cloud, so that it can be analyzed and actioned by other Level 2 Capabilities.

Dynamic Operations Sensing

Definition and objectives

Drivers for Change:

- Traditional continuous improvement programs are seeing diminishing returns.
- Companies increasingly need additional, richer data sets to solve modern problems.
- Real-time visibility into operations is needed to drive quality throughput.

Example:

One of the largest automobile manufacturers in America has connected roughly 8,000 robots to the internet, allowing for data to be streamed into the cloud for analysis and failure prevention.

Dynamic Operations Sensing

Relations with other level-1 Capabilities

Synchronized Planning	The Synchronized Planning function evaluates demand forecasts, inventory requirements and production plans using data models based on real-time sensor data.
Intelligent Supply	The Intelligent Supply function provides data that can drive reordering, input to specifications and specification revisions, vendor assessments, payment triggers, and more.
Dynamic Fulfillment	Sensor data can provide early warnings about problems or needed adjustments in Smart Operations, potentially impacting fulfillment timing, channel selection and more.
Connected Customer	Connected sensors enable real-time insight into the current status and quality of customer orders.
Digital Development	The Digital Development function enables integration layers between enterprise resources planning and internet of things platforms for a homogenous conversion of data into actionable insights.

Dynamic Operations Sensing

Impact of digital disciplines

Sense	• Includes the ability to read, store and analyze the continuous or discrete data being transmitted to and from assets, work-in-process material, infrastructure and personnel. The data is transmitted through either built-in asset sensors or retrofitted external sensors added to solve specific operational challenges.
Collaborate	• Utilizes a large number of many different types of sensors that work together to provide a complete picture of the whole operation. No single sensor or sensor type is sufficient to support the complete system.
Optimize	• Uses sensor data to optimize Smart Operations that use the Digital Process Twin
Respond	• Uses sensors to generate the inputs that signal changes in processes to enable Smart Operations to make corrections and maintain control

Dynamic Operations Sensing

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Smart Operations	Dynamic Operations Sensing	OEE - Equipment Availability		%		Service	Measure of actual run time compared to planned production run time	Run Time / Planned Production Time
Smart Operations	Dynamic Operations Sensing	Mean Time To Repair (MTTR)	Mean Time To Failure (MTTF)	Time		Service	Measure of average time required to repair a broken-down asset	Total corrective maintenance time / Total number of corrective maintenance actions for failures during a given time
Smart Operations	Dynamic Operations Sensing	Mean Time Between Repair (MTBR)	Mean Time Between Failure (MTBF)	Time		Service	Measure of average time that passes between two successive failures of an asset	Total operational time / Total number of failures
Smart Operations	Dynamic Operations Sensing	OEE - Equipment Performance		%		Efficiency	Measure of ideal equipment run time compared to actual equipment run time	(Ideal Cycle Time x Total Count) / Run Time
Smart Operations	Dynamic Operations Sensing	Machine changeover time		Time		Efficiency	Measure of time taken to modify a production line or station to produce a new batch of the same or another product	Time taken to change a machine from the last part of a production lot to the first good part of the next production lot
Smart Operations	Dynamic Operations Sensing	OEE - Equipment Quality		%		Quality	Measure of actual planned production time that is considered productive	Good Count / Total Count

Dynamic Operations Sensing

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Smart Operations	Dynamic Operations Sensing	Capacity Utilization		%		Efficiency	Measure of the amount of available capacity being used to supply current demand	Actual Output / Potential Output
Smart Operations	Dynamic Operations Sensing	Capacity Utilization - % of floor space		%		Efficiency	Measure of the amount of available floor space utilized to supply current demand	Actual Space Used / Available Space
Smart Operations	Dynamic Operations Sensing	Capacity Utilization - % of machine hours		%		Efficiency	Measure of the actual machine production hours to the available machine production hours	Actual Machine Hours/ Available Machine Hours
Smart Operations	Dynamic Operations Sensing	Capacity Utilization - % of labor hours		%		Efficiency	Measure of the actual labor production hours to the available labor production hours	Actual labor Hours/ Available labor Hours
Smart Operations	Dynamic Operations Sensing	Unit Cost (Direct Material)		$	Yes	Cost	Measure of cost of raw material used per unit produced	[Cost / Raw Material] *[Total Amount of Raw Materials / Unit]
Smart Operations	Dynamic Operations Sensing	Machine changeover time		Time		Efficiency	Measure of time taken to modify a production line or station to produce a new batch of the same or another product	Time taken to change a machine from the last part of a production lot to the first good part of the next production lot
Smart Operations	Dynamic Operations Sensing	OEE - Equipment Quality		%		Quality	Measure of actual planned production time that is considered productive	Good Count / Total Count

Augmented Workforce

Definition and objectives

Definition:

The ability to **enhance worker safety, productivity, capability and performance** by delivering task-specific information directly to the point of use via augmented interfaces, collaborative robots and image recognition to support the worker and **minimize waste**

Why Digital Supply Networks:

Traditional workers are encumbered with manual or repetitive tasks that decrease their efficiency. It is not unusual for workers to create their own work-arounds for production steps and transfer knowledge about these work-arounds through word of mouth. Augmented interfaces, collaborative robots, sensors, image recognition and other emerging technologies enhance the workforce of tomorrow by delivering task-specific information directly to workers. In addition, workers are able to do more value-added work as automation frees up time previously spent on repetitive tasks. The workers also become data sensors as they create more data inputs and leverage data outputs. These tools improve worker health and safety while also enabling them to minimize product waste.

Augmented Workforce

Definition and objectives

Drivers for Change:

- Visual displays and sensors are being integrated into personal protective equipment.
- Computing power is increasing and input/output devices are becoming smaller.
- Industry 4.0 and hyper-connectivity make it possible for operations to leverage enhanced connectivity.
- Technological evolutions have given birth to co-bots and process automation.
- Most organizations still operate on legacy systems with rigid or fixed operational processes and instructions.
- Manufacturing labor is becoming scarce, and the manufacturing industry is evolving toward more complex hybrid manufacturing jobs.

Example:

A Fortune 500 automotive and energy company has recently filed patents to use augmented reality to increase efficiency and accuracy on the manufacturing floor. Examples of use include highlighting weld spots and structural adhesive placement.

Augmented Workforce

Relations with other level-1 Capabilities

Synchronized Planning	The Synchronized Planning function provides improved insights into labor costs and updates information as plans change to inform buying decisions.
Intelligent Supply	Digital wearables assess worker performance and provide enhanced insights into true labor capacity.
Dynamic Fulfillment	Workers use augmented interfaces to directly and easily access information about customer needs and respond accordingly.
Connected Customer	An augmented workforce shares real-time data to connect the end user with lead time and product customization updates in order to create value for the customer.
Digital Development	Workers utilize sensors and robots to generate data about non-value-added services and activities with engineering teams in order to minimize product waste and improve worker health and safety.

Augmented Workforce

Impact of digital disciplines

Sense	• Gathers data from location- and proximity-based sensors to augment performance and environmental data. This can be combined with intelligent imagery to identify specific units and sub-assemblies as well as voice- or biometrics-based command and recognition systems.
Collaborate	• Enhances collaboration among the planning, production and maintenance functions to provide real-time task-related information for augmenting the human workforce that is working in tandem with co-bots and enhancing synchronization and collaboration among the human workforce members
Optimize	• Improves the alignment of changes to the production plan, leading to optimized production efficiency; improved machine-tending time; and assisted maintenance using augmented reality and virtual reality technology, which leads to increased machine utilization and manpower efficiency
Respond	• Uses visual displays in personal protection equipment and other means to give the Augmented Workforce the data provided by co-bots and other technology-based aids. This gives human workers opportunities to respond to and make informed decisions about changes in Smart Operations and the entire value network. In addition, because co-bots are handling the more mundane tasks, human workers are freed to handle these higher value tasks.

Augmented Workforce

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Smart Operations	Augmented Workforce	Unit Cost (Direct Labor)		$	Yes	Cost	Measure of cost of labor (salary) per unit produced	[Direct Labor Hourly Rate]*[Time for Completion / Unit of Product]

Digital Process Twin

Definition and objectives

Definition:

The ability to aggregate data from products, processes and enterprise systems to create **real-time digital models** of what has transpired, is transpiring and might transpire in the physical operations or network. The Digital Process Twin **contextualizes input data** and serves as a **single source of truth** for other Level 2 Capabilities.

Why Digital Supply Networks:

Today's operations can generate a vast amount of data but lack the tools to turn it into meaningful insights. Improvements in data collection, storage and analysis technologies, along with advanced process modeling tools, allow for the creation of a Digital Process Twin. The Digital Process Twin contextualizes the raw data collected by Dynamic Operations Sensing to create a high-fidelity picture of actual operations performance. Simulation tools can use the Digital Process Twin to model future scenarios at a low cost, providing insights into the impacts of potential changes. This provides a single source of truth about an operation's past, present and potential future.

Digital Process Twin

Definition and objectives

Drivers for Change:

- Organizations are seeking increased asset utilization.
- Stringent industry and government standards require accurate records.
- Current manual processes do not easily scale.
- Complex and non-linear production systems require digital insights with scenario-planning capabilities to improve accuracy.

Example:

A major electronics company is identifying improvement areas, macro trends and deviations from standard by aggregating sensor-level data and comparing it with 100% efficiency digital models.

Digital Process Twin

Relations with other level-1 Capabilities

Synchronized Planning	The Digital Process Twin can provide real-time, updated information as plans change to inform buying. It also can give updates based on process changes that result in specification, quantity or other changes.
Intelligent Supply	The Digital Process Twin can feed process performance information back to Intelligent Supply teams to show a difference in performance between or among various suppliers to lower the cost of purchased components.
Dynamic Fulfillment	The Digital Process Twin can feed updated predictions for process completion timing to update warehouse operations planning and fulfillment planning. It also can provide serialized part-processing information to feed Chain of Custody and Integrity and flag challenges to allow for adjustments and network response.
Connected Customer	Information from connected customers can feed Smart Operations with inputs that may be used to run scenarios to adjust processing parameters such as temperature, cure time and others.
Digital Development	The Digital Process Twin can feed process performance information back to the Digital Development team to identify opportunities to relax material specifications. The Digital Process Twin also is reliant on Model-Based Definition to facilitate its ability to run scenarios and execute other tasks.

Digital Process Twin

Impact of digital disciplines

Sense	• Combines the data coming from a variety of sensors to form a virtual image of a plant for the purposes of remote monitoring and control • Captures performance time series data streams along with biometric, process and safety data logs in a central repository that can be presented on role-based dashboards as part of the Operations Command Center • Uses data from intelligent assets across the ecosystem to support use cases like comparing the performance profile of a specific asset with other similar or identical assets around the globe to identify optimal performance conditions
Collaborate	• Enables remote collaboration among the design, training, operations and maintenance functions to support prototyping, human resources development as well as creation and analysis of critical scenarios, respectively
Optimize	• Utilizes the Digital Process Twin to run scenarios that allow for iteration and testing of new configurations faster than is typically possible in the real world • Enables re-optimization under changing conditions
Respond	• Uses Digital Process Twin simulations to predict the effects of identified trends. This allows Level 2 Capability to formulate responses.

Digital Process Twin

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Smart Operations	Digital Process Twin	New Product Introduction (NPI) Effectiveness (Time)		Time	Yes	Innovation	Measure of the time from demand signal of new unit type to operationalization of new unit type	Sum of the time spent from Phase 0 (Concept Phase) to Phase 4 (Market Release)
Smart Operations	Digital Process Twin	New Product Introduction (NPI) Effectiveness (Cost)		$	Yes	Cost	Measure of the cost to operationalize a new unit type	Sum of direct and indirect costs for operationalizing a new unit type

Operations Command Center

Definition and objectives

Definition:

The ability to provide **real-time visibility into operations performance** and **identify deviations from standards** by applying data science methods to the Digital Process Twin and other enterprise systems across the production ecosystem. Role-based dashboards and alerts enable **simulation and instantaneous intervention** when an anomaly or a risk is detected.

Why Digital Supply Networks:

Generating insights into current operational environments requires significant manual data analysis and limited-use custom-built tools. Improvements in machine learning, artificial intelligence and human-machine interfaces, combined with a robust Digital Process Twin, enable the creation of an Operations Command Center. The Operations Command Center

- uses advanced analytics to rapidly detect anomalies and drive solutions via feed-forward and feedback interactions throughout the process
- uses role-specific dashboards and alerts to enables instantaneous intervention and course corrections
- assesses information and inputs from all operations
- augments operator intelligence to drive insightful decision-making to prioritize worker input for the highest impact.

Operations Command Center

Definition and objectives

Drivers for Change:

- Pressure to decrease the total cost of production in industrialized markets requires that direct labor be more value-added.
- Increasing production complexity makes it difficult for even the most experienced production managers to create and deploy countermeasures without digital assistance.
- Tightly integrated systems do not allow for lengthy corrections to process errors.

Example:

A global oil and gas company has a refinery optimization center (ROC) that spans 38,000 square feet and enhances the refinery’s efficiency, environmental stewardship and reliability. The ROC transforms inputs from refinery operators, who collect equipment and surveillance data using handheld devices. This data becomes actionable insights and allows the ROC to ensure that everything is working properly.

Operations Command Center

Relations with other level-1 Capabilities

Synchronized Planning	The Operations Command Center can provide updated, real-time information as exceptions arise and humans make changes to plans. This information can inform buying based on operations or process changes that result in specification, quantity or other changes.
Intelligent Supply	The Operations Command Center can feed process performance information back to Intelligent Supply teams to show a difference in performance between or among various suppliers to lower the cost of purchased components, alter delivery destinations and more.
Dynamic Fulfillment	The Operations Command Center can feed updated decisions based on exceptions, including impacts to process completion timing, to update warehouse operations planning and fulfillment planning. It also can provide serialized part-processing information to feed Chain of Custody and Integrity and flag challenges to allow for adjustments in network response.
Connected Customer	Information from Connected Customer function can feed the Operations Command Center and provide valuable input that may impact trade-off decisions made when responding to an exception or a constraint.
Digital Development	The Operations Command Center can feed adjustment decisions back to the Digital Development teams to identify Design for Excellence targets.

Operations Command Center

Impact of digital disciplines

Sense	• Utilizes sensory and data inputs from across the digital supply network to provide information that allows for the fusion of machine intelligence and human judgement to steer responses
Collaborate	• Collaborates among the planning, operations, and health and safety functions to ensure a safe, highly productive work environment
Optimize	• Provides real-time visibility into operations and quality issues, enabling optimization of process cycle times and workforce allocation and helping to improve health and safety standards
Respond	• Acts on insights based on predictive analytics to prevent machine failures, potential bottlenecks, staffing issues and imminent health and safety–related incidents

Total Operations Synchronization

Definition and objectives

Definition:

The ability to continuously **schedule and allocate scarce resources** to optimally execute production and operational activities based on Operations Command Center insights to increase visibility and coordination of machines, people and processes across the network ecosystem

Why Digital Supply Networks:

Making optimal use of scare resources necessitates either rigid schedules or significant support staff to manage the resources in a flexible system. Total Operations Synchronization coordinates and schedules products, equipment, tools, people and material flows, but human operators will still have the ability to overrule in the Operations Command Center. Smart Operations will leverage the integration of enterprise resources planning (ERP) systems, management execution systems (MES), the Operations Command Center and the Digital Process Twin to provide optimized execution of operational activities, locally and at partner sites, based on real-time conditions and insights from local operations and the supply network. The advancement of real-time data collection and improvements in information technology software capabilities enable Total Operations Synchronization and help realize an augmented workforce free to focus on high-impact items.

Total Operations Synchronization

Definition and objectives

Drivers for Change:

- The trends toward mass customization and increasing product mixes and production complexity will exceed the capacity of prescriptive planning tools.
- Business needs require that production facilities adjust increasingly more rapidly to changing market conditions.
- Changes in workforce competition and size are leading to a shortage of skilled production planners and shop floor managers.
- A lack of visibility into equipment, people and processes across the supply network results in delayed decision-making and wasted resources.

Example:

An American medium- and heavy-duty trucks manufacturer has implemented an automated system for truck production, incorporating synchronized automatic monorail systems that are able to operate independently based on information technology integration and sensor data to optimize production speed while minimizing collisions and safety defects.

Total Operations Synchronization

Relations with other level-1 Capabilities

Synchronized Planning	The sensing enterprise attempts to decentralize the company's intelligence and move on to a scenario in which the company acts as a complex, smart organization capable of detecting, sensing and reacting to business stimuli, which aids in strategic planning.
Intelligent Supply	Having a proactive overview of the full network helps companies estimate the demand and supply statistics because they are aware of the needs and usage patterns of their consumers. This empowers them to negotiate with the supplier side in a more streamlined manner because they know in advance what material and what quality and quantity is required. Supply information, in turn, informs the ability of the network to synchronize and adjust.
Dynamic Fulfillment	Total Operations Synchronization emphasizes standardized tools focused on planning and shipping. Technologies such as bar codes and touchscreen interfaces on the shop floor enable increased flexibility and efficiency when fulfilling orders.
Connected Customer	Complete visibility into currently available capacity and incoming customer demands allows for instantaneous price and lead-time adjustments that can help companies level load processes.
Digital Development	Connecting production with development allows product designers to easily adjust their product designs and configurations to achieve reduced costs and resource requirements.

Total Operations Synchronization

Impact of digital disciplines

Sense	• Collects and analyzes in real time the requirements of raw material, work in process, consumables, and tools and fixtures at workstations as well as the locations of assets and automated guided vehicles to enable optimized material movement
Collaborate	• Collaborates among the production, maintenance and material management functions to ensure availability and manage allocation
Optimize	• Uses sensor-driven material management and autonomous movement to help optimize material requirements and reduce overhead energy costs
Respond	• Adjusts the center-lining process in real time to support optimized asset performance by balancing tradeoffs such as output, quality, scrap rate, uptime and energy costs

Total Operations Synchronization

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Smart Operations	Total Operations Synchronization	Cycle Time (Operations Planning)		Time	Yes	Efficiency	Measure from when a signal of new demand is received until the value added work starts	[time of execution]-[time of new demand signal]
Smart Operations	Total Operations Synchronization	Cycle Time (Operations Execution)		Time	Yes	Efficiency	Measure from when the value added work starts until when it stops	[execution stop time]-[execution start time]
Smart Operations	Total Operations Synchronization	Cycle Time (Operations Closing)		Time	Yes	Efficiency	Measure from when the value added work stops until the unit leaves the operation	[time unit leaves operation]-[execution stop time]
Smart Operations	Total Operations Synchronization	On Time Shipment		%		Service	% of products in orders filled on time	[Units in orders shipped on time / Units Required] * 100
Smart Operations	Total Operations Synchronization	Throughput		%	Yes	Efficiency	Measure of the rate of production	Actual Output / Run Time
Smart Operations	Total Operations Synchronization	Production Attainment		%		Efficiency	% of units manufactured or assembled calculated against the units scheduled over that period	[Actual Production Output in Units / Target Production Output in Units] *100
Smart Operations	Total Operations Synchronization	Productivity		%		Efficiency	Measure of the output per the unit of input specific to each operation. Eg: paper mill - lbs of finished paper product / lb wood warehousing - packages shipped / forklift traveled distance	Value of Output / Value of Inputs

Autonomous Process Control

Definition and objectives

Definition:

The ability to drive real-time process control and adjustment by responding to local issues and opportunities through feedback or feed-forward mechanisms to **autonomously correct problems**

Why Digital Supply Networks:

Today's operations require an experienced staff to control complex processes. By leveraging advancements in edge computing, real-time data streaming, machine learning and cloud computing, the assets of Smart Operations will have the ability to take action on their own, correcting issues and making improvements using feedback and feed-forward information from the Operations Command Center. The increase in autonomous sensing and quality-control capabilities throughout the supply network enables Autonomous Process Control to detect anomalies in process or product data in real time. This Level 2 Capabilities maximizes the value of the product by reducing scrap and rework by using insights from other Level 2 Capability to drive automated responses, thus improving asset and process performance.

Autonomous Process Control

Definition and objectives

Drivers for Change:

- Locating services in the cloud can introduce unacceptable latency for critical processes.
- Moving manufacturing closing to customers results in a linear increase of demand for on-site process experts.
- Requiring human interaction to adjust production equipment and remediate pain points is both resource and time intensive.

Example:

A Fortune 500 pharmaceutical company's system health monitoring (SHM) process allows for automated identification of issues, freeing workers to perform higher-value-added activities and address these issues as needed. In a future state, the SHM could be able to resolve the issues without human intervention, allowing human workers to remain focused on those value-added activities.

Autonomous Process Control

Relations with other level-1 Capabilities

Synchronized Planning	Because Autonomous Process Control is based on autonomous, almost reflexive responses within the confines of a single operation, it will not impact the other disciplines.
Intelligent Supply	Because Autonomous Process Control is based on autonomous, almost reflexive responses within the confines of a single operation, it will not impact the other disciplines.
Dynamic Fulfillment	Because Autonomous Process Control is based on autonomous, almost reflexive responses within the confines of a single operation, it will not impact the other disciplines.
Connected Customer	Because Autonomous Process Control is based on autonomous, almost reflexive responses within the confines of a single operation, it will not impact the other disciplines.
Digital Development	Because Autonomous Process Control is based on autonomous, almost reflexive responses within the confines of a single operation, it will not impact the other disciplines.

Autonomous Process Control

Impact of digital disciplines

Sense	• Uses sensors and other technologies that detect critical events throughout an operation to trigger automated reactionary processes to resolve the event that caused the system to malfunction
Collaborate	• Uses feedback and feed-forward mechanisms to execute collaborative, localized efforts among machines to provide known corrections for known issues as triggered by sensor input in a reflexive manner
Optimize	• Adjusts process controls to optimize the value, usually in terms of highest grade or least defect cost, of each work-in-process element, part or batch without manual intervention
Respond	• Uses sensors and data models generated from the sensor data to identify machine failures or scrap events and risks in real time using process and product data and resolve them immediately using known solutions independent of human interaction

Deloitte.

Intelligent Supply

Intelligent Supply

Definition and vision

Definition: Intelligent Supply impacts every component of the procurement function to source goods and services from leading suppliers at the best value while driving efficiencies in procurement operations, improving supplier relationships and mitigating risks.

Vision: Intelligent Supply enables organizations to source goods and services at predictable costs; collaborate with suppliers and business partners to accelerate innovation; transform the experience of internal customers through automated requisitions, contract management and touchless invoicing; and monitor risks in real time to proactively optimize end-to-end operations.

Intelligent Supply

Overview of level-2 Capabilities

	IS Analytics	Category Management	Sourcing Execution	Intelligent Contract Management
Definition	The ability to both **use value chain analytics and industry insights to move from retrospection** to prediction and aggregate disparate data sources to predict cost and price fluctuations, demand patterns, and supplier and country factors to make proactive decisions and **actively manage end-to-end costs**	The ability to engage cross-functional teams, **use IS Analytics and supply market insights** to **create sustainable category strategies, improve the supply network, mitigate risks, identify and partner with preferred suppliers, and lead value-generating opportunities** across the entire supply network to optimize costs	The ability to **digitize sourcing processes** to facilitate quick screening, including self-service registration for suppliers, competitive bidding and online negotiations, and enable a **real-time ability to assess supplier quotes and decision criteria,** including comparisons with cost analytics and commodity indexes to select optimal suppliers	The ability to enable **proactive contract life cycle management with customizable workflows that provide visibility at each step** of authoring, facilitate contract negotiations and thereafter enforce contractual terms to **realize cost savings and achieve desired performance levels**
What's New	• Understanding of each component of costs along with margin paid to supplier and fixed versus variable cost drivers • Analysis of elements of design and requirements that are the biggest cost driver • Assessment of performance versus cost trade-offs	• Collaboration with internal and external cross-functional teams to develop category and sourcing strategies, supplier goals and contract terms • Dynamic monitoring of external factors, risks and internal requirements that might impact the categories in supply assurance or cost	• Cost-effective sourcing decisions • Improved supplier assessment, qualification and onboarding • Visibility of supply network operations • Regulations compliance • Increased competitive bidding, which can help with negotiating better pricing terms	• Technology that makes contract authoring and compliance checking efficient and effective • Contract management processes that are digitized • Continuous monitoring of supplier key performance indicators compared with contract terms • Next-generation technologies that offer spend visibility

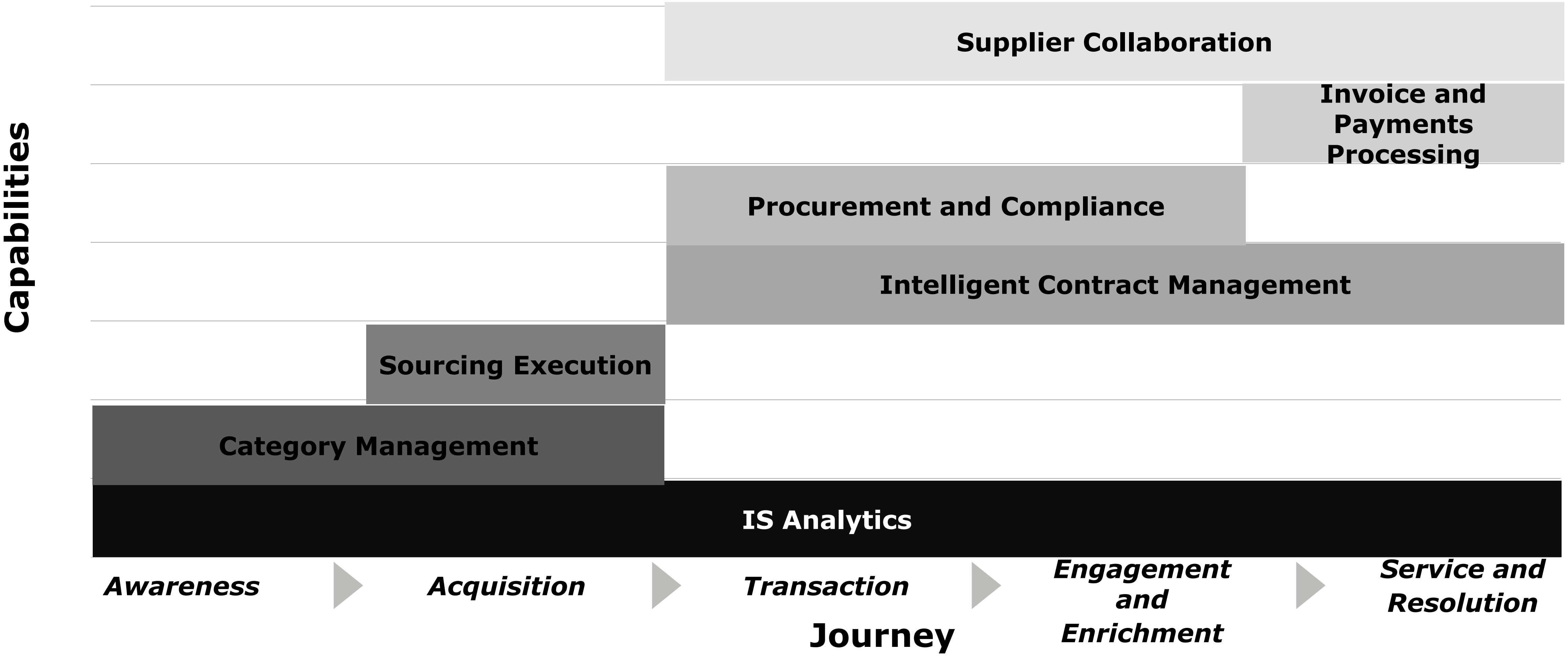
Intelligent Supply

Overview of level-2 Capabilities

	Procurement and Compliance	Invoice and Payments Processing	Supplier Collaboration
Definition	The ability to **maximize spend with preferred suppliers and compliance with catalogs and contracts** to eliminate rogue spending; streamline approvals through **real-time budget-checking** capabilities along with leading practices for **management hierarchy approvals;** dispatch purchase orders and monitor them with inventory detail through advanced **order acknowledgement** functionalities; and provide simple and intuitive user interfaces for procurement of both goods and services	The ability to **accommodate multiple formats and channels for receiving invoices and systematically flip purchase orders to invoices for** touchless transaction processing. Invoice and Payment Processing also includes the use of multiple electronic invoicing technologies to process all invoice types, **automate two-way and three-way matching**, and **streamline exception routing and resolution** to minimize invoice processing time and support supply chain financing and dynamic discounting.	The ability to provide **structured and effective collaboration on product innovation and upstream strategic considerations** between buyers and suppliers along with **real-time visibility into transactions**, including orders, invoices and credit memos, by replacing email and offline communications with next-generation technology that monitors performance metrics to enable partnership with suppliers in order to **reduce risks, improve performance** against contract terms and achieve negotiated savings
What's New	• An increase in self-service through peer-to-peer solutions without compromising on controls, enabling procurement organizations to focus on strategic initiatives • Peer-to-peer operations that enable the sourcing, accounts payable and finance teams to achieve category key performance indicator goals	• Electronic invoice receiving processes enabled by supplier connectivity • Technologies that quickly read and process invoices • Automated matching processes for invoices • Next-generation tools that improve payment efficiencies and compliance with regulations and contract terms	• Greater supplier partnership in mitigating risks and generating mutual value by using shared financials and key performance indicators as well as interconnected forecasts and alerts • Self-reporting on competitive, risk, audit, sustainability and compliance issues • Extended collaboration between buyers and sellers that ranges from pure execution to strategic collaboration in product design, development, manufacturing and service

Intelligent Supply

Journey map



 |

Intelligent Supply

Capability maturity

Dimension	Ad-hoc	Typical	Advanced	Leading
IS Analytics	Supply decisions are made based on available spend by supplier.	Supply decisions are made based on assessments of suppliers that offer a low cost at the current point in time.	Historical views of IS Analytics and total landed cost are used to determine the best-value source.	Cost insights about supplier cost build-up can be used by cross-functional teams to address each cost driver and identify trade-offs to create a sustainable cost advantage in the future.
Category Management	Category strategy is not consistently developed and often is limited to a few categories and created without cross-functional business engagement.	Category strategy exists for centrally managed buys and is primarily developed by the procurement team with cross-functional input.	Category strategy has cross-functional strategic planning and product development elements. Business teams are engaged in value-generating projects.	Category strategy is an integral part of new product development, operations planning, supply chain and corporate strategy. Sourcing teams partner with the business to identify and lead value-generating initiatives.
Sourcing Execution	Sourcing strategy does not exist, is broadly ignored or has limited impact across business units.	Sourcing strategy exists but has limited tracking or success.	Sourcing strategy meets all functional needs. Automation is not adopted across the process.	Sourcing strategy is differentiated, with automation and analytics appropriately applied.

Intelligent Supply

Capability maturity

Dimension	Ad-hoc	Typical	Advanced	Leading
Intelligent Contract Management	No formal ownership or system governing contract management exists. Any existing contract management policies have little to no impact on business units.	Contract management policies and systems are used but are not widely enforced.	Contract management policies and systems are involved in most contracting efforts but do not accommodate all situations.	Contract management proactively engages with business units, contracts are easily viewed and searched, and performance and compliance are tracked.
Procurement and Compliance	Procurement is performed and audit trails are maintained, but there are high levels of non-purchase-order transactions.	The requisition to pay process is digitized, and approvals are driven through an automated system.	Organizations have a simple and intuitive user experience for procurement of both goods and services that uses automation and enforces the right level of controls.	Organizations leverage automated approvals, analytics, high spend visibility and purchase suggestions for users.
Invoice and Payments Processing	Invoices are received and payments are processed manually. The organization does not have any localization for country-specific rules and compliance policies.	Electronic invoicing and payment processing and use of optical character recognition is limited.	An organization boasts high levels of electronic invoicing and first-pass match rates. Direct debit accounts are set up with key customers. Invoice matching is mostly automated, with out-of-tolerance exceptions kicked out for resolution.	An organization has a clear working capital management strategy with optimized payment terms, dynamic discounting and supply chain financing. It also employs a multi-channel approach to address all invoice types using next-generation technologies. In addition, it has well-defined compliance policies and invoice system enforcement to support regional and country compliance.

Intelligent Supply

Capability maturity

Dimension	Ad-hoc	Typical	Advanced	Leading
Supplier Collaboration	Communication between companies is limited and only done as required.	Collaboration happens through recurring meetings and by sharing basic information from downloads from enterprise resources planning systems.	Organizations and their suppliers engage in cross-functional online and offline communication, including about forecasts, bottlenecks and market intelligence	There is greater supplier partnership in mitigating risks and generating mutual value using shared financials and key performance indicators, interconnected forecasts, and alerts. Suppliers also conduct self-reporting about competitive, risk, audit, sustainability and compliance issues.

Intelligent Supply

Profile: Rafael, procurement manager

Overview

Rafael manages procurement for a large machine tool manufacturer. He plays a key role in sourcing all of the necessary components to build his company's CNC milling and lathe machines, along with their optional accessories. His success in minimizing costs directly affects the profits his company can earn on machine sales.

Education

Illinois State University

- Bachelor of Science in Finance

Experience

Current position

- Procurement manager

Rafael is responsible for upholding his company's sourcing requirements by utilizing preferred suppliers and approved catalogs for procuring necessary items. He also analyzes buying patterns to ensure the company is using the right suppliers and reduce non-catalog purchases. In addition, he is responsible for digitizing the purchase order and invoice processes to reduce manual operations, minimize errors and improve communication. Through the use of dashboards and automated demand and capacity leveling, he minimizes the need for alerts, escalation and replanning.

Previous positions

- Procurement analyst
- Buyers

IS Analytics

Definition and objectives

Definition:

The ability to both **use value chain analytics and industry insights to move from retrospection** to prediction and aggregate disparate data sources to predict cost and price fluctuations, demand patterns, and supplier and country factors to make proactive decisions and **actively manage end-to-end costs**

Why Digital Supply Networks:

IS Analytics enables companies to

- understand each component of costs, including the margins paid to suppliers and fixed and variable costs
- analyze the elements of design that are the biggest cost drivers and assess performance versus cost trade-offs
- compare the cost structures of suppliers relative to best-in-class suppliers and engage suppliers to reduce their costs
- identify all negotiable costs and define terms in contracts to achieve sustainable costs and discounts
- clarify which cost components vary based on supplier and economic factors to justify inflation
- assess how design and performance specifications impact product and service costs and whether the internal cost structure is superior to that of supply base.

IS Analytics

Definition and objectives

Drivers for Change:

- Companies are looking for cost insights that are not limited to the data received from suppliers and product or service specifications.
- Cross-functional teams need information they can use to address each cost driver, identify trade-offs and mitigate inflation to create sustainable cost advantages.
- It is increasingly easy for customers to compare product or service prices, which requires manufacturers and service providers to identify and maximize the value delivered by their products and services.

Example:

A global consumer packaged goods company wanted to transform its packaging cost structure. Traditional analysis of spend highlighted plastic and glass bottles and closures as the highest cause for inflation, but the sourcing team could not provide actionable insights. Repeated strategic sourcing events and contract negotiations had not resulted in savings. Suppliers were asking for price increases. Deep cost driver insights were necessary to reduce costs.

Through a bottom-up should cost model that replicated the supplier cost structure and assessed impact on total landed cost from all cost drivers across the value chain, the key cost drivers were identified. This insight highlighted areas of product specifications that could be rationalized. Across the supply network, requirements for demand forecasting, inventory, order fulfillment, transportation, warehousing and logistics were fine-tuned. The product portfolio complexity–related costs as well as customer shipments and logistics costs were identified.

IS Analytics

Relations with other level-1 Capabilities

Digital Development	The Digital Development function proactively identifies product and service value drivers to optimize various specifications.
Dynamic Fulfillment	The Dynamic Fulfillment function provides insights about supply network cost drivers to optimize warehousing and logistics.
Synchronized Planning	The Synchronized Planning function identifies future tiers of forecasted order volume to permit suppliers to generate economies of scale.
Smart Operations	The Smart Operations function provides insights into detailed material and production planning to generate economies of scale in production.
Connected Customer	The Connected Customer function discovers cost and profit components to improve the value proposition of a product or service to the customer.

IS Analytics

Impact of digital disciplines

Sense	• Senses changes in cost and underlying cost drivers related to macroeconomic and microeconomic factors, such as changes in the market index
Collaborate	• Collaborates with suppliers and internal cross-functional teams to optimize cost drivers and product and service requirements
Optimize	• Dynamically conducts scenario analyses that can help minimize supply network risks and maximize benefits
Respond	• Proactively measures costs based on any critical changes and the impacts of those changes on the value chain

IS Analytics

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Intelligent Supply	IS Analytics	Source-to-Pay Cost		%	Yes	Cost	Cost incurred to perform all source-to-pay activities as compared to out of total spend expressed in percentage. This is calculated during a specific time period (quarterly, annually, etc).	(Total operating budget for S2P/Total spend $)*100
Intelligent Supply	IS Analytics	Realized Cost Savings		%		Cost	The percentage of total savings achieved through supplier negotiations, demand management and other savings levers relative to prevailing baseline cost. These savings are realized in P&L.	(Savings $ realized/Total spend $)*100
Intelligent Supply	IS Analytics	Direct Material Production Cost		$	Yes	Cost	The amount of spend that is incurred on direct material	Sum of $ spent on sourcing direct materials
Intelligent Supply	IS Analytics	Cost Avoidance		$		Cost	Value created by Sourcing by reducing or eliminating cost increases sought by supplier over and above prevailing baseline cost	New Price Sought by Supplier - Final Negotiated Price - Baseline Cost
Intelligent Supply	IS Analytics	Indirect Material Production Cost		$	Yes	Cost	Sum of indirect cost components, such as manufacturing and production overhead that do not contribute directly to manufacturing of the products	Factory Overhead + Production Overhead
Intelligent Supply	IS Analytics	$/FTE		$		Cost	Spend managed by the Procurement Organization per full time employee	Spend managed by the procurement Organization/ # of Full Time Employees in the Procurement Organization

Category Management

Definition and objectives

Definition:

The ability to engage cross-functional teams, **use IS Analytics and supply market insights** to **create sustainable category strategies, improve the supply network, mitigate risks, identify and partner with preferred suppliers, and lead value-generating opportunities** across the entire supply network to optimize costs

Why Digital Supply Networks:

Category Management enables companies to

- collaborate with external and internal cross-functional teams to develop category and sourcing strategies, supplier goals, and contract terms
- dynamically monitor external factors, risks and internal requirements that may impact the categories
- leverage total cost analytics to identify and maximize value-generating ideas
- analyze and forecast costs for the category to support strategic business planning
- gather insights from cross-functional teams that can help address each cost driver and identify trade-offs to create a sustainable cost advantage.

Category Management

Definition and objectives

Drivers for Change:

- Management has higher expectations for identifying and realizing cost savings throughout the product or service life cycle.
- Advances in data science have provided an ability to model and forecast costs for most products and services.
- Companies want to partner with suppliers that offer cost transparency, value, innovation and global reach.
- Cross-functional leadership is needed to incorporate sourcing inputs into product and services design and supply network and technology strategy.

Example:

A global technology company wanted to transform its procurement function to achieve the company's financial and innovation objectives. Lack of cost management and weak supplier capabilities were identified as key hurdles. The company organized its spend areas and suppliers into market-facing categories. Category management was reinforced by investing in tools and technologies that enable dynamic cost tracking, conduct proactive and real-time supplier engagement, manage contracts effectively, and conduct enterprise-level spend analyses to drive future benefits. Category managers were hired to bring strategic, business, analytical and cross-functional leadership capabilities. In addition, the procurement team received a seat at the table to help develop product and service requirements, business forecasts and supply network strategies.

Category Management

Relations with other level-1 Capabilities

Digital Development	The Digital Development function proactively identifies product and service value drivers to optimize various specifications.
Dynamic Fulfillment	The Dynamic Fulfillment function provides insights into future requirements through accurate order and lead-time information.
Synchronized Planning	The Synchronized Planning function provides insights into forecast volume for both existing and new requirements related to direct and indirect materials.
Smart Operations	The Smart Operations function provides real-time information about receiving, consumption and safety stocks to enable better decision-making.
Connected Customer	The Connected Customer function has the ability to make decisions that help generate maximum value at reduced costs for end users.

Category Management

Impact of digital disciplines

Sense	• Senses changes in behavior that result in different amounts of spend across categories, thus impacting the spend categories
Collaborate	• Collaborates with external and internal teams to conduct RFx processes, negotiations and terms finalization
Optimize	• Conducts should cost analyses for multiple factors to find the best prices for requirements
Respond	• Successfully analyzes cost changes in the future

Category Management

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Intelligent Supply	Category Management	Commodity Cost Variance		%		Cost	The percentage change in the cost of a particular commodity analyzed YOY to understand the variance trend	[(Commodity in Current Year - Commodity Cost in previous year)/Commodity Cost in previous year]*100
Intelligent Supply	Category Management	Categories on Catalog		%		Efficiency	The percentage of categories with negotiated prices that can be added to a price catalog for the users to enable ease of ordering.	(# of Categories on Catalog/Total # of Categories)*100
Intelligent Supply	Category Management	Spend Under Contract	-	%	-	Quality	The percentage of spend that is under a contract agreement which is active and the terms of the contract have been approved by authorized agents in buyers and sellers	($ spent under contract/ Total spend with vendor)*100
Intelligent Supply	Category Management	Spend under Management		%		Quality	Percentage of spend actively managed by the Procurement & Sourcing Organization	(Spend $ managed by Procurement department/Total spend $)*100
Intelligent Supply	Category Management	Core Suppliers		%		Efficiency	Suppliers that account for high proportion (~ 80%) of total spend with all suppliers for the category and/or may be of strategic importance to buyer	(Number of suppliers that account for 80% of total spend / Total number of suppliers)*100
Intelligent Supply	Category Management	Tail Spend Suppliers		%		Quality	Suppliers that account for low proportion (less than 20%) of total spend with all suppliers for the category and/or not of strategic importance to buyer	(Number of suppliers that account for 20% of total spend / Total number of suppliers)*100

 |

Source Execution

Definition and objectives

Definition:

The ability to **digitize sourcing processes** to facilitate quick screening, including self-service registration for suppliers, competitive bidding and online negotiations, and enable a **real-time ability to assess supplier quotes and decision criteria**, including comparisons with cost analytics and commodity indexes to select optimal suppliers

Why Digital Supply Networks:

Advancement in strategic sourcing involves Self-Service e-sourcing tools with incorporated negotiation capabilities and market feedback mechanisms plus broader RFx and award-analysis capabilities. These combined resources and capabilities result in key benefits such as

- cost-effective sourcing decisions
- improved supplier assessment, qualification and onboarding
- visibility of supply network operations
- compliance with regulations
- increased competitive bidding, which can help with negotiating better pricing terms.

Source Execution

Definition and objectives

Drivers for Change:

- Companies are realizing the importance of automatically sensing demand and then automatically requesting a quote from suppliers.
- Dynamic benchmarks make quote assessment, price negotiations and award analysis easier.
- Companies are striving for more effective price negotiations.
- Standardized buying processes have shorter lead times and are less resource intensive.
- Companies seek improved input from category management and insights into world-class supplier capabilities.

Example:

A technology giant wanted to standardize and automate its internal buying process to ensure control over spend, enable quick turnarounds, make sure items were purchased from preferred suppliers and make due diligence easier. The company conducted a spend assessment and categorization based on taxonomy to understand the major areas of spend as well as the number of purchase orders, requisitioners and vendors, which was beneficial in developing a tile strategy for user-friendly application. Off-the shelf cloud-based technology solutions were selected to efficiently conduct sourcing events, obtain real-time input about supplier bid status and provide bid analytics for decision-making.

Source Execution

Relations with other level-1 Capabilities

Dynamic Fulfillment	There are rising customer expectations for companies to increase on-time deliveries and manage commitments to key customers. To manage a smooth supply network, it is becoming critical to identify the right suppliers.
Synchronized Planning	The Synchronized Planning function involves planning production to accurately match demand. It is critical to use demand-sensing technologies, accurately analyze demand for categories and then design an effective sourcing strategy.
Connected Customer	Through next-generation technologies, the Connected Customer function drives lower cost to serve and enhanced predictability of customer needs. Leveraging the sourcing process to find low-cost suppliers with high quality and pricing becomes critical.
Digital Development	The Digital Development function improves cross-functional collaboration throughout the product life cycle, drives efficiency in product design and speeds up time-to-market. Supplier assessment using the sourcing process helps in selecting better-fitting and low-cost suppliers.

Source Execution

Impact of digital disciplines

Sense	• Senses the decision criteria for supplier selection
Collaborate	• Collaborates with the procurement team to ensure understanding of the pricing
Optimize	• Optimizes price-negotiation discussions
Respond	• Responds to supplier selection requirements

Sourcing Execution

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Intelligent Supply	Sourcing Execution	% of eRFx	-	%	-	Efficiency	Percentage of RFx conducted electronically	(Number of RFx conducted electronically / Total number of RFx)*100
Intelligent Supply	Sourcing Execution	RFx Cycle Time		Time	Yes	Efficiency	The average length of time it requires to complete all the steps in the RFx process (draft, circulate, receive responses, score, award decisions)	Time to draft RFx + Time to circulate and receive responses + Time to score responses + Time to determine award decisions
Intelligent Supply	Sourcing Execution	Source Cycle Time		Time	Yes	Efficiency	The average time it requires to complete all the steps required to source (identify suppliers, negotiate, order, payment etc.) products/services from an internal or external source of supply	Identify Sources of Supply Cycle Time + Select Supplier and Negotiate Cycle Time +Schedule Product Deliveries Cycle Time + Receive Product Cycle Time + Verify Product Cycle Time + Authorize Supplier Payment Cycle Time

Intelligent Contract Management

Definition and objectives

Definition:

The ability to enable **proactive contract life cycle management with customizable workflows that provide visibility at each step** of authoring, facilitate contract negotiations and thereafter enforce contractual terms to **realize cost savings and achieve desired performance levels**

Why Digital Supply Networks:

Traditionally, contract authoring and compliance checking have been manual processes with significant lead times. Through the latest technology, the contract management process can be digitized. Some of the solutions and their benefits include the following:

- Intelligent cloud solutions based on leading practices provide out-of-the-box functionalities that easily and quickly replace Excel and offline or paper-based contracting processes with standardized contract templates, preapproved clause libraries, Microsoft Word-based plug-ins for advanced authoring, default version-controlled redlining and seamless system-based collaboration with external trade partners.
- Customizable workflows provide visibility at each step.
- Adaptable user interfaces provide flexibility to build functionalities and user experiences suitable for all stakeholders.
- Next-generation technologies enable visibility of contract terms and spend.
- Artificial intelligence and robotic process automation solutions provide accurate and fast extraction and digitization of metadata from legacy contracts, which enables multidimensional reporting, reduced cycle times, accurate decision-making and enhanced contract compliance.

Intelligent Contract Management

Definition and objectives

Drivers for Change:

- Current lead times for closing a contract are high, and human errors can affect contract authoring.
- Companies desire the ability to automate contract life cycle management.
- Companies have identified the need for insight into contract costs and availability.
- Some industries require traceability of deviations to contract terms.

Example:

A client wanted to ensure faster turnaround of contracts that use data from different sources, track the status of approvals, support contract negotiations and manage exceptions to standard terms. Blockchain-based smart contracts were implemented to ensure parties can agree upon terms virtually and trust that the contracts will be executed automatically, with reduced risk of error or manipulation. Technology solutions were implemented to support contract development, manage version control and track contract key performance indicators.

Intelligent Contract Management

Relations with other level-1 Capabilities

Dynamic Fulfilment	There are rising customer expectations for companies to increase on-time deliveries and manage commitments to key customers. The contracting process is very important to managing a smooth supply network because it helps companies screen suppliers and perform due diligence to mitigate supply network risks.
Synchronized Planning	Synchronized Planning involves planning production to accurately match demand. Using blockchain technology such as smart contracts, orders can be placed with vendors automatically based on predefined criteria.
Connected Customer	Through next-generation technologies, Connected Customer drives lower cost to serve and enhanced predictability of customer needs. Faster contracting processes, which include the process of finding suppliers, will reduce response time and increase conversion rate.
Digital Development	Digital Development improves cross-functional collaboration throughout the product life cycle, drives efficiency in product design and speeds up time-to-market. Leveraging long-term contracts from valued suppliers will result in faster response times and increased cost savings.
Smart Operations	The Digital Process Twin can apply next-generation technologies to optimize performance and factory overhead and identify deviations from standards. This also will help in evaluating supplier performance regularly, resulting in annual contract negotiation.

Intelligent Contract Management

Impact of digital disciplines

Sense	• Senses the type of contract required
Collaborate	• Collaborates with the procurement and legal teams to set up the contract process
Optimize	• Optimizes the contract preparation and compliance check time
Respond	• Responds to new supplier or existing supplier contract change requirements

Intelligent Contract Management

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Intelligent Supply	Intelligent Contract Management	Contract Structure Accuracy		%		Quality	Percentage of contract documents that follow the standard template to specific deliverables, structured with a MSA and SOWs/ Work Orders referencing the MSA out of all contracts	(# of contracts followed the template/Total # of contracts)*100
Intelligent Supply	Intelligent Contract Management	Contract Cycle time		Time		Efficiency	Average time required during which the commercial terms & conditions of the business are discussed among the parties in action to arrive at a signed contract	(Date of contract signature - Date of verbal agreement between parties)

Procurement and Compliance

Definition and objectives

Definition:

The ability to **maximize spend with preferred suppliers and compliance with catalogs and contracts** to eliminate rogue spending; streamline approvals through **real-time budget-checking** capabilities along with leading practices for **management hierarchy approvals;** dispatch purchase orders and monitor them with inventory detail through advanced **order acknowledgement** functionalities; and provide simple and intuitive user interfaces for procurement of both goods and services.

Why Digital Supply Networks:

Traditionally, purchase orders almost always were created by the procurement team. Now, as peer-to-peer solutions have improved, there is an increase in Self-Service without compromising on controls, enabling procurement teams to focus on strategic initiatives. Procurement and Compliance helps companies through

- contract compliance through catalogs and preferred suppliers selection
- streamlined approvals through real-time budget-checking capabilities
- touchless conversion of requisitions to orders and order confirmations
- increased usage of next-generation technologies to encourage persona-based buying that customizes the buying experience based on user behavior and previous purchases
- an increased focus on customer journeys.

Procurement and Compliance

Definition and objectives

Drivers for Change:

- Sourcing and procurement managers are moving into strategic roles while companies automate tactical tasks.
- Companies are seeking discounted pricing by mandating purchases through catalogs.
- Mobile applications can easily help manage the procure-to-pay process.

Example:

A global manufacturing giant implemented technology and processes related to the procurement of indirect by categorizing their spend, creating catalogs for high-frequency purchases and efficiently routing approvals based on level of authority. Areas were identified where purchase orders could be automated. Multiple legacy systems, which were used for different spend categories, were decommissioned, consolidating the overall procurement process into one source-to-pay solution and saving thousands of dollars in system maintenance and data-integrity maintenance.

Procurement and Compliance

Relations with other level-1 Capabilities

Digital Development	The Digital Development function establishes catalogs to facilitate the development team’s requests within a minimal amount of time.
Dynamic Fulfilment	The Dynamic Fulfillment function ensures that purchase orders are in place and ready for fulfillment.
Synchronized Planning	The Synchronized Planning function communicates with the procurement team about where purchase orders are sent based on the requirements provided by the planning team.
Smart Operations	The Smart Operations function communicates resource shortages to the factory on time to allow for production planning.
Connected Customer	Emerging relationship

Procurement and Compliance

Impact of digital disciplines

Sense	• Senses purchasing trends and makes catalogs available for use
Collaborate	• Collaborates with suppliers and leverages relationship- and volume-based buys
Optimize	• Optimizes the approval process by enabling leaders to quickly and efficiently approve plans through mobile applications
Respond	• Responds to supplier risk and quality metrics and takes corrective actions with the supplier

Procurement & Compliance

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Intelligent Supply	Procurement and Compliance	Strategic v/s transactional FTEs		%		Quality	The percentage of FTE's dedicated to strategic activities (category management, sourcing strategy, supplier selection) as compared to transactional activities (order and procure materials and services)	# of FTE dedicated to strategic activities/ # of FTEs dedicated to transactional activities
Intelligent Supply	Procurement and Compliance	Electronic Purchase Requisitions		%		Efficiency	Percentage of electronic purchase requisitions out of all total purchase requisitions	[# of electronic requisitions/ total requisitions]*100
Intelligent Supply	Procurement and Compliance	Percentage of spend on POs		%		Efficiency	Percentage of spend going through Purchase Orders out of the total spend managed by the Procurement organization	($ spend on POs/ $ spend managed by the Procurement Org)*100
Intelligent Supply	Procurement and Compliance	Percentage of touchless POs		%		Efficiency	Percentage of POs that don't require any approvals or other intervention between the requisition initiation and PO creation steps	(# of touchless POs/ Total # of POs)*100
Intelligent Supply	Procurement and Compliance	Purchase Order Cycle Time		Time		Efficiency	The total time it takes from when a request for purchase requisition is requested until the first purchase order is created	(PO transmission date - Purchase requisition creation date)

Invoice and Payment Processing

Definition and objectives

Definition:

The ability to **accommodate multiple formats and channels for receiving invoices and systematically flip purchase orders to invoices for** touchless transaction processing. Invoice and Payment Processing also includes the use of multiple electronic invoicing technologies to process all invoice types, **automate two-way and three-way matching**, and **streamline exception routing and resolution** to minimize invoice processing time and support supply chain financing and dynamic discounting.

Why Digital Supply Networks:

In a world with increasing focus on automated procurement integration, Invoice and Payment Processing enables

- electronic invoice receiving through supplier connectivity
- automated payment processing
- intelligent reporting capabilities
- remote log in and mobile-application-based capabilities
- quick reading and processing of invoices
- automated matching processes for invoices
- improvements in payment efficiencies and compliance with regulations and contract terms
- finance and dynamic discounting capabilities
- virtual card integration for faster processing of low-dollar-value invoices.

Invoice and Payment Processing

Definition and objectives

Drivers for Change:

- Companies are seeking to increase productivity for low-complexity tasks while minimizing errors and delays.
- Managers are pushing to increase savings associated with payment terms.
- Digitized data can support complex and real-time analytics for financial reporting.
- Today's complex global landscape calls for streamlined tax-related operations.
- More and more organizations are triggering payments by utilizing real-time signals and executing automated secure payments.

Example:

A U.S.-based senior living organization wanted to transform its accounts payable department by providing an integration platform to conduct invoice matching, payment processing and report generation. A cloud-based procure-to-pay solution was implemented to permit seamless integration of the accounts payable and procurement processes with supplier portals. Paper and email invoices were scanned using optical character recognition technologies to allow consistent invoice and payment processing for all suppliers. Significant improvements were achieved in financial and tax reporting, savings insights, and supplier on-time payments.

Invoice and Payment Processing

Relations with other level-1 Capabilities

Digital Development	The Digital Development function enables electronic data transfer; customizable reports; and mobility features, such as remote log in and mobile applications.
Dynamic Fulfilment	The Dynamic Fulfillment function provides insights about future requirements through accurate order information.
Synchronized Planning	The Synchronized Planning function provides insights about forecast volume related to direct and indirect materials.
Smart Operations	The Smart Operations function provides real-time information about receiving and consumptions to enable better payment processing.
Connected Customer	Emerging relationship

Invoice and Payment Processing

Impact of digital disciplines

Sense	• Identifies the appropriate approval process based on the type of transaction • Executes touchless invoicing while adhering to compliant invoicing
Collaborate	• Collaborates with functional groups, such as finance, procurement and receiving
Optimize	• Makes changes to the process based on transaction type • Manages exceptions
Respond	• Predicts spend based on current spend versus projected spend

Invoice and Payment Processing

Capability maturity

	Ad-hoc	Typical	Advanced	Leading
Data Analytics	Number of invoices	Invoice accuracy percentage	Number of electronic invoices and number of electronic payments	Number of electronic invoices and payments, in which the available discounts are correctly applied and a full match can be resolved

Invoice and Payment Processing

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Intelligent Supply	Invoice and Payments Processing	On-time payments		%		Efficiency	Evaluating the percentage of invoices that are paid on time or before they are due to help understand opportunities for negotiating future payment terms and discounts	(# of Invoices paid on or before due date in a month/# of Invoices in a month)*100
Intelligent Supply	Invoice and Payments Processing	Days Payable Outstanding		Time	Yes	Cost	No. of days from purchasing materials, labor and/or conversion resources until cash payments must be made	Days Payable Outstanding = (Average Accounts Payable / Cost of Goods Sold) x Number of Days in Accounting Period
Intelligent Supply	Invoice and Payments Processing	Average early payment discount		%		Cost	Percentage of discount negotiated with suppliers as a consequence of making invoice payment earlier than the invoice due date	(Early payment Discount in $/ Total invoice amount in $)*100
Intelligent Supply	Invoice and Payments Processing	PO-backed Invoices		%		Efficiency	Percentage of invoices submitted against POs out of all invoices submitted in a defined time period	(# of Invoices submitted against a PO/# of Invoices submitted)*100
Intelligent Supply	Invoice and Payments Processing	3-way Matched Invoices		%		Efficiency	Percentage of invoices that were paid after fulfilling the 3-way match criteria(PO, Invoice and Receipt) out of all the invoices submitted, in a defined time period	(# of 3-way matched Invoices/# of Invoices submitted)*100

Supplier Collaboration

Definition and objectives

Definition:

The ability to **provide structured and effective collaboration between buyers and suppliers along with real-time visibility into** transactions, including orders, invoices and credit memos, by replacing email and offline communications with next-generation technology that monitors performance metrics to enable partnership with suppliers in order to **reduce risks, improve performance** against contract terms and achieve negotiated savings

Why Digital Supply Networks:

Networks now are more holistic, allowing for supplier enablement, supplier discovery, supplier analytics, supplier compliance and supplier payment, all of which enable greater supplier partnership in mitigating risks and generating mutual value. Supplier Collaboration enables

- self-reporting about competitive, risk, audit, sustainability and compliance issues
- real-time demand and capacity sharing
- supplier financing, transaction visibility and advanced payment terms
- document collaboration, the use of built-in templates, and mass-mailing and communication that can be tracked
- industrial symbiosis, or the realization of the interdependence of companies
- supplier partnership in mitigating risks and generating mutual value by using shared financials, key performance indicators and interconnected forecasts and raising alerts in case of non-compliance
- an increased focus on delivering a 360-degree view for suppliers that includes frameworks for supplier risk and performance.

Supplier Collaboration

Definition and objectives

Drivers for Change:

- There's a notable market shift from reactive supplier communication to proactive strategic relationships with suppliers.
- The market is demanding increased supplier accountability to achieve all contract terms.
- Greater access to suppliers' constraints and needs could help mitigate supply network risks.
- Customers and organizations have an increased desire for order-to-delivery traceability.
- Competing in today's digital world requires an ability to exchange information in real time.

Example:

A global life sciences corporation wanted to evolve beyond traditional supplier management to develop a more collaborative supplier relationship and accelerate innovation. Supplier collaboration and development programs were identified to help the company work with suppliers to reduce lead times and increase flexibility, reduce shortages, improve planning and scheduling information and information flow, enhance quality, optimize and balance inventory, improve engineering change communications processes, and facilitate better information sharing for faster issue resolution. This improved supply network flexibility also helped the company adjust to changes in demand, design, operations and risk. The company also developed a roadmap and timeline for supplier engagements, clarified alignment between supplier replenishment and shipping and the firm's ordering and receiving processes, and eliminated unnecessary hand-offs between traditional organizational boundaries. In the end, the company achieved end-to-end management of product configuration, global visibility into production and material requirements, and integration of suppliers into the client's larger strategic vision.

Supplier Collaboration

Relations with other level-1 Capabilities

Digital Development	The Digital Development function supports collaboration between companies and facilitates discovery and market awareness.
Dynamic Fulfilment	The Dynamic Fulfillment function links demand and supply information and assists with risk identification and replanning.
Smart Operations	The Smart Operations function links demand and supply information with compliance information, often in the form of certificates.
Connected Customer	The Connected Customer function provides intercompany alerts or demand signals, risk information, drop-ship confirmations, and market intelligence to deliver an improved customer experience.
Synchronized Planning	The Synchronized Planning function enables supply and demand planning through real-time supply continuity input.

Supplier Collaboration

Impact of digital disciplines

Sense	• Senses market and risk factors, in terms of supply assurance risks, quality risks, pricing risks and more, in the supply network
Collaborate	• Shares risk information and all internally generated supply network signals with suppliers, thus driving intercompany signals and reporting requirements
Optimize	• Optimizes supply and demand based on the collaborated inputs, drives improved customer service at a lower cost, and enables a more agile supply network
Respond	• Reduces risk and increases speed to serve customers, all at a lower cost

Supplier Collaboration

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Intelligent Supply	Supplier Collaboration	Suppliers with an EMS, ISO 14001 or other certifications, or producing CSR reports		%		Quality	Percentage of suppliers with EMS or ISO 14001 out of Total number of suppliers (can break this down by product category to assess differences in parts of the procurement organizations, such as number of products or components meeting specified environmental performance requirements)	(Number of suppliers with EMS or ISO 14001 / Total number of suppliers)*100
Intelligent Supply	Supplier Collaboration	Volume Discount/Rebate		%		Cost	Percentage of discount negotiated with suppliers as a consequence of ordering above certain volume thresholds	(Volume Discount in $/ Total Invoice amount in $)*100
Intelligent Supply	Supplier Collaboration	Preferred/Strategic Suppliers Spend		%		Quality	Percentage of spend that was transacted with preferred suppliers i.e. strategic suppliers identified as per the supplier management program out of total spend	($ spend with preferred vendors/Total $ spend)*100
Intelligent Supply	Supplier Collaboration	Supplier’s Risk Rating		#	Yes	Quality	The numerical risk rating for a supplier	1- Low , 2- Medium, 3 - High

Deloitte.

Digital Development

Digital Development

Definition and vision

Definition: Digital Development is a new way of developing and managing products and services that are responsive to customer experience and transformed by smart real-time data, advanced technologies and agile innovation. The direct result is improved design quality, increased productivity, and enhanced communication and visibility.

Vision: Digital Development allows an organization to conceptualize, design and launch products and services by leveraging technology and activating a development ecosystem to rapidly fulfill unique customer needs. This Capability improves cross-functional collaboration throughout the product life cycle, drives efficiency in product and service design, speeds up time-to-market, and enables higher-quality products.

 |

Digital Development

Overview of level-2 Capabilities

	Common Platform and Product Architecture	Development Collaboration Ecosystem	Model-Based Definition (MBD)
Definition	A design approach that defines **standardized parts** and **assemblies** that can be shared across many products. A common interface facilitates interchangeability of parts that might offer different functionalities. This Level 2 Capability enables the **transition** from engineer-to-order to **configure-to-order** while continuing to **meet** a diverse set of **customer needs**. As a result, part customization and proliferation can be minimized.	The ability to break the internal organization's conventional boundaries and **integrate** the product strategy and development processes across both **internal and external stakeholders**	The ability to enable engineers to make the **3D model** the single **source of truth** for design information, **eliminating** the need to create and use **out-of-date 2D drawings** throughout the digital supply network. Additionally, using 3D models in manufacturing and through the supply chain enables downstream users to dynamically pull geometrical information from the models, requiring engineers to only annotate the most critical information.
What's New	• Software technology that delivers higher amounts of product differentiation faster • Reduction in overall costs by commonization of expensive, hidden parts but still allowing for customization at or near the user interface • Implementation of one or a few functional elements in their entirety for each physical assembly instead of implementing functional elements by a group of assemblies	• Continuous collaborative input from customers that helps foster innovation • Early, frequent and open engagement with all company functions and external parties, such as suppliers • Product development flexibility achieved through collaboration with external partners	• Out-of-the-box 3D annotation capabilities available in latest computer-aided design (CAD) solutions • Little to no additional software investment required because of today's CAD and product life cycle management integration • Faster access to more information through the distribution of 3D models rather than 2D drawings

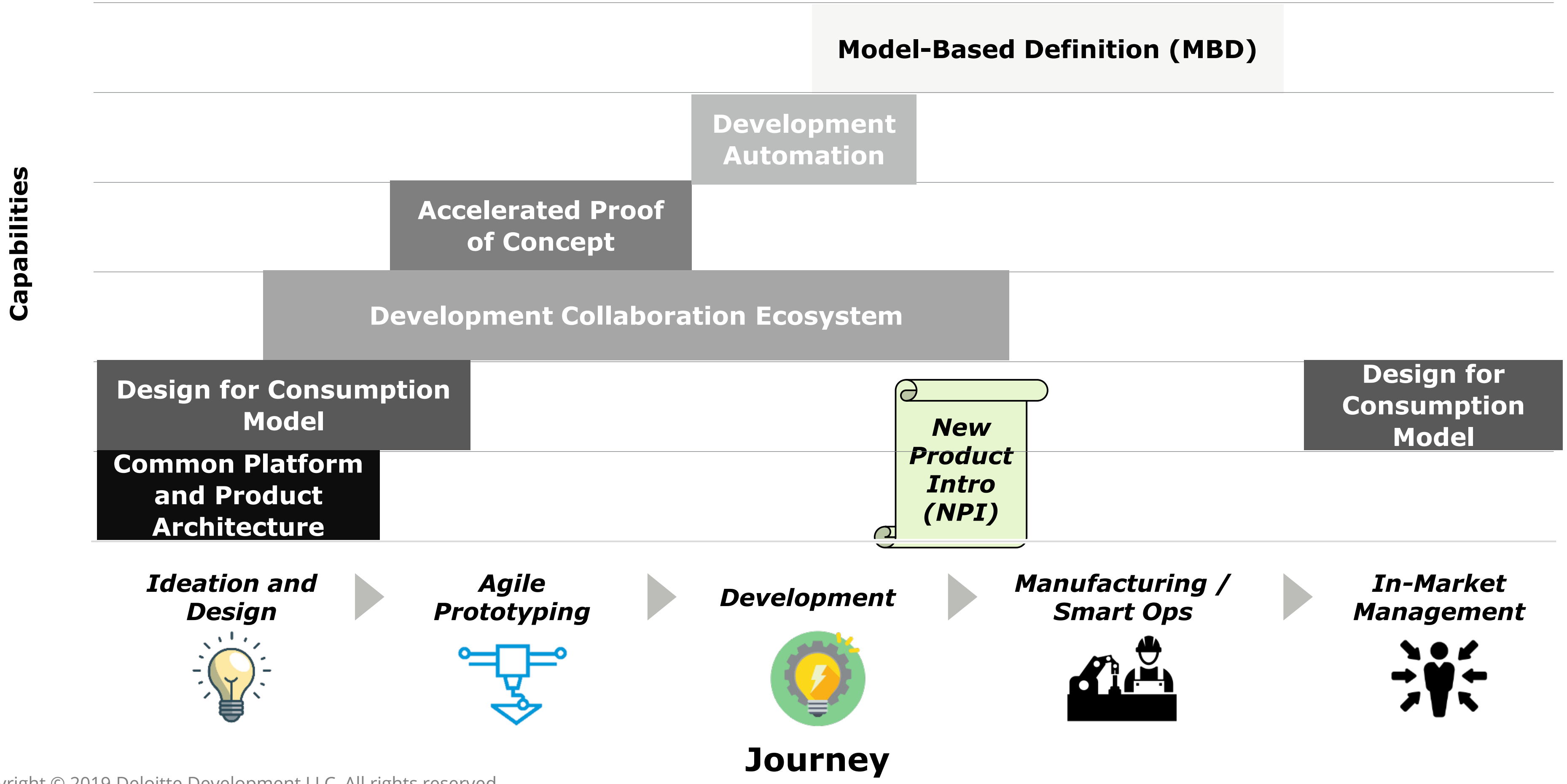
Digital Development

Overview of level-2 Capabilities

	Development Automation	Design for Consumption Model	Accelerated Proof of Concept
Definition	The ability to apply technology that accepts structured inputs and uses business rules to **execute** a subset of design processes **without human intervention**	The ability to enable a company to sell services for existing and future products, including additional features and packages that further enhance the performance and utility of a base product, such as adjacent services or the opportunity to unlock additional features	The ability to enable engineers to develop physical products, product visualizations and product simulations **faster** and **with improved accuracy**. This helps to discover and **course correct** design errors **faster and earlier** in the design cycle by enabling **more agile** design activities.
What's New	• Reduction in the amount of manual effort required to perform standardized tasks, allowing designers to focus more time on the creative design process • Improvement in the quality and efficiency of product development	• Delivery of value to customers through both a product itself and associated services • Incorporation of services design into traditional product design approaches • Enhancements to the use of an existing product through additional features that facilitate the consumption model, like tracking usage to determine when a refill or maintenance is needed	• Reduction in prototyping cost and time by leveraging technologies such as 3D printing and additive manufacturing design • Use of virtual reality and augmented reality to simulate prototypes in order to understand how users will interact with a product once its design is completed • Improved design accuracy and predictability of final product performance through advanced systems for building prototypes and evaluating design integrity

Digital Development

Journey map



 |

Digital Development

Capability maturity

Dimension	Ad-hoc	Typical	Advanced	Leading
Common Platform and Product Architecture	New designs are created from scratch with limited consideration for assembly interchangeability or part reuse.	New designs are created from scratch with consideration for existing parts and assemblies. Design is rarely driven by upgradeability or the ability to leverage existing manufacturing techniques.	New products leverage existing product architectures, and functionality is closely aligned to physical sub-assemblies or digital packages. Products are easily upgraded with additional or different functionality.	New products leverage existing product architectures. Products are easily upgraded post-sale by using software activation and upgrades.
Development Collaboration Ecosystem	There is limited collaboration with cross-functional team members to review design or development decisions, which often is done on an as-needed basis.	Cross-functional collaboration within an organization is prevalent and formalized into a development process, such as Stage-Gate.	Established collaboration channels allow internal and external collaborators to own and share design responsibility.	Collaboration with customers, vendors and functions within the organization enables high-impact innovations and future-proof product designs.
Model-Based Definition (MBD)	Traditional 3D models are used in design, but only 2D drawings are used by other functions.	Internally designed parts and assemblies are made using 3D models with product and manufacturing information (PMI). 2D drawings are made for external suppliers and other internal stakeholders on an as-needed basis.	Internally designed parts and assemblies are made using 3D Models with PMI and are used throughout the supply network. 2D drawings are rarely created or used.	A product definition model is created as a digital twin to integrate form and fit with product functions to create a true virtual representation of product behavior. This is used as a single source of truth and can be updated in real time by any business function.

Digital Development

Capability maturity

Dimension	Ad-hoc	Typical	Advanced	Leading
Development Automation	Redundant tasks are rarely automated.	Only a few people have knowledge about how to automate redundant tasks.	There is an established organization-wide methodology for automating redundant tasks.	Automating redundant tasks is integral to regular day-to-day activities and has the support of leading-edge people, processes and technology.
Design for Consumption Model	Service is provided as an add-on component post-sale, often in response to the market.	Service is defined as part of the product package to maintain a healthy customer relationship.	The marketing, field service and customer service departments collaborate during the product design process to identify value-added services that can be offered as part of the product.	Consumer needs are identified to establish building blocks for consumption during the design process. This approach is multi-faceted and can be upgraded and expanded to provide additional value to consumers.
Accelerated Proof of Concept	Basic physical and virtual prototyping and testing methods are leveraged by a few groups to validate design on an as-needed basis.	Some teams have a predictable way to simulate and validate designs and share findings with the broader organization.	Criteria for and usage of proof of concept is institutionalized across the organization. Advanced simulation tools are used to consistently catch design errors and lower overall product costs.	Simulation and prototyping are fully integrated as part of the design process. Any design decision can be supported with live validation through the most advanced simulation tools.

Digital Development

Profile: Carol, design engineer

Overview

Carol is a design engineer at a global smartphone manufacturer working on the next-generation phone model. Carol introduced a cool design for the battery that would reduce the thickness of the phone considerably, but she needs to quickly test out prototypes while collaborating with multiple stakeholders.

Education

Stanford University

- Master of Science in electrical engineering

Cornell University

- Bachelor of Science in electrical engineering

Experience

Current position

- Design engineer

Carol researches and develops ideas for new products and designs and modifies existing products and designs to improve efficiency or performance of the products or design and manufacturing processes. Because she is part of a digital supply network, Carol can collaborate with stakeholders across organizations and integrate prototyping as part of the design process. This greatly speeds up the design approval process.

Previous position

- Electrical engineering intern, focusing on electronics component design

Digital Development

Profile: Carol, design engineer

	Week 1	Week 4	Month 2	Month 6	Year 2
Before implementation of Digital Development, Carol had limited collaboration with stakeholders and had to wait longer to test prototypes.	Carol brainstorms ideas with her team to create innovative and efficient product designs.	Carol and her team put together initial drafts for the new and modified designs.	Throughout the next couple of weeks, Carol shares the designs with stakeholders from other departments within the organization to gather additional insights into the design.	Carol sends the designs for prototyping and waits for the prototypes to be delivered.	Carol and her team make the necessary modifications to the design before releasing it to production.
After implementation of Digital Development, Carol is able to coordinate with multiple stakeholders across organizations while also minimizing lead times to test prototypes.	Carol brainstorms ideas with the ecosystem, or her extended team of vendors and customers.	Carol and her team start prototyping the initial drafts and validate the requirements with accelerated proof-of-concept capability.	Carol shares the 3D models with internal and external stakeholders and receives real-time feedback.	Carol and her team make the necessary modification s and release the design to production. The team starts working on its next project.	Not applicable

Digital Development

Profile: Antonio, manufacturing engineer

Overview

Antonio is a manufacturing engineer at a global automotive manufacturer working on the next platform for electric vehicles. He is part of the new product introduction team and is readying the factory for the launch of a new car, the first to be launched on the new electric platform.

Education

Purdue University

- Master of Science in industrial and operations engineering

University of Illinois

- Bachelor of Science in mechanical engineering

Experience

Current position

- Manufacturing engineer

Antonio optimizes the production process and partners with operations and design engineering to introduce new products into the factory. As part of a digital supply network, Antonio has earlier access to design information and can simulate the manufacturing process prior to the first physical prototype. This helps him better identify manufacturing constraints and saves a significant amount of rework on the design and production process.

Previous positions

- Mechanical engineer
- Mechanical engineering intern

Digital Development

Profile: Antonio, manufacturing engineer

	Week 1	Week 4	Month 2	Month 6	Year 2
Before the implementation of Digital Development, Antonio had limited visibility into design activities and had to wait longer to validate production processes.	Antonio is pulled into a late-stage design review and sees the new electric car platform for the first time. He is told that the product will launch in six months.	Antonio has reviewed the design in detail and finds that many of the parts and assemblies will require new manufacturing processes. He cannot start to work on them because he needs to wait to receive the first set of parts from the prototype manufacturers.	Antonio receives the first set of parts and pulls in his team for an all-hands-on-deck prototype build. Issues are documented and sent back to design engineering.	The manufacturing line begins running parts, but issues keep happening throughout the day. New issues are surfacing constantly because only a handful of prototypes were made.	Antonio identifies a design change to improve the manufacturing process. He prints out a drawing and redlines it, and it sits in a long queue before a design engineer calls him for clarification. The change is implemented months later.
After the implementation of Digital Development, Antonio is able to simulate production processes and collaborate in the design process.	Antonio reviews an early version of the new design with model-based definition (MBD) models and confirms that a majority of the production processes to make the car's parts will be similar to each other, thanks to the use of a common architecture with previous designs.	Antonio creates a manufacturing simulation leveraging the MBD models created by the design team. He pulls in suppliers to get their input on the assembly process.	Using rapid prototyping, manufacturing fixtures are created to validate key steps in the production process.	The manufacturing line is up and running with minimal challenges, thanks to the simulation and prototyping.	Antonio identifies a design change to improve the manufacturing process and annotates the MBD model with the request change. The change request is quickly routed to a design engineer via change control automation.

Common Platform Product Architecture

Definition and objectives

Definition:

A design approach that defines **standardized parts** and **assemblies** that can be shared across many products. A common interface facilitates interchangeability of parts that might offer different functionalities. This Level 2 Capability enables the **transition** from engineer-to-order to **configure-to-order** while continuing to **meet** a diverse set of **customer needs**. As a result, part customization and proliferation can be minimized.

Why Digital Supply Networks:

Common Platform Product Architecture enables companies to

- leverage software technology to deliver a higher amount of product differentiation faster
- reduce overall costs by commonization of expensive, hidden parts while still offering parts customization at or near the user interface
- implementing one or a few functional elements in their entirety for each physical assembly instead of implementing functional elements by a group of assemblies.

Common Platform Product Architecture

Definition and objectives

Drivers for Change:

- Customers are increasingly demanding product personalization and configurability.
- There is significant competitive pressure for more frequent product updates.
- Companies also are facing pressure for lower development and operational costs.

Example:

Tesla cars all share a common hardware platform to limit parts and subassembly variability across models, but the platform frequently receives software updates to enhance functionalities and add new features, such as parking and lane-change assistance.

Common Platform Product Architecture

Relations with other level-1 Capabilities

Synchronized Planning	Smaller numbers of variations in base design parts facilitates more stable long-term demand forecasts and buffers against any fluctuations in customer demand. Advanced planning can be focused on variable peripheral components that are more cost effective to procure.
Connected Customer	By having a more modular set of base designs, engineering can fine-tune designs more quickly and incrementally to meet changing customer demands while limiting costly redesigns. By having a stable platform of products over a span of multiple product generations, customer usage and changing habits can be more easily tracked against a set of stable base products.
Smart Operations	Limiting the number of parts and components makes it easier to automate assembly and reduce manufacturing cycle times. Modularity also makes it easier to virtually simulate manufacturability of a combination of different subsystems and components.
Intelligent Supply	Fewer variations in parts results in a more stable supply network and a smaller, easier to maintain supplier base. This, in turn, makes it easier to react to changing demand and consolidate volume to leverage better prices.
Dynamic Fulfillment	Modular design makes it easier to quickly deliver necessary parts while maintaining a relatively small amount of inventory. Late-stage assembly of parts closer to customers might be possible if variation is limited to peripheral and less-expensive parts, which increases fulfillment agility for products with long lead times.

 |

Common Platform Product Architecture

Impact of digital disciplines

Sense

- Leverages Common Platform and Product Architecture to quickly create product visualizations and gather early customer feedback to simplify and reduce costs for the design process

Collaborate

- Collaborates with the customer service and marketing teams via 3D models to help the design team better understand the requirements for core customer value-added functionalities as well as the cost effectiveness of a reasonable product architecture

Optimize

- Designs a reasonable product architecture
- Rationalizes the resources spent during product design
- Increases a product's configurability
- Maximizes profit while serving the market with configurable products

Respond

- Creates configurability and leverages existing product modules to simplify the customer ordering process and reconfigure products to quickly meet new customer needs

Common Platform Product Architecture

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Digital Development	Common Platform and Product Architecture	Savings from Reduced Part Proliferation		$		Cost	Adoption - Cost reductions due to using common platforms and standardized/reusable parts	
Digital Development	Common Platform and Product Architecture	Additional revenue enabled by customization		$		Cost	Common platform enables more customer-driven customization - capture increased revenue for customized products leveraging common components	
Digital Development	Common Platform and Product Architecture	Overall Product Test Time		Time	No	Efficiency	Adoption - Leveraging common components that are already tested can reduce overall testing time	
Digital Development	Common Platform and Product Architecture	Custom Request Cycle Time		Time	No	Efficiency	Measure ability to respond to custom requests and design to customer needs	
Digital Development	Common Platform and Product Architecture	Field service and maintenance cycle time		Time	No	Efficiency	Common interfaces - allows customer to do some maintenance; leverage software for field upgrades (instead of hardware); simplified parts list - more inventory on hand for maintenance	

Development Collaboration Ecosystem

Definition and objectives

Definition:

The ability to break the internal organization's conventional boundaries and integrate the product strategy and development processes across both internal and external stakeholders

Why Digital Supply Networks:

Development Collaboration Ecosystem enables

- continuous collaborative input from customer that helps foster innovation
- early, frequent and open engagement with all company functions and external parties, such as suppliers
- product development flexibility through collaboration with external partners.

Development Collaboration Ecosystem

Definition and objectives

Drivers for Change:

- Customers want the option to choose the features they want.
- Faster, better products can be created through synergistic product development relationships that involve customer inputs.
- More agile and faster product development cycles can help companies quickly adapt to customers' changing needs.

Example:

Automotive manufacturers are collaborating with technology companies to enable consumers to connect their smartphones to car radios and infotainment systems and project apps, music, call and text functions, and other features through the system.

Development Collaboration Ecosystem

Relations with other level-1 Capabilities

Synchronized Planning	The Synchronized Planning function directly incorporates market demand through voice of the customer and builds design requirements and production priorities via cross-functional collaboration between engineering and marketing. This helps to deliver the features that customers value sooner.
Connected Customer	The Connected Customer function sets up virtual environments where customers can learn about concepts in progress and share early feedback. In addition, previously inaccessible inputs on design can be unearthed by monitoring product usage on the customer end.
Smart Operations	Manufacturing across the globe can be realized by modern processes of separating product design data from downstream data, such as manufacturing bills of materials, routings and more. In addition, advanced data sharing and security policies reduce threats to a design function’s intellectual property while allowing the factory to access the latest designs easily and at a much earlier stage in design process.
Intelligent Supply	Sourcing partners can participate in the design process with the least threat to core product design data.
Dynamic Fulfillment	Emerging relationship

Development Collaboration Ecosystem

Impact of digital disciplines

Sense	• Applies sensing techniques to understand which partners to collaborate with and what inputs are needed in order to meet changing customer demands
Collaborate	• Promotes better collaboration among various internal and external functions by breaking conventional boundaries and by enabling a digital network
Optimize	• Optimizes the number of iterations to be made during the design phase • Improves time-to-market by integrating various functions
Respond	• Integrates real-time customer input during the design phase by responding quickly to changing customer needs

Development Collaboration Ecosystem

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Digital Development	Development Collaboration Ecosystem	Cost for identifying, prioritizing, and aggregating DEVELOP requirements			Yes	Cost	The sum of the costs associated with identifying, prioritizing, and aggregating DEVELOP requirements	
Digital Development	Development Collaboration Ecosystem	Process Costs for Winning and Setting up Customer Reference			Yes	Cost	% of feedback requests issued to the correct target group within the defined time horizon, documented according to standards, and with the required infrastructure operational	
Digital Development	Development Collaboration Ecosystem	Perfect feedback receipt			Yes		% of feedback received from the correct target group within the defined time horizon, and documented according to standards.	
Digital Development	Development Collaboration Ecosystem	Cycle time for balancing DEVELOP requirements with DEVELOP resources			Yes		The average time associated with balancing DEVELOP requirements with DEVELOP resources	
Digital Development	Development Collaboration Ecosystem	Cycle Time for validating offerings in the market			Yes			
Digital Development	Development Collaboration Ecosystem	Feedback receipt cycle time			Yes		Average time to receive feedback	

Model-Based Definition (MBD)

Definition and objectives

Definition:

The ability to enable engineers to make the **3D model** the single **source of truth** for design information, **eliminating** the need to create and use **out-of-date 2D drawings** throughout the digital supply network. Additionally, using 3D models in manufacturing and through the supply network enables downstream users to dynamically pull geometrical information from the models, requiring engineers to only annotate the most critical information.

Why Digital Supply Networks:

The latest computer-aided design (CAD) solutions offer out-of-the-box 3D annotation capabilities. Plus, with today’s integration between CAD and product life cycle management, implementing MBD requires little to no additional software investment. As the world continues to move toward a paperless future, MBD fits neatly into the continued push for faster access to more information through the distribution of 3D models in place of 2D drawings.

Model-Based Definition (MBD)

Definition and objectives

Drivers for Change:

- Customer expectations for faster time-to-market and greater product personalization create a demand for faster design and new product introduction processes.
- In a world with ever-increasing product complexity expected at lower and lower costs, the success of an organization depends on better manufacturability to reduce product costs.
- To improve efficiency in the supply network, there is an increasing necessity for improved cross-functional collaboration.

Example:

A Swedish automaker has been shifting away from drawings as the principle method of design documentation to 3D models for communication of product information. The company has achieved faster time-to-market, improved manufacturing transfer through dynamic 3D work instructions and improved supplier quality.

Model-Based Definition (MBD)

Relations with other level-1 Capabilities

Synchronized Planning	The Synchronized Planning function leads to improved collaboration with manufacturers and suppliers throughout the product design process, giving the planning team earlier access to design information.
Connected Customer	The Connected Customer function enables the use of 3D MBD models to create augmented reality and virtual reality experiences for customers and customer service, enhancing real-time feedback about product performance to improve new product design.
Smart Operations	The Smart Operations function creates dynamic work instructions and allows manufacturing engineers to simulate and design manufacturing processes using 3D models without needing to wait for the first physical prototype.
Intelligent Supply	The Intelligent Supply function empowers manufacturers and suppliers to work directly with 3D models as the single source of truth, reducing rework cycles and improving collaboration between them and the engineering team.
Dynamic Fulfillment	The Dynamic Fulfillment function enables the use of the Digital Process Twin, which gives the full supply chain team access to a digital model of the physical configured product that will be delivered to the end user.

Model-Based Definition (MBD)

Impact of digital disciplines

Sense	• Leverages MBD models to create early product visualizations that can be used to gather early customer feedback throughout the design process
Collaborate	• Shares 3D models with cross-functional collaborators • Facilitates information exchange between the design engineering team and downstream users and customers, reducing the likelihood that models will need to be scrapped or reworked because of miscommunication
Optimize	• Uses the 3D model as the single source of truth throughout the supply network, which results in less rework and less time to revise engineer parts and assemblies
Respond	• Leverages existing MBD models to create dynamic work instructions and augmented reality and virtual reality service manuals quickly and easily

Model Based Definition (MBD)

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Digital Development	Model-Based Definition (MBD)	% of new parts released in 3D only		%	No	Efficiency	Parts being released with MBD content only; few if any 2D drawings created	# of 3D parts / Total # of Parts
Digital Development	Model-Based Definition (MBD)	% of Design Engineers releasing 3D files		%	No	Efficiency	Tracking adoption of MBD processes across User groups	# of Users Leveraging MBD / Total # of Users
Digital Development	Model-Based Definition (MBD)	Faster Time to Market and Reduced NPI Churn		Time	No	Efficiency	Reduced cycle time between Stage Gates and faster Design Reviews	#1 Average Current NPI Cycle Time - Average Post MBD Implementation NPI Cycle Time #2 Current Number of Iterations During Design Cycle - Number of Iterations Post MBD Implementation
Digital Development	Model-Based Definition (MBD)	Reduction in Engineering Cycle Time		Time	No	Cost	Reduction in cycle time spent modeling and drafting documents in advance of CO release	Average Current Design to Release Time - Average Post MBD Implementation Design to Release Time
Digital Development	Model-Based Definition (MBD)	Decreases in Fabrication, Assembly Cycle Times and Rework		Time	No	Quality	Increased throughput and Right First Time; Decrease in errors and rework	#1 Average Current Manufacturing Time - Average Post MBD Implementation Manufacturing Time #2 Current Number of Quality Issues - Post MBD Implementation Quality Issues

Development Automation

Definition and objectives

Definition:

The ability to apply technology that accepts structured inputs and uses business rules to **execute** a subset of design processes **without human intervention**

Why Digital Supply Networks:

Product development is increasingly relying on automation technology to reduce manual, repetitive work, such as building conceptual computer-aided designs using attributes, creating drawings and reviewing change documentation. Automation increases productivity by allowing engineers to focus more on their core design activities. Automation also can reduce errors, delays and dependencies by minimizing manual intervention and hand-offs.

Development Automation

Definition and objectives

Drivers for Change:

- Customers and designers are requiring increasingly higher precision and quality for development processes.
- Companies are seeking improved accuracy and repeatability from autonomous systems so that little to no human intervention is needed.
- In many industries today, there is an increasing necessity for enhanced data collection and traceability of the design process.

Example:

At a major aerospace and defense company, key stage-gate review steps automatically trigger design quality checks that monitor adherence to a predefined set of input criteria and business rules. The design process cannot proceed until the automated system confirms that the design meets minimum criteria or the design receives an exception from a governing body.

 |

Development Automation

Relations with other level-1 Capabilities

Synchronized Planning	Emerging relationship
Connected Customer	Inputs from customers can be leveraged to enhance design features by automating process steps during the product development phase.
Smart Operations	Manufacturing receives early access to accurate inputs about design activities that could affect the process design and process equipment.
Intelligent Supply	Emerging relationship
Dynamic Fulfillment	Emerging relationship

Development Automation

Impact of digital disciplines

Sense	• Utilizes automation in product development, which prompts a shift in the tools and processes used to collect inputs for product design • Can use previously unnoticed or hard-to-capture inputs, such as supplier capability, to build accurate predictions of market response into the design process
Collaborate	• Enables the designer or engineer to provide accurate information to other stakeholders, such as the manufacturing and procurement teams • Allows engineers to dedicate time, which previously would have been consumed by redundant activities, to ensuring that all collaborators and design partners are well informed and involved in the design process
Optimize	• Accurately captures design inputs • Ensures that the design process can be handled in the most efficient way with minimal waste of time and human effort
Respond	• Enables the design engineer to prepare better estimates of time-to-market and lost hours in change management, thus ensuring that a product is built in the most effective manner

Design for Consumption Model

Definition and objectives

Definition:

The ability to enable a company to sell services for existing and future products, including additional features and packages that further enhance the performance and utility of a base product, such as adjacent services or the ability to unlock additional features

Why Digital Supply Networks:

Design for Consumption Model enables companies to

- deliver value to customers through both a product itself and associated services
- incorporate services design into traditional product-design approaches
- enhance the use of an existing product by adding features to facilitate the consumption model, such as an ability to track product usage to determine when a refill or maintenance is needed.

Development Automation

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Digital Development	Development Automation	Adoption rate of automation tools				Efficiency	Measure tool usage among targeted users and continuously improve the accessibility and capability of the tool	
Digital Development	Development Automation	Cost savings from reduced error				Cost	Measure loss prevented from reduced human error and saving captured from reduced manual work	
Digital Development	Development Automation	New revenue enabled				Innovation	Measure value created by diagnostic and predictive analytics	
Digital Development	Development Automation	Cycle time - executing engineering tasks and processes			No	Efficiency	Measures engineering speed improvements by process groups and capability	

Design for Consumption Model

Definition and objectives

Drivers for Change:

- Customers no longer want just the product. They also want associated services.
- Customer pressure to improve the total life cycle cost of products pushes companies to find innovative ways to extend product life cycles and expand their features.
- Traditional product companies are continuously seeking additional sources of revenue.
- Increased competition has forced companies to add complementary services to their manufactured products.
- Customers would prefer to pay only to the extent that they use a product, rather than paying for the full product.
- In today's competitive environment, there is a constant drive for reduction in IS Analytics for the customer.

Example:

When a consumer uses a copy machine at OfficeMax, he or she only pays for the copies he or she makes. Consumers do not pay for the entire cost of the copy machine.

Design for Consumption Model

Relations with other level-1 Capabilities

Synchronized Planning	Consumers are seeking add-on services for base products. This requires more advanced, agile planning for higher complexity sourcing of parts and services.
Intelligent Supply	The Intelligent Supply function requires new ways to deliver services to customers, such as through leasing or digital downloads.
Dynamic Fulfilment	The Dynamic Fulfillment function needs an advanced way to deliver and track consumption of add-on services by customers, whether through usage data, permission settings or other metrics.
Connected Customer	The Connected Customer function improves a company’s agility to meet customers’ changing needs by offering add-on services and products that cater to their specific interests and levels of engagement. This is a preferable alternative to developing new hardware from scratch that customers will have to buy and own.
Smart Operations	The Smart Operations function adds complexity to manufacturing requirements through the integration of software and hardware products that enable embedded software to transform a base product’s form, fit and function.

Design for Consumption Model

Impact of digital disciplines

Sense	• Delivers timely feedback collected from customers during service sessions to the product development team to help the members understand the market's needs for new product features or services
Collaborate	• Promotes strong collaborations not only within the traditional supply chain groups but also across the marketing and service teams. In order to provide improved customer experience, all functions need to collaborate in designing products and supporting value-added services related to those products.
Optimize	• Optimizes the revenue channel via services designed around the products and increasing the reach of target customer groups, such as by allowing them to lease rather than buy physical products
Respond	• Allows faster responses to changes • Reduce time-to-market by designing new releases and upgrades as part of added services

Design for Consumption Model

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Digital Development	Design for Consumption Model	"True" Top Line growth		$		Cost	Top line growth from product launch adjusted to the cannibalization of other adjacent products and SKUs from same platform	
Digital Development	Design for Consumption Model	Return on Innovation Spend		$		Efficiency		
Digital Development	Design for Consumption Model	Innovation $ in pipeline		$		Innovation	Total Revenue potential for the Ideas and Projects in the portfolio. This can be sliced as per the organizations need per Gate, per Project type, per Product Platform type etc.	Total Revenue potential for the Ideas and Projects in the portfolio
Digital Development	Design for Consumption Model	Time To Market		Time	No	Efficiency	Time between gates from ideation to industrialization. May wary for industries and can be from ideation to Product launch	Derived from time between gates
Digital Development	Design for Consumption Model	Cycle Time: Innovation		Time	No	Innovation	Speed of converting ideas into prototypes/products	Time between Gates. Can be different based on what model of phase gate is followed [Typical - G1 to G3]
Digital Development	Design for Consumption Model	Cycle Time: Industrialization [Standardize name]		Time	No	Efficiency	Speed of industrializing prototypes/Beta products	Time between Gates. Can be different based on what model of phase gate is followed [Typical - G3 to G6]

Accelerated Proof of Concept

Definition and objectives

Definition:

The ability to enable engineers to develop physical products, product visualizations and product simulations **faster** and **with improved accuracy**. This helps to discover and **course correct** design errors **faster and earlier** in the design cycle by enabling **more agile** design activities.

Why Digital Supply Networks:

Accelerated Proof of Concept enables

- a reduction in prototyping cost and time by leveraging technologies such as additive manufacturing design
- the use of virtual reality and augmented reality to simulate prototypes in order to understand how users will interact with the product once it is completed
- improved design accuracy and predictability of final product performance through advanced systems for building prototypes and evaluating design integrity.

Accelerated Proof of Concept

Definition and objectives

Drivers for Change:

- Today's rapidly moving markets demand faster time-to-market.
- Rapid prototyping technologies are decreasing in cost.

Example:

Nike is using virtual reality and 3D printing to prototype new generations of running shoes to anticipate the individual needs of consumers and to tailor products to those needs.

Accelerated Proof of Concept

Relations with other level-1 Capabilities

Synchronized Planning	With Accelerated Proof of Concept, fine signals in the form of changing planning-related inputs and trends can be built into the product-development and concept-generation stage.
Connected Customer	Inputs from customers and trends can be captured and tested for new developments in less time, thus expediting the process for launching the products.
Smart Operations	A factory can use technology to maintain a better response time to the design needs of prototypes.
Intelligent Supply	At the factory level, companies can both capture supply-side signals and test supplier designs within shorter lead times.
Dynamic Fulfillment	Companies can fulfill requests for prototypes and samples more quickly, thus reducing the design cycle and helping project teams ship products to customers faster.

Accelerated Proof of Concept

Impact of digital disciplines

Sense	• Uses technology to create prototypes and samples and to maintain data about test failures. This data can be used to improve the product's design.
Collaborate	• Smoothly collaborates with prototype labs and external suppliers • Uses technology to expedite the timeline to product launch
Optimize	• Captures and analyzes test data and prototype build data to help optimize the design process and assess product risks early in the development cycle
Respond	• Rapidly adjusts prototypes to address new customer requirements, thus enabling faster concept realization

Accelerated Proof of Concept

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Digital Development	Accelerated Proof of Concept	Number of defects after launch		#		Quality	Measuring number of design defects not captured in the design maturation process	# of defects after product launch date
Digital Development	Accelerated Proof of Concept	Number of new design errors per design phase		#		Quality	Downwards trend of net new design errors found as design cycle progresses	# of design errors per milestone
Digital Development	Accelerated Proof of Concept	Prototype Costs		$		Cost	Downwards trend of prototyping costs through use of digital technologies (Augmented and Virtual Reality, FEA, 3D Printing, 3D CAD, etc.)	Total cost of prototypes for product B vs total cost of prototypes for similar product A
Digital Development	Accelerated Proof of Concept	Design Schedule Variance		Time		Efficiency	Days ahead of or behind scheduled design timeframe	Actual Development Days - Planned Development Days
Digital Development	Accelerated Proof of Concept	Percentage of Design Reuse		%		Efficiency	Percentage of parts reused from previous designs	Design Reuse Parts / Total # Of Bill of Material Parts

Dynamic Fulfillment

Dynamic Fulfillment

Definition and vision

Definition: A Dynamic Fulfillment network is an **interconnected cross-enterprise system** that enhances the customer experience by getting the **right product and service** to the **right customer** or node at the **right time** and in the **right quantity, quality** and **condition** while providing supply networks with the desired level of logistics visibility, responsiveness, scalability and flexibility through the application of leading practices, empowering technologies and cross-functional collaboration.

Vision: Dynamic Fulfillment delivers **extended visibility** and **increased optionality** that **improves flexibility**; **enables scalability**; and achieves the **optimal balance of cost**, **speed and risk** by embracing the opportunities provided by sensors; geolocation data; digitization; cloud computing; blockchain; the internet of things; robotics; wearables and assisted reality devices; distributed order management, warehouse execution and transportation management systems; and emerging modes of transportation.

Dynamic Fulfillment

Overview of level-2 Capabilities

	Automated Fulfillment Signals	Chain of Custody and Integrity	Omnichannel Order Fulfillment	Efficient Warehouse Operations
Definition	The ability to automatically transmit demand; supply; and other data signals, such as signals related to order placement and fulfillment and return authorization, by leveraging cloud platforms, upstream and downstream triggers, sensors, and other system controls to **extend real-time visibility** beyond the four walls of a site, **improve responsiveness** and **reduce overhead**	The ability to provide visibility into the transfer of custody, movement of inventory and provenance of a product as it advances through the network … thus **improving traceability, enhancing accountability, minimizing the risk of gray market leakage** or **counterfeit product acceptance, enabling targeted recalls,** and **protecting brand equity**	The ability to confirm, aggregate, orchestrate and fulfill orders through multiple service points, including warehouses, stores and suppliers … allowing companies to **reduce fulfillment time and costs** while **enhancing the customer experience**	The ability to implement the right balance of interconnected human, technology and physical assets to **improve order accuracy and inventory management; expedite order processing;** and **reduce injury, costs and reliance on labor**
What's New	• Customer expectations for shorter lead times, increased supply network responsiveness and an increase in the number and quality of recommendations to fulfill demands on time in full • Innovators pushing the boundaries of analytics, translating insight into a competitive differentiator	• Legislation, regulation and industry standards that define accountabilities and responsibilities across the supply network • Consumer demand for authentic, Fair Trade and socially conscious products • Customer expectations regarding safety and traceability • Focus on the preservation of intellectual property and brand equity and managing supply network risks	• Proliferation of customer channels • Higher customer expectations about how and when they can acquire an ordered product • Higher customer expectations related to product availability and supply network responsiveness • Innovators' effective and holistic management of their supply networks	• Consumer demand for reduced lead times • Variability of demand and seasonality • Market demand to reduce logistics costs • Labor shortages and attrition risk

 |

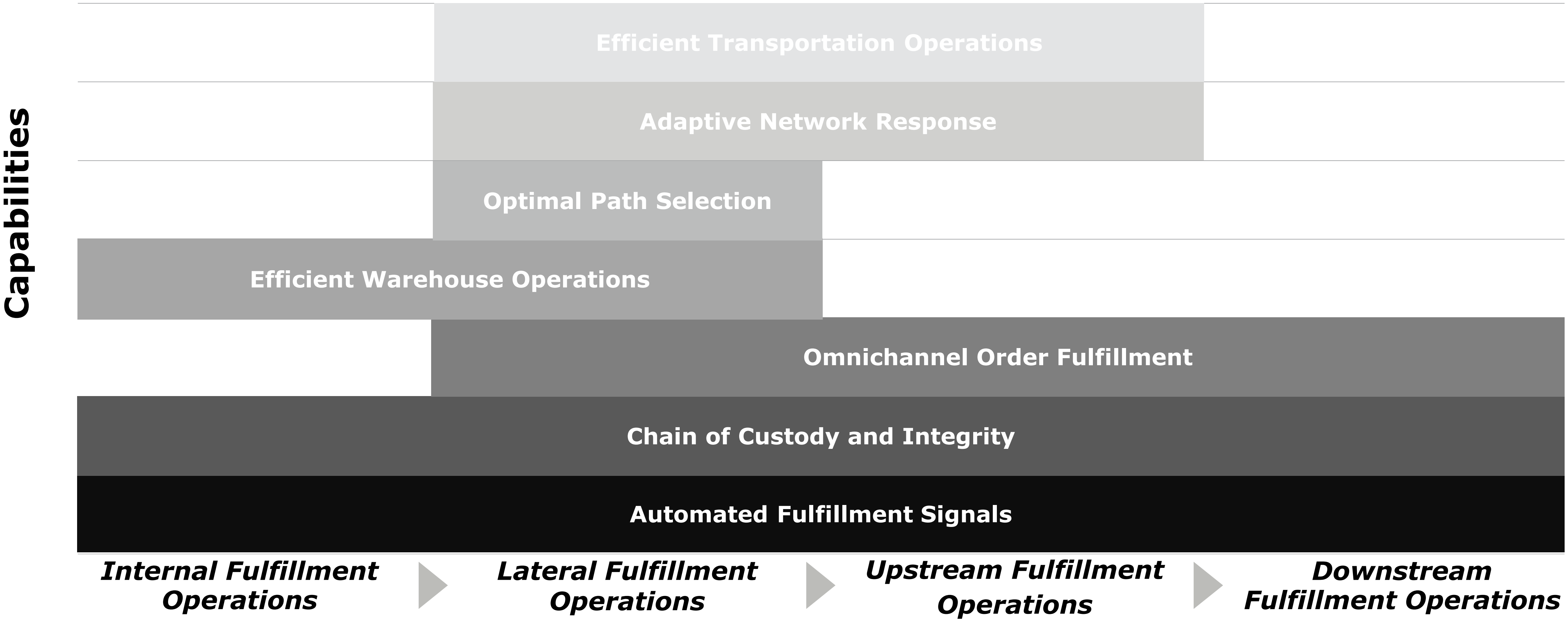
Dynamic Fulfillment

Overview of level-2 Capabilities

	Optimal Path Selection	Adaptive Network Response	Efficient Transportation Operations
Definition	The ability to dynamically and automatically select or determine — and adjust in transit, if needed — the optimal modes and routes for shipping a product … given logistics requirements, hub locations, costs, planned shipments and available transportation options to **improve flexibility; enable scalability;** and **balance cost, speed and risk**. Innovative companies extend this Level 2 Capabilities to consider new modes, such as autonomous vehicles, drones and crowd-sourced last-mile-delivery options emerging from the gig economy.	The ability to design, develop, cultivate and deploy a flexible network of fulfillment points, leveraging crowd-sourced solutions and on-demand warehousing, that can dynamically scale capacity on short notice, thus enabling **improved demand fulfillment** while **reducing start-up costs and increasing supply network resilience**	The ability to apply advanced technologies, such as transportation management solutions, telematics, drones and autonomous vehicles, to automate the end-to-end transportation process from tendering freight to customer delivery in both the first and last mile, thus **improving efficiency, optimizing costs,** and **reducing delivery times**
What's New	• Innovators' success in harnessing the power of data and real-time geospatial information • Drive for continuous improvement and cost optimization • Customers' roles as suppliers of defective, expired or otherwise unwanted products, thus making them a new point of entry into the supply network	• Demand for supply network responsiveness that can rapidly expand or contract distribution capacity • Complex last-mile fulfillment requirements in dense urban areas, coupled with the high cost of establishing a physical presence in those areas, requiring alternate solutions to surge capacity • Regulatory, legislative and industry demand for solutions that minimize the negative impacts of transportation on the environment and quality of life	• Focus on environmentally friendly transportation solutions • Customer expectations related to accelerated delivery and sustainable solutions • Capacity constraints due to labor shortages • Regulatory, legislative and industry demand for solutions that promote safety and minimize the negative impacts of transportation on the environment and quality of life

Dynamic Fulfillment

Journey map



 |

Dynamic Fulfillment

Capability maturity

Dimension	Ad-hoc	Typical	Advanced	Leading
Automated Fulfillment Signals	Orders must be placed and reviewed manually before fulfillment can begin.	Orders are placed electronically but need to be manually verified before fulfillment can begin.	Order placement is automated through sensors or other triggers, but orders are still manually verified before fulfillment.	End-to-end automated signal transmissions automate order placement, verification and fulfillment and provide real-time visibility to customers.
Chain of Custody and Integrity	Authenticity is spot-checked.	The company is able to track shipments with increased frequency.	There is a high frequency of shipment monitoring across a range of key performance indicators (KPIs).	Shipments are tracked in real time, and quality checks are conducted across a range of KPIs.
Omnichannel Order Fulfillment	All orders placed across channels are tracked and fulfilled.	Sellers work with vendors to address orders across channels. Inventory gaps are proactively identified.	Channel priority is determined based on flow and additional factors from a robust order management dataset. Orders are automatically pulled from inventory.	Goods are priced dynamically based on channel and vendor priority and the cost of fulfillment, which is calculated by a real-time distributed order management system. Orders are dynamically pulled from inventory.

Dynamic Fulfillment

Capability maturity

Dimension	Ad-hoc	Typical	Advanced	Leading
Efficient Warehouse Operations	Inventory is turned consistently and successfully.	Inventory is turned consistently and successfully. Warehouse managers consistently work to identify opportunities for increased efficiency.	Inventory is turned consistently and successfully through the use of select technology enablers, which also minimize costs and improve worker accuracy.	Inventory is turned consistently and successfully through the use of a suite of interconnected digital enablers that accurately drive efficiency and continuous improvement.
Optimal Path Selection	Transportation analysis takes place to determine the best path. No formal analytics approach is applied.	Transportation analysis helps determine the best path. Analytics are applied in some forms but are not comprehensive or optimized.	Transportation analysts make all decisions based on predictive data, with little manual input necessary.	Transportation analysts monitor a fully automated and connected path selection module that is part of a central software platform.
Adaptive Network Response	Organizations have a distribution network with fixed assets that can meet average demand but is ill-equipped to expand or contract.	Organizations have a reactive distribution network with mostly fixed assets that are slow to react to demand changes but can eventually surge after significant resource investment.	Organizations have a responsive distribution network that leverages data to predict and adapt to changing demand by augmenting the fixed network with transient assets.	Organizations have a highly proactive and resilient distribution network that leverages transient assets and is seamlessly scaled to match demand.

Dynamic Fulfillment

Capability maturity

Dimension	Ad-hoc	Typical	Advanced	Leading
Efficient Transportation Operations	Movement of goods occurs from one point to another at the lowest cost.	Movement of goods occurs from one point to the other at the lowest cost and within the agreed service times.	Movement of goods occurs from one point to another at the lowest cost and in an environmentally efficient manner while meeting all service requirements.	Automated movement of goods occurs from one point to another in a manner that optimizes costs, enhances collaboration with carriers and enhances the customer experience.

Dynamic Fulfillment

Profile: John, warehouse director

Overview

John is a seasoned leader with more than 20 years of logistics and warehouse management experience. He is proficient in managing the operations of a warehouse and in setting the vision for the future of a warehouse to ensure that operations are run efficiently and profitably.

Education

Pennsylvania State University

- MBA with a concentration in supply chain

University of Pittsburgh

- Bachelor of Science in mechanical engineering

Experience

Current position

- Warehouse director

John manages factory performance in real time using accurate metrics dashboards that highlight issues on the warehouse floor. He can flag an issue to his managers and receive reports within minutes to enable fast and efficient decision-making.

John also works with the engineering team to identify new technologies that can improve the efficiency of operations and ensures seamless integration.

Previous positions

- Senior manager of warehouse operations
- Warehouse manager

Dynamic Fulfillment

Profile: John, warehouse director

	Arrival	Morning	Midday	Afternoon	End Of Day
Before implementing the principles of Dynamic Fulfillment, John had no access to real-time dashboards and had to rely on end-of-day reports to manage his operations, leading to reactive decision-making.	John begins to pour over the reports in his email inbox from his floor managers.	John reviews the reports from the previous day and identifies any problem areas within the warehouse. He identifies that the shipping department was well below its expected efficiency level.	John has a meeting with the outbound manager to discuss the issues from yesterday. The manager mentions that a faulty sortation system caused delays, and the team is working to resolve the issue.	John spends the entire afternoon trying to resolve the issue with the vendor of the sortation system while at the same time trying to work with staffing agencies to hire additional labor to remove the backlog.	John has managed to hire additional labor for the following day to clear the shipping backlog and is thinking of ways to proactively manage this situation next time.
With Dynamic Fulfillment, real-time dashboards help John make proactive decisions to ensure that operations run efficiently and meet the requirements of customers.	John has a meeting with the outbound manager to review the issues with shipping that he saw in his real-time performance dashboard app.	The outbound manager mentions that the vendor was notified, and a remote diagnosis suggested that the problem will take two days to resolve. John approves the hiring of additional labor to fill the backlog for the next couple of days.	John notifies the supply chain control tower about the issue and asks to divert orders to other distribution centers for fulfillment. He then proceeds to a meeting with a vendor about a new automated storage and retrieval system for the distribution center.	John has a meeting with the robotics team to implement a new picking solution that can potentially improve productivity by 30%.	John reviews the metrics for the day and makes an action plan for the next day.

Automated Fulfillment Signals

Definition and objectives

Definition:

The ability to automatically transmit demand; supply; and other data signals, such as signals related to order placement and fulfillment and return authorization, by leveraging cloud platforms, upstream and downstream triggers, sensors, and other system controls to **extend real-time visibility** beyond the four walls of a site, **improve responsiveness** and **reduce overhead**

Why Digital Supply Networks:

Traditionally, technology limitations, costs and an absence of standards prevented end-to-end visibility. If inventory positions and signals were shared at all, the sharing typically was limited to adjacent tiers and through vendor-managed inventory programs or supplier portals. A lack of transparency frequently results in suboptimal supply network performance, unrealized service targets and bullwhips. In a digital supply network, visibility and collaboration prevail, and information exchange and signal transmission underpin the network, benefitting the stakeholders by

- automatically triggering upstream activities, minimizing human bottlenecks, reducing lead times and improving convenience through the application of the internet of things and related sensors to capture and transmit consumption signals
- more optimally serving the customer and pre-positioning or pre-shipping inventory to accelerate fulfillment through the application of advanced analytics and the deployment of cloud platforms that facilitate information exchange across broad networks, eliminating the constraints of desktop software.

Automated Fulfillment Signals

Definition and objectives

Drivers for Change:

- Customers increasingly expect lead-time shrinkage, recommendation proliferation and increased supply network responsiveness.
- Innovators are pushing the boundaries of analytics and translating insight into a competitive differentiator and value driver.

Example:

A large integrated delivery network uses stocking cabinets with embedded radio frequency identification scanners to actively monitor inventory availability and aging across its network of supply rooms. Triggers and algorithms have been established to proactively alert supply managers to reposition inventory when it is out of balance or the risk of expiration exceeds a designated threshold.

 |

Automated Fulfillment Signals

Relations with other level-1 Capabilities

Synchronized Planning	The Synchronized Planning function sends automated demand signals and receives back supply signals, including orders, that drive or adjust future planning requirements. This information enables Automated Fulfillment Signals to guide the positioning of inventory, warehousing and transportation assets across the network and trigger some fulfillment activities.
Intelligent Supply	The Intelligent Supply function sends supply signals to suppliers, enabling Automated Fulfillment Signals to guide the positioning of inventory, warehousing and transportation assets across the network, help the company anticipate internal fulfillment needs, and trigger some fulfillment activities.
Connected Customer	The Connected Customer function empowers the customer with sensor- and internet of things–enabled products and connected portals that trigger fulfillment activities and share information about customer fulfillment needs, such as acceptable delivery windows and preferred delivery locations.
Smart Operations	The Smart Operations function sends supply signals to internal manufacturing facilities, enabling Automated Fulfillment Signals to guide the positioning of inventory, warehousing and transportation assets across the network, help anticipate internal fulfillment needs, and trigger some fulfillment activities.
Digital Development	The Digital Development function designs for fulfillment, embraces data standards, and incorporates sensors and internet of things technology into designs to issue automated signals to trigger fulfillment activities.

Automated Fulfillment Signals

Impact of digital disciplines

Sense	• Provides the ability to monitor product controls, such as temperature requirements, expiration dates and inventory levels, and automatically trigger orders, thus improving responsiveness
Collaborate	• Automatically initiates orders based upon triggers, thresholds and inventory levels, enabling seamless collaboration across downstream and upstream digital platforms
Optimize	• Automates orders and optimally routes those orders for fulfillment, thereby reducing costs while improving service levels
Respond	• Uses data to inform and refine predictive analytics, which can in turn be used to pre-position inventory in an optimal manner and improve supply network performance • Helps establish return kiosks to ensure a more convenient returns process for the customer

Automated Fulfillment Signals

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Dynamic Fulfillment	Automated Fulfillment Signals	Signal Coverage		%	No	Innovation	Measures signal and system controls in terms of overall coverage of signal transmission. A component of measuring a signal transmission's overall performance in reference to the breadth of signals that can be transmitted.	(Number of Triggers, Sensors, and System Controls / Total Signal Transmissions Possible) *100
Dynamic Fulfillment	Automated Fulfillment Signals	Signal Accuracy		%	No	Innovation	Measures signal and system controls in terms of overall accuracy of signal transmission. A component of measuring a signal transmission's overall performance as it relates to extending real-time visibility	(Number of Accurate Data Signals / Total Number of Data Signals) *100
Dynamic Fulfillment	Automated Fulfillment Signals	Traceability Variance		%	No	Quality	Measures the visibility/transparency value that signal transmissions bring an organization. Signal Transmissions should be able to monitor, measure, analyze, and improve KPIs and improve a supply chain's responsiveness. Particularly important for recalls.	(Discrete Steps Signaled by Data Transmission Signals / Total Number of Steps in the Supply Chain) *100

Chain of Custody and Integrity

Definition and objectives

Definition:

The ability to provide visibility into the transfer of custody, movement of inventory and provenance of a product as it advances through the network by applying sensors; unique identifiers, such as quick-response codes; geo-tracking data; blockchain technology; and system controls, thus **improving traceability, enhancing accountability, minimizing the risk of gray market leakage** or **counterfeit product acceptance, enabling targeted recalls,** and **protecting brand equity**

Why Digital Supply Networks:

Traditionally, little unit-level traceability existed across the supply network, and attempts to trace unit-level product flow often required manual intervention and were reserved for select high-value items. Most products were tracked at the stock keeping unit level by scanning a bar code. As a result, recalls were broad and expensive, and counterfeit and gray market activity was challenging to control. In a digital supply network, sensors, unique identifiers, geo-tracking data and blockchain technology help track unit-level transactional data and transfer of ownership and create records of provenance. This benefits stakeholders by

- assuring product integrity and authenticity, allowing brand owners to extract an appropriate premium for their intellectual property and giving consumers confidence that they are getting a safe, quality product
- enabling targeted recalls that can effectively identify and isolate defective or contaminated products and remove them from the marketplace
- fulfilling consumer expectations of social responsibility and supply network accountability amid a world increasingly reliant on outsourced production, fulfillment and returns management.

Chain of Custody and Integrity

Definition and objectives

Drivers for Change:

- Companies are required to adhere to increased legislation, regulation and industry standards that define accountabilities and responsibilities across the supply network.
- Consumers are demanding authentic, Fair Trade and socially conscious products.
- Customers expect product safety and traceability.
- In today's competitive innovative landscape, an increased focus on the preservation of intellectual property, brand equity and managing supply network risks is required.

Example:

A leading retailer conducted a pilot of blockchain technology in order to reverse-track mangos back to their point of origin. The baseline process, when performed manually, took almost seven days to complete. The blockchain-enabled process took just more than two seconds to complete.

Chain of Custody and Integrity

Relations with other level-1 Capabilities

Synchronized Planning	The Synchronized Planning function provides planning data against which a product can be traced to plan, thereby creating an end-to-end record of transfer of custody of a product and its components that can confirm integrity, authenticity and provenance across the supply network.
Intelligent Supply	The Intelligent Supply function provides supply data against which a product can be traced to inputs, thereby creating an end-to-end record of transfer of custody of a product and its components that can confirm integrity, authenticity and provenance across the supply network.
Connected Customer	The Connected Customer function provides purchase data against which a product can be traced, thereby creating an end-to-end record of transfer of custody of a product and its components that can confirm integrity, authenticity and provenance across the supply network. This facilitates targeted recalls and market withdrawals and enables customer segmentation and outreach and the sale of value-added services.
Smart Operations	The Smart Operations function provides data against which a product can be traced to production, thereby creating an end-to-end record of transfer of custody of a product and its components that can confirm integrity, authenticity and provenance across the supply network.
Digital Development	The Digital Development function embeds sensors and unique identifiers into product designs to promote traceability.

 |

Chain of Custody and Integrity

Impact of digital disciplines

Sense	• Uses sensors and controls to track the location, custody and integrity of inventory, assets and shipments in order to support fulfillment and returns management. This data can be algorithmically analyzed against historical patterns to monitor compliance with shipping requirements, provide early identification of adverse trends and support root cause analysis.
Collaborate	• Shares Chain of Custody and Integrity data across the network with suppliers and customers alike. This data can be used to trigger responses, such as logging a custody transfer for regulatory purposes, automatically ordering based on periodic automatic replenishment levels, efficiently recalling a product or issuing delivery notifications, and promote brand equity.
Optimize	• Uses Chain of Custody and Integrity data to help optimize distribution. For example, consistent and reliable temperature readings can identify points of failure that need to be eliminated in order to maintain temperature integrity for perishable products.
Respond	• Analyzes and uses Chain of Custody and Integrity data to predict future shipping times as a product moves across the network. For example, a company might use such data to predict customs holds, lead times and risk and calibrate future lead times accordingly.

Chain of Custody Integrity

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Dynamic Fulfillment	Chain of Custody and Integrity	Shipment Delays		Time	No	Service	Measures delays in shipment that should be communicated to stakeholder in real-time	Days (Expected Delivery Date - Actual Delivery Date)
Dynamic Fulfillment	Chain of Custody and Integrity	Product Quality		%	Yes	Service	Measures % of orders that were delivered that meet quality requirements	(Total Perfect Orders) / (Total Number of Orders) *100
Dynamic Fulfillment	Chain of Custody and Integrity	Technology Tracking Accuracy		%	No	Service	Measures accuracy of Chain of Custody technology to accurately track products	(Number of products accurately tracked throughout network / Total Products through network) *100

Omnichannel Order Fulfillment

Definition and objectives

Definition:

The ability to confirm, aggregate, orchestrate and fulfill orders through multiple service points, including warehouses, stores and suppliers, through the application of distributed order management, advanced warehouse management and transportation management systems, allowing companies to **reduce fulfillment time and cost** while **enhancing the customer experience**

Why Digital Supply Networks:

Traditionally, transactions were largely limited to two or three parties: a buyer, a seller and, sometimes, a broker. Selection and quantity were often limited to the inventory that could be maintained within a given warehouse or closed network. Orders were larger, and there were fewer direct-to-consumer transactions. Exceptions required manual intervention. Increased transaction costs resulted when buyers had to connect with multiple sellers to identify the optimal product or otherwise fulfill their needs. In a digital supply network, technology enables more integrated networks that feature multiple vendors with inventory positioned at myriad locations and in various channels that can seamlessly be aggregated into a single order for the customer. This benefits stakeholders by

- expanding the selection available to the customer through a single portal, thus increasing convenience, reducing transaction costs and improving the likelihood that the buyer can select the most optimal product available in the marketplace
- right-sizing inventory, and consequently costs, across the network by optimizing the number of locations and tiers at which product is held and appropriately pre-positioning it close to the customer to reduce lead time.

Omnichannel Order Fulfillment

Definition and objectives

Drivers for Change:

- Today's market environment is characterized by a proliferation of customer channels and increased expectations about how and when customers can acquire a product.
- Customers have high expectations related to product availability and supply network responsiveness.
- For organizations to stay competitive in today's innovation-driven world, innovators' effective and holistic management of their supply networks

Example:

A leading retailer synchronizes order management across its e-commerce site, mobile app and brick-and-mortar stores. Employees use tablets to monitor inventory in real time to assist customers and can instantly replenish inventory based on demand, should a store run out of stock. Furthermore, they can process customer orders via the tablets to complete the customer's experience.

Omnichannel Order Fulfillment

Relations with other level-1 Capabilities

Synchronized Planning	Emerging relationship
Intelligent Supply	Intelligent Supply may issue orders for direct or indirect material fulfilled through a supplier-facing distributed order management system.
Connected Customer	Connected Customer may issue orders for direct or indirect material fulfilled through a Customer-facing distributed order management system.
Smart Operations	Smart Operations inventory consumption may trigger orders for direct material fulfilled through a client-facing distributed order management system.
Digital Development	Emerging relationship

Omnichannel Order Fulfillment

Impact of digital disciplines

Sense	• Integrates stocking-location sensors to empower a distributed order management system and better fulfill orders with distributed inventory positions
Collaborate	• Uses a distributed order management system to support visibility and collaboration across a variety of customers, suppliers, competitors and internal stocking points
Optimize	• Uses a distributed order management (DOM) system to optimize the customer experience by providing seamless interoperability between brick-and-mortar, web and mobile customer experiences • Integrates feedback and data captured from those experiences to improve inventory and order management • Uses a DOM system to greatly reduce transaction costs by providing the customer with a single platform with which to access inventory aggregated from multiple suppliers
Respond	• Uses a distributed order management system to monitor customer behavior and purchasing habits to improve forecasting and increase sales through recommendations optimization

Omnichannel Order Fulfillment

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Dynamic Fulfillment	Omnichannel Order Fulfillment	% of Returns		%	Yes	Quality	Measures the percent of omnichannel related orders that go through the Returns process	(% of Omnichannel Returns / Total Omnichannel Orders) *100
Dynamic Fulfillment	Omnichannel Order Fulfillment	Average Order Value		%	Yes	Cost	Measures value of each omnichannel order	Total Omnichannel Sales / Total Omnichannel Orders
Dynamic Fulfillment	Omnichannel Order Fulfillment	Customer Satisfaction	CSAT	%	No	Service	Measures the percentage of customers who are satisfied with the entire omnichannel ordering process	(Customers Respond w/ Satisfactory Fulfillment / Total Customer Responses) *100

Omnichannel Order Fulfillment

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Dynamic Fulfillment	Omnichannel Order Fulfillment	Order Fulfillment Cost		$	Yes	Cost	Measures the total cost of completing the order from the moment the end consumer places an order to the time the end consumer receives the ordered product(s)	Cost of Warehouse Inventory + Cost of Processing Order + Packaging Order + Shipping Product to Fulfillment Location
Dynamic Fulfillment	Omnichannel Order Fulfillment	Order Fulfillment Accuracy		%	Yes	Quality	Measures the percent of orders that are accurately confirmed, aggregated, orchestrated, and fulfilled throughout the entire omnichannel process	(Omnichannel Orders Accurately Fulfilled/Total Omnichannel Orders Placed) *100
Dynamic Fulfillment	Omnichannel Order Fulfillment	Fraction of on-time Omnichannel Deliveries		%	No	Service	Measures the number of deliveries that were within committed time	(On Time Deliveries / Total Deliveries) *100
Dynamic Fulfillment	Omnichannel Order Fulfillment	Omnichannel Sales	% of Total Sales	%	No	Efficiency	Measures the percentage of sales directly tied to Omnichannel ordering from the customer (gives a sense of how big a role Omnichannel Fulfillment plays in the operations of a business)	(Omnichannel Orders/Total Orders from all Channels) *100
Dynamic Fulfillment	Omnichannel Order Fulfillment	# of Orders Fulfilled from each Channel		#	No	Efficiency	Measures number of orders fulfilled from a particular channel	Channel 1 Orders Fulfilled + Channel 2 Orders Fulfilled …....+ Channel n Orders Fulfilled = Total Orders Fulfilled
Dynamic Fulfillment	Omnichannel Order Fulfillment	Omnichannel Issue Resolution Time		Time	No	Service	Measures the time taken to resolve all customer issues in accordance with customer expectations	Days (Date of Customer Complaint - Resolution Date)

Efficient Warehouse Operations

Definition and objectives

Definition:

The ability to implement the right balance of interconnected human, technology and physical assets to **improve order accuracy and inventory management; expedite order processing;** and **reduce injury, costs and reliance on labor**

Why Digital Supply Networks:

Traditionally, warehouse activities were relatively dangerous, highly manual, monotonous and physically taxing. Over time, the introduction of conveyors, forklifts, automated sortation systems and radio-frequency identification scanners has helped improve safety, performance and efficiency. However, a heavy reliance on human labor still persists. In a digital supply network, the paradigm is changed. Warehouses are no longer just physical assets but also technological ones, benefitting stakeholders by

- improving order accuracy through technology-assisted or fully automated pick, pack and ship activities
- effectively prioritizing fulfillment based on customer value or need or other types of segmentation
- increasing safety and reducing reliance on labor through robotics, autonomous vehicles and wearables
- accelerating fulfillment by enabling dynamic warehouse configurations and analytics-driven put locations
- enabling new value-added services, such as kitting, light manufacturing and assembly, postponed differentiation opportunities, and targeted free samples, that benefit suppliers, enterprises and customers alike.

Efficient Warehouse Operations

Definition and objectives

Drivers for Change:

- Consumers are demanding decreasing order-fulfillment times.
- The variability of demand and seasonality increases are putting pressure on warehouse operations.
- With increasing cost pressure, markets today are striving to continuously reduce logistics costs.
- In a competitive labor market characterized by labor shortages and attrition risk, focus is required to run efficient warehouse operations.

Example:

A major internet-based retailer deploys robots that dynamically bring shelves to the picker in some fulfillment centers. This serves to reduce dependency on human labor, increase accuracy and maximize usage of the warehouse space. Aisles are no longer fixed but instead dynamically adjust to real-time needs. Similarly, performance gains are driven not by the pickers but instead by the enabling technology.

Efficient Warehouse Operations

Relations with other level-1 Capabilities

Synchronized Planning	The Synchronized Planning function shares supply-demand forecasting data that helps organizations anticipate and prepare for expansion and contraction of volume, highlights transportation requirements, guides the positioning of inventory and warehouse assets across the network, and triggers some fulfillment activities.
Intelligent Supply	The Intelligent Supply function shares requirements and data that influence warehouse network operations and send supply signals that guide the positioning of inventory and warehouse assets across the network and trigger some fulfillment activities.
Connected Customer	The Connected Customer function issues customer requirements and orders that inform warehouse network operations as well as orders that trigger some fulfillment activities.
Smart Operations	The Smart Operations function sends supply signals that guide the positioning of inventory and warehouse assets across the network and trigger some fulfillment activities.
Digital Development	Product design informs warehouse configuration and network design.

Efficient Warehouse Operations

Impact of digital disciplines

Sense	• Uses sensors to track equipment in the warehouse to determine when preventive maintenance is needed in order to avoid costly breakdowns. Sensors also can be used to track product damage and waste and maximize asset performance, such as by more accurately and dynamically assessing shipment characteristics in order to more closely approach capacity thresholds.
Collaborate	• Uses wearables and augmented reality and virtual reality technology to support collaboration between associates and managers. For example, managers can track worker performance in real time and provide the required support.
Optimize	• Uses emerging technology such as robotics and wearables to optimize warehouse operations, help increase fulfillment velocity, improve worker productivity, enhance safety and reduce costs
Respond	• Uses data to predict the orders that will be received in order to improve labor planning, maintenance scheduling and other operations activities

Efficient Warehouse Operations

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Dynamic Fulfillment	Efficient Warehouse Operations	Receipt to Putaway	Dock to Stock	Time	No	Efficiency	Measures operational efficiency of warehouse processes to physically and systematically receive materials, process and putaway in storage location	Putaway - Receipt
Dynamic Fulfillment	Efficient Warehouse Operations	Order Processing Time		Time	Yes	Efficiency	Measures the time it takes production to begin manufacturing the product from the time the initial order is placed	Days(Initial Order Date - Start Production Date)

Efficient Warehouse Operations

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Dynamic Fulfillment	Efficient Warehouse Operations	Shrinkage	% Loss of Inventory	%	No	Quality	Measures damage or theft in warehouse and is the % of inventory that is listed in records but is not physically in the actual inventory	(Orders Classified as 'Shrinkage' / Total Orders) *100
Dynamic Fulfillment	Efficient Warehouse Operations	Days on Hand		Time	No	Efficiency	Measures the movement of materials through the warehouse and cost of storage	The number of days in the period divided by the inventory turnover ratio
Dynamic Fulfillment	Efficient Warehouse Operations	Excess Inventory	Inventory Turns	#	Yes	Efficiency	Measures if there is too much inventory sitting at the warehouse	Ideal # of Units in Inventory - Current # of Units in Inventory
Dynamic Fulfillment	Efficient Warehouse Operations	# of Days since last Incident	Incident Rate	%	No	Service	Measures the number of days since the last accident occurred	# of days since last incident
Dynamic Fulfillment	Efficient Warehouse Operations	% of Orders Fulfilled	Service Level; Order Fill Rate	%	Yes	Service	Measures the number of orders that were able to be fulfilled	(# of Orders Fulfilled) / (# of Orders Received) *100
Dynamic Fulfillment	Efficient Warehouse Operations	Order Accuracy	Yield	%	Yes	Quality	Measures the percentage of time that a manufacturer fully and accurately completes an order	(Goods Produced w/in Specifications/Total Goods Produced) *100
Dynamic Fulfillment	Efficient Warehouse Operations	Changeover Time		Time	Yes	Efficiency	Measures the time it takes for a manufacturer to transition from making one product to another	Days(Start New Production of X - Completion of Production of Y)
Dynamic Fulfillment	Efficient Warehouse Operations	Inventory Turns		$	Yes	Efficiency	Measures the number of times inventory is purchased and sold annually and measures the efficiency of forecasting to sales	Cost of Goods Sold / Average Inventory

Optimal Path Selection

Definition and objectives

Definition:

The ability to dynamically and automatically select or determine — and adjust in transit, if needed — the optimal modes and routes for shipping a product through the application of advanced analytics and cloud computing, given logistics requirements, hub locations, costs, planned shipments and available transportation options to **improve flexibility; enable scalability;** and **balance cost, speed and risk**. Innovative companies extend this Level 2 Capability to consider new modes, such as autonomous vehicles, drones and crowd-sourced last-mile-delivery options emerging from the gig economy.

Why Digital Supply Networks:

Traditionally, selection of modes, shipments and routes was largely rule based and guided by estimates and rules of thumb. The use of cross-docking, less-than-truckload shipments, parcel distribution, third-party logistics providers and fourth-party logistics providers has helped remove some inefficiencies from the network. In a digital supply network, however, the transportation information and options available to enterprises increases dramatically, benefitting stakeholders by

- allowing consumers to dictate delivery windows, determining a convenient time during which they want, and are available to, receive a delivery
- reducing delivery windows through analytics-driven understanding of traffic patterns and greater accuracy of distance
- automatically selecting the best mode and route among myriad options given target service levels, lead times, costs and environmental impacts
- enabling flexibility and scalability by augmenting owned-, contracted- and leased-fleets with emerging solutions such as autonomous vehicles, drones and crowd-sourced last-mile-delivery options.

Optimal Path Selection

Definition and objectives

Drivers for Change:

- Consumers are demanding decreasing order-fulfillment times.
- The variability of demand and seasonality increases are putting pressure on warehouse operations.
- Markets today are striving to continuously reduce logistics and transportation costs.
- In a competitive labor market characterized by labor shortages and attrition risk, focus is required to run efficient transportation operations.

Example:

A package-delivery company developed a real-time navigation system that can optimize delivery routes by integrating multiple data sources. In addition to utilizing real-time information about traffic congestion and road conditions, the system integrates real-time customer information inputs. A value-added program enables end customers to specify pick-up times and locations, including the customer's home or office or a retail location or pick-up locker. This data is then fed into the navigation system to help dynamically update driver routes.

Optimal Path Selection

Relations with other level-1 Capabilities

Synchronized Planning	The Synchronized Planning function drives supply network optimization, which should be tightly coupled with optimal path selection to ensure a seamless connection from strategy to planning to operations.
Intelligent Supply	The Intelligent Supply function sends supply signals that may inform or trigger routing decisions.
Connected Customer	The Connected Customer function issues customer requirements, such as acceptable delivery windows and preferred delivery locations, and real-time customer data that may inform or trigger routing decisions.
Smart Operations	The Smart Operations function sends supply signals that may inform or trigger routing decisions.
Digital Development	Emerging relationship

Optimal Path Selection

Impact of digital disciplines

Sense	• Uses sensors to monitor ongoing traffic patterns in order to guide routing decisions and avoid unanticipated bottlenecks
Collaborate	• Utilizes crowd-sourcing to improve collaboration across tiers and networks in order to optimize fulfillment and returns through increased visibility
Optimize	• Uses data from multiple real-time sources to optimize deliveries and returns from customers
Respond	• Utilizes predictive analytics to anticipate delays and proactively avoid common bottlenecks in routing

Optimal Path Selection

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Dynamic Fulfillment	Optimal Path Selection	# of Available Routes		#	No	Innovation	Measures the number of available routes possible for a delivery	Total number of Available Routes for Delivery
Dynamic Fulfillment	Optimal Path Selection	Cost per Mode of Transportation		$	No	Cost	Measures the per unit cost of delivering product to end consumer for each mode to ensure that the most cost effective mode of transportation is used	Total Delivery Cost per Mode/ # Units delivered by that mode
Dynamic Fulfillment	Optimal Path Selection	Expedited Shipment Cost	Premium Delivery Cost	$	No	Cost	Measures incremental cost incurred to expedite order shipments	Cost of Expedited Shipment - Cost of Regular Shipment
Dynamic Fulfillment	Optimal Path Selection	% Incorrect Deliveries		%	No	Quality	Measures incorrect deliveries following the optimal path for delivery	(# of Incorrect Deliveries / Total # of Deliveries) *100
Dynamic Fulfillment	Optimal Path Selection	Average # of re-reroutes per order		%	No	Efficiency	Measures number of times an average order was re-routed, this is an indicator of efficiency for optimal path selection routing.	(Total Number of Route Changes) / (Total Orders)
Dynamic Fulfillment	Optimal Path Selection	Deliver Cycle Time		Time	Yes	Efficiency	Measures total time required to deliver an item, measure the total time taken from when an order has been confirmed to actual delivery to the customer	MAX{Reserve Resources & Determine Delivery Date Cycle Time + Consolidate Orders Cycle Time + Schedule Installation Cycle Time + Build Loads Cycle Time + Route Shipments Cycle Time + Select Carriers and Rate Shipments Cycle Time + Receive Products from Make/Source Cycle Time} + Pick Product Cycle Time + Pack Product Cycle Time

Adaptive Network Response

Definition and objectives

Definition:

The ability to design, develop, cultivate and deploy a flexible network of fulfillment points, leveraging crowd-sourced solutions and on-demand warehousing, that can dynamically scale capacity on short notice, thus enabling **improved demand fulfillment** while **reducing start-up costs and increasing supply network resilience**

Why Digital Supply Networks:

Traditionally, once a shipment was in transit, significant manual intervention was required to reroute it or intercept it at a cross-docking facility. Likewise, once a truck left a facility, it generally had to adhere to a route. If a delay occurred that resulted in rerouting, the driver identified and adjusted for the situation by using his or her own experience, hunches or information obtained via a citizens band radio. In a digital supply network, real-time information is available to allow individual shipments, routes and even networks to be optimized as needed. This benefits stakeholders by

- dynamically adapting to delays, congestion and bottlenecks to move the product to the customer as efficiently as possible, maximize performance and minimize lead times, considering the breadth of modes and assets available
- enabling the network to rapidly flex by using on-demand solutions such as crowd-sourced transportation and warehousing and reducing capital investments while increasing resilience
- promoting sustainability by regularly adjusting routes and the network to minimize the environmental impact.

Adaptive Network Response

Definition and objectives

Drivers for Change:

- Today's changing market conditions demand supply chain responsiveness and an ability to rapidly expand or contract distribution capacity.
- Complex last-mile fulfillment requirements in dense urban areas, coupled with the high cost of establishing a physical presence in those areas, requires alternate solutions to surge capacity.
- Regulations, legislation and industries are demanding solutions that minimize the negative impacts of transportation on the environment and quality of life.

Example:

An e-commerce fulfillment startup offers a network of distribution centers across the United States that companies can leverage to fulfill customer demand. There are no start-up fees or long-term contracts. A fast-growing e-commerce company augmented its fulfillment capabilities through the startup's service and quickly scaled fulfillment from 30,000 orders a month to more than 100,000 orders without significant capital investment or customer service disruption.

Adaptive Network Response

Relations with other level-1 Capabilities

Synchronized Planning	Emerging relationship
Intelligent Supply	The Intelligent Supply function sends supply signals that may inform or trigger warehouse footprint or routing adjustments.
Connected Customer	The Connected Customer function transmits customer requirements, such as acceptable delivery windows and preferred delivery locations, and real-time customer data that may inform or trigger warehouse footprint or routing adjustments.
Smart Operations	The Smart Operations function sends supply signals that may inform or trigger warehouse footprint or routing adjustments.
Digital Development	Emerging relationship

Adaptive Network Response

Impact of digital disciplines

Sense	• Embeds sensors and thresholds within the network that can trigger network expansion or contraction based on changes in demand
Collaborate	• Uses flexible networks to augment owned capacity with that of agile partners and crowd-sourced solutions
Optimize	• Adopts flexible and agile networks that scale and contract, when appropriate, to minimize underutilization and capital expenses
Respond	• Leverages predictive analytics to guide the proactive establishment of the relationships required to design a flexible supply network. Adaptive networks can anticipate capacity reduction and suggest when an investment in fixed assets is required.

Adaptive Network Response

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Dynamic Fulfillment	Adaptive Network Response	Capacity Utilization		%	No	Efficiency	Measures the relative capacity utilized to fulfill orders compared to the total network capacity	(Capacity Utilized / Total Network Capacity) * 100
Dynamic Fulfillment	Adaptive Network Response	Demand Volatility		#	No	Service	Measures rate of change of demand (using historical demand patterns)	Standard Deviation of Demand over a given period (i.e., month, 3 months, year)
Dynamic Fulfillment	Adaptive Network Response	Value at Risk (Plan, Source, Make, Deliver, Return)		$	Yes	Service	Measures all risk events captured across the network	(Sum of probability of risk events) * (Monetary impact in all Plan, Source, Make, Deliver, Return Activities)
Dynamic Fulfillment	Adaptive Network Response	Total Cost to Serve		$	No	Cost	Measures the total end-to-end supply chain cost to fulfill an order	Warehouse Cost + Transportation Cost + Inventory Holding Cost

Efficient Transportation Operations

Definition and objectives

Definition:

The ability to apply advanced technologies, such as transportation management solutions, telematics, drones and autonomous vehicles, to automate the end-to-end transportation process from tendering freight to customer delivery in both the first and last mile, thus **improving efficiency, optimizing costs** and **reducing delivery times**

Why Digital Supply Networks:

Traditionally, transactions were largely limited to two or three parties: a buyer, a seller and, sometimes, a broker. Selection and quantity were often limited to the inventory that could be maintained within a given warehouse or closed network. Orders were larger, and there were fewer direct-to-consumer transactions. Exceptions required manual intervention. Increased transaction costs resulted when buyers had to connect with multiple sellers to identify the optimal product or otherwise fulfill their needs. In a digital supply network, technology enables more integrated networks that feature multiple vendors with inventory positioned at myriad locations and in various channels that can seamlessly be aggregated into a single order for the customer. This benefits stakeholders by

- expanding the selection available to the customer through a single portal, thus increasing convenience, reducing transaction costs and improving the likelihood that the buyer can select the most optimal product available in the marketplace
- right-sizing inventory, and consequently costs, across the network by optimizing the number of locations and tiers at which product is held and appropriately pre-positioning it close to the customer to reduce lead time.

Efficient Transportation Operations

Definition and objectives

Drivers for Change:

- Today's market is characterized by increased ethical and environment concerns, which are driving increased focus on environmentally friendly transportation solutions.
- Consumers expect faster deliveries but also sustainable transportation solutions.
- Companies are facing capacity constraints because of labor shortages.
- Regulations, legislation and industries are demanding solutions that promote safety and minimize the negative impacts of transportation on the environment and quality of life.

Example:

Several startups are testing the concept of fully autonomous highway trucks that will move freight from one transfer hub to another. At the transfer hub, a human driver will take over to complete the last mile of delivery. This improves the lives of the drivers, making their working hours more predictable and minimizing time away from their families.

 |

Efficient Transportation Operations

Relations with other level-1 Capabilities

Synchronized Planning	The Synchronized Planning function shares supply-demand forecasting data that helps the transportation operations team anticipate and prepare for volume expansion or contraction, highlight transportation requirements, guide the positioning of inventory and transportation assets across the network, and trigger some transportation activities.
Intelligent Supply	The Intelligent Supply function shares requirements and data that influence transportation network operations, sends supply signals that guide the positioning of inventory and transportation assets across the network, and triggers some transportation activities.
Connected Customer	The Connected Customer function issues customer requirements, such as acceptable delivery windows and preferred delivery locations, that inform transportation network operations and transmits orders that trigger some transportation activities.
Smart Operations	The Smart Operations function sends supply signals that guide the positioning of inventory and transportation assets across the network and trigger some transportation activities.
Digital Development	Product design may inform transportation network design.

Efficient Transportation Operations

Impact of digital disciplines

Sense	• Uses sensors to track truck performance to determine when preventive maintenance is needed in order to avoid costly breakdowns. Likewise, sensors can maximize asset performance by more accurately and dynamically assessing shipment characteristics and assigning the right vehicle to the shipment.
Collaborate	• Allows near-real-time collaboration between transportation planners and third-party carriers through advanced transportation management systems
Optimize	• Utilizes technology such as electric and autonomous vehicles to optimize fuel consumption as well as labor usage and costs by dedicating human drivers only to last-mile deliveries
Respond	• Leverages data to predict the orders that will be received to improve freight tendering, labor planning and other operations activities

Efficient Transportation Operations

DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Dynamic Fulfillment	Efficient Transportation Operations	Delivery Time		Time	Yes	Service	Measures the time it takes for a product to be delivered to the end consumer during the transportation process	Days (Start Delivery Date - End Delivery Date)
Dynamic Fulfillment	Efficient Transportation Operations	% Late Order		%	Yes	Efficiency	Measures the number of orders that are not delivered on-time as communicated to the stakeholders	(Total Late Deliveries / Total Deliveries) *100
Dynamic Fulfillment	Efficient Transportation Operations	Cost of Delivery		$	Yes	Cost	Measures the overall cost of delivering a product to the end consumer (most commonly cost/lb)	Sum of $ spent on delivering all material to the customers
Dynamic Fulfillment	Efficient Transportation Operations	Delivery Performance to Customer Commit Date		%	Yes	Service	Measures the % of orders that were delivered on time	(Total number of orders delivered on the original commitment date) / (Total number of orders delivered) *100
Dynamic Fulfillment	Efficient Transportation Operations	% of Orders Delivered On Time in Full		%	Yes	Efficiency	Measures the % of orders that were delivered in full and on time	(Total number of orders delivered in full) / (Total number of orders delivered) *100
Dynamic Fulfillment	Efficient Transportation Operations	% On-time Delivery		%	Yes	Efficiency	Measures the % of time that a delivery is completed on-schedule as agreed upon with the customer	(Total On-Time Deliveries / Total Deliveries) *100
Dynamic Fulfillment	Efficient Transportation Operations	Cost per Mile		$	Yes	Cost	Measures the cost of delivering product(s) per mile traveled	Cost of Delivery / Miles Traveled
Dynamic Fulfillment	Efficient Transportation Operations	Freight cost per unit shipped		$	No	Cost	Measure the efficiency of the carrier network	Total freight costs / Number of units Shipped per Period

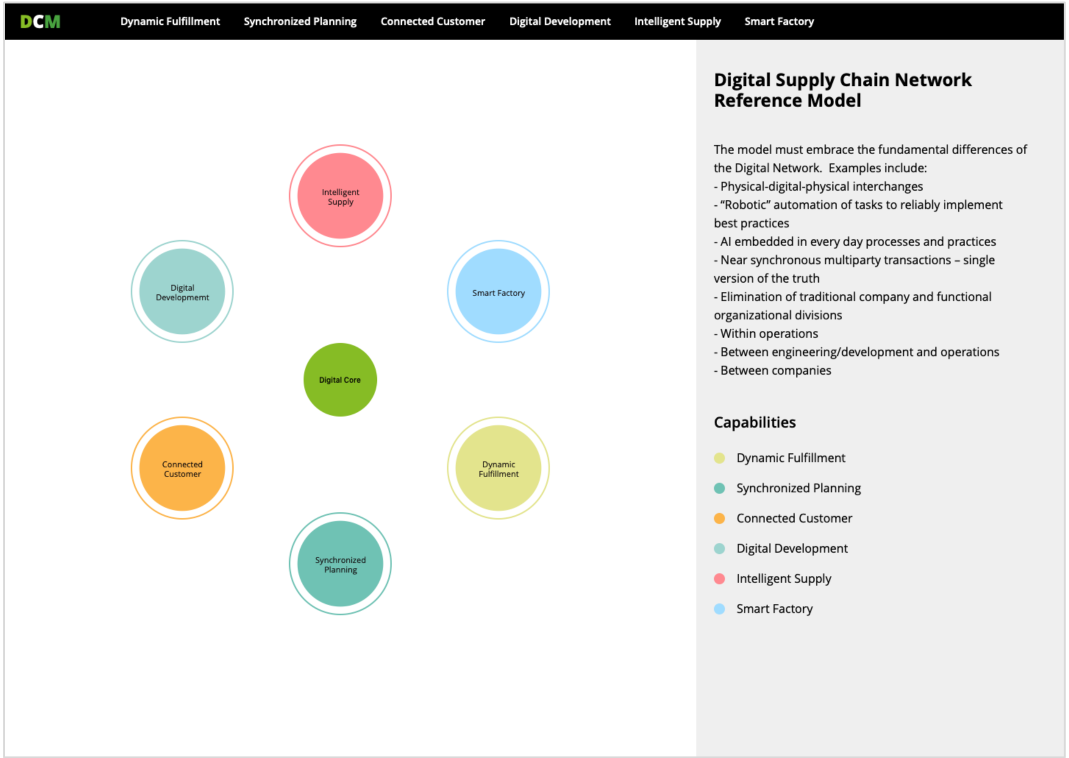
Efficient Transportation Operations

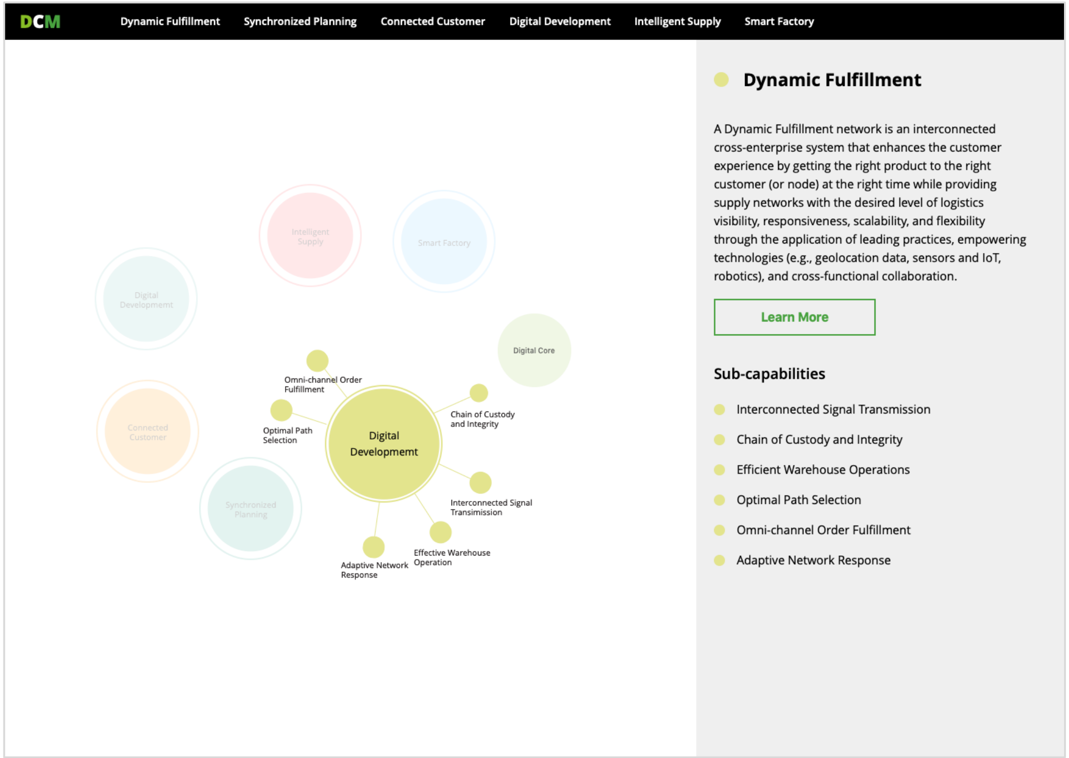
DCM		KPIs						
Level 1	**Level 2**	**Name**	**Also known as..**	**UOM**	**Covered in SCOR?**	**Primary Value Driver**	**Description**	**Formula**
Dynamic Fulfillment	Efficient Transportation Operations	Cost of Receiving as % of Purchases	Inbound Freight Costs	%	No	Cost	Measures the cost of receiving goods relative to the amount paid to procure the goods and materials	Cost of Inbound Freight / Procurement Cost
Dynamic Fulfillment	Efficient Transportation Operations	Claims as % of Freight Costs		$	Yes	Cost	Measure the efficiency of the carrier network	Total loss & Damage Claims / Total Freight Costs
Dynamic Fulfillment	Efficient Transportation Operations	Fraction Transported by each Mode	Mode Sélection vs. Optimal Sélection	%	No	Efficiency	Measures the accuracy of choosing the correct mode of transportation. When faced with a decision, the professional should strive to choose the most efficient means of transportation to improve responsiveness and reduce overhead.	(Number of Times Optimal Mode Selected / Total Number of Mode Selection Occurrences) *100

Overview

Homepage

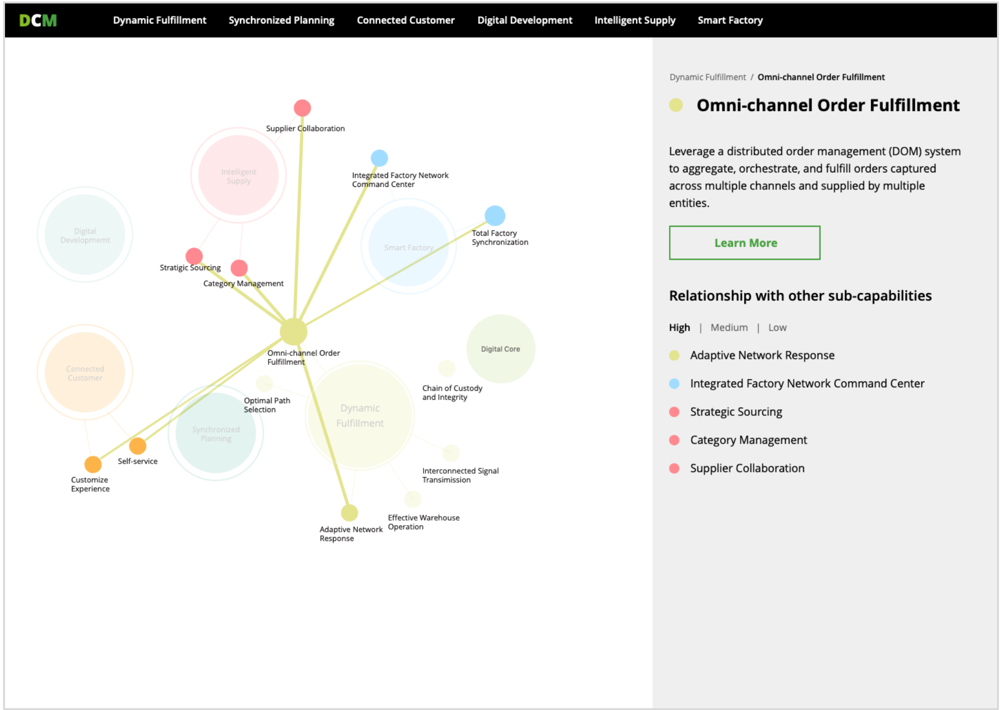
Delivering the content in an easy-to-navigate webpage that has all the elements at your fingertips

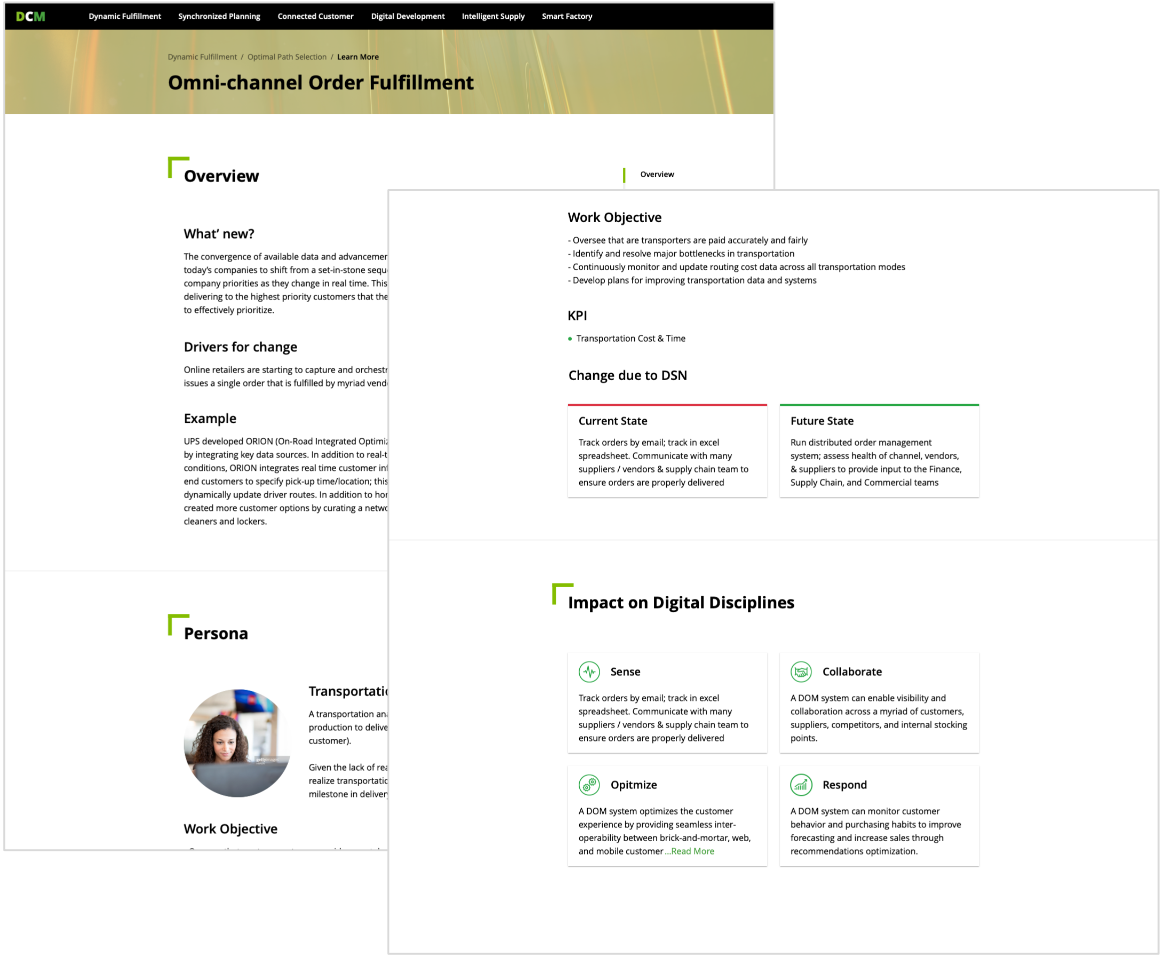




Deep Dive Pages

Providing all content in a comprehensive format





Overview

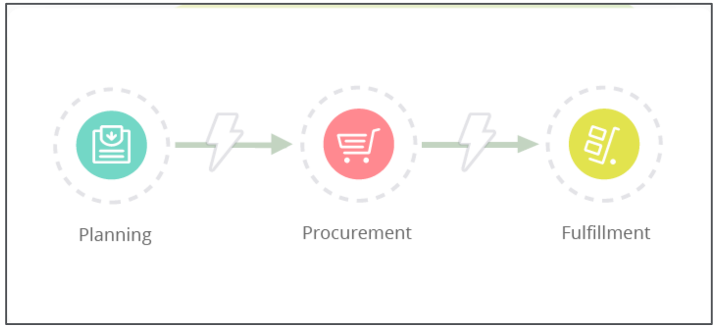
Digital Chords in a Digital Supply Network

What is a Digital Chord?
A Digital Chord is a connected set of capabilities In sequence to address a specific business challenge or enable an integrated business function. Digital chords represent streams of information and digital twins that are harmonized through people, processes and technologies, and define the connections within a Digital Supply Network.
Harmonious chord.

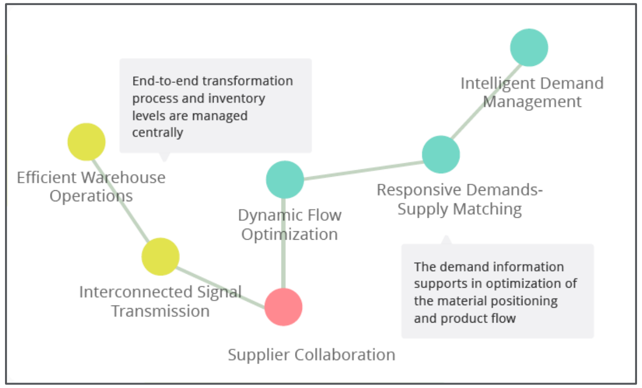
Digital Chords Use Case

Use Case:
Pro-active end-to-end solutions & impacts driven by Digital Chords:
Company A was struggling to match supply with demand, due to Tier-1 and Tier-2 supplier capacity constraints. This is resulting in inconsistent and unpredictable replenishment cycles, which are causing delays in order fulfillment and order cancellation.

Current Operations in Silos: In the current method companies struggle to break through boundaries which cause communication failures and insufficient visibility to understand full end to end impact causing delays in responding to supply chain disruptions.



Digital Chord Solution: Using the digital chord, Company A was able to determine that the failure to meet supply requirements can be improved by having a robust sourcing strategy, optimizing fulfillment operations by collaborating better with the existing suppliers and critical customer feedback flowing into planning decisions.



Overview

How to use Self-guided approach

The transformation approach provided by DCM, along with the Digital Readiness Survey will help you develop your Digital Supply Network roadmap. A cheat-sheet is also provided as a reference to guide you through the process

Start with the Digital Readiness Survey and move through the first 4 steps of the cascade (Steps A-D), to arrive at an **integrated set of answers** for key questions at each step

The DCM Model can be used as a guide to answer the key questions. The **relational manner** in which the model is designed will give you a **holistic view** to make informed decisions at each step

Synthesizing the set of answers for the first 4 steps from the Digital Readiness Survey (steps A–D), will provide you with the necessary details that are required to **plan a suitable digital transformation** for your organization (in step E)

A Cheat-sheet provided with this document will help you understand additional details on **inputs, processes and expected outcomes** for the key questions each step

Developing your Digital Supply Network roadmap

Following these five steps will help you identify the capabilities you need and thereby develop the roadmap for transforming your supply chain, by leveraging intermediate outputs as inputs for subsequent steps

Next steps after self-guided approach to attain measurable results

Asses Your Digital Readiness

Click Here for Digital Readiness Survey

Take this 10-minute online survey to discover the level of preparedness of your supply chain, for using emerging digital technologies. Upon completion, you will receive a readiness report

A — Establish Goals

What is Our Winning Aspiration?

- *What are the key problems we face in our supply chain today?*
- *What is our vision for supply chain digitization?*

B — Prioritize Opportunities & Identify focus functions

Where Will We Play? | **How Will We Win?**

- *What could we do to achieve our goals? (i.e., what are the opportunities)*
- *What are the top 3-5 opportunities we want to go after?*
- *What functions should we focus on to achieve our goals?*

C — Identify Required Capabilities

What Capabilities are required?

- *What capability gaps do we need to close to address our top supply chain opportunities?*
- *What is the as-is maturity of our current supply chain capabilities?*
- *What interdependencies do these L2 capabilities have on each other?*

D — Identify Key Activities to fill the Major Gaps

How do we achieve the desired capability?

- *What data and technologies are required to build the capabilities?*
- *What additional skill sets and process changes are required to build the capabilities?*
- *What activities do we need to undertake to build the capabilities?*
- *What team structure and cross-functional communication channels do we need?*

E — Develop Implementation Roadmap

How Do I Synthesize and Develop the plan?

- *What is the sequencing that will drive results and adoption?*
- *What metrics will we use to measure progress and success?*
- *What are the key milestones to track the implementation progress?*

Run Pilot

Implement

THINK BIG | **START SMALL** | SCALE FAST

 |

Cheat-sheet (1/3)

How Key Questions can be answered

#	Step	Focus	Key Questions	Input	Process	Outcome
A	**Establish Goals**	**What is Our Winning Aspiration?**	*What are the key problems in the current supply chain?*	Identify key supply chain problems that you want to solve through digitization. Business context & competitive requirements.	Review low performing metrics, and obtain feedback from various functions on what problems they are facing. Align on key success factors against those issues.	Pinpoint the root cause of the problem, i.e. the core issue, as well as its knock on effects across the value chain. **Output**: List of root causes with impact & priority against each
			What is the enterprise vision regarding supply chain digitization?	Consolidate the information on the core issues and review what improvements need to be made, and how digitization would help	Define your desired end state digitizing a process / workstream	A well defined end state which is in sync with the vision of the firm. **Output**: Project title for the DSN Transformation efforts.
B	**Prioritize Opportunities & Identify focus functions**	**Where Will We Play?** **How Will We Win?**	*What could we do to achieve our goals? (i.e., what are the opportunities)*	End state vision for digital supply chain along with milestones / goals to be met to achieve the end state	Define the high level action plan to achieve the goals identified	Plan of action for the desired end state to answer the identified core issues with measurable goals **Output**: Action Plan with RACI
			What functions should be focused on to achieve our goals?	The business functions (e.g. Sourcing, Demand Planning) identified based on the plan of action defined in previous step	Go to the DCM model and identify the core L1 capabilities for the solution envisioned based on the pertinent business functions	Core L1 capabilities are identified for the solution envisioned **Output**: Roster of functions with respective leads to drive the project
			What are the top 3-5 opportunities we want to go after?	List of opportunities to be targeted Leverage the L1 capabilities identified in the previous step	Go to the DCM model and look at L2 capabilities, select the ones that are most pertinent to identified top opportunities	The initial shortlist of L2 capabilities (such as Intelligent Demand Management, Dynamic Flow Optimization, etc.) **Output**: List of process leads who will drive transformation activities

Cheat-sheet (2/3)

How Key Questions can be answered

#	Step	Focus	Key Questions	Input	Process	Outcome
C	**Identify Required Capabilities**	**What Capabilities are required?**	*What interdependencies do these L2 capabilities have on each other?*	The L2 capabilities shortlisted in Step “B” need to be studied further	Go to the DCM model and click on any of the L2 capabilities to see the relationships &strengths of the relationships with other L2 capabilities Add the key L2 capabilities identified based on interdependencies to the L2 Shortlist	An understanding of the interconnectivity among the different L2 capabilities and the strength of the interconnectivity Shortlist of L2 capabilities that we will be interested in. **Output**: Digital Chord
			What is the as-is maturity of our current supply chain capabilities?	Identify your current strength/ maturity of the L2 capabilities identified	Go to the identified L2 capabilities in the DCM model, navigate to capability maturity section Compare your current processes against the DCM benchmarks	A well defined Capability Maturity Matrix across all the shortlisted L2 capabilities classified as ‘Ad-hoc, Typical, Leading or Advanced’ **Output**: Current maturity level on the Capability Matrix
			What capability gaps do we need to close to address our top supply chain opportunities?	Review the current maturity stage and define the target maturity stage for the L2 capabilities	Go to the identified L2 capabilities in DCM model, navigate to capability maturity section Identify gaps from the target maturity state	Understanding of gaps in reaching the envisioned maturity stage for the respective L2 capabilities **Output**: Well defined desired capability maturity

Cheat-sheet (3/3)

How Key Questions can be answered

#	Step	Focus	Key Questions	Input	Process	Outcome
D	**Identify Key Activities to fill the Major Gaps**	**How do we achieve the desired capability?**	*What data and technologies are required to build the capabilities?*	Identify the current capabilities in data and technology	Refer to the overview sections for each L2s	Tech initiatives needed to cover gaps identified in Step "C" (e.g. IoT, ML, AI, etc.) **Output**: Technology Strategy
			What additional skill sets and process changes are required to build the capabilities?	List of shortlisted technologies and required skillset along with skillset available within the organization	Refer to Persona section to under the selected L1s	New skills & key process changes required across various functions **Output**: New Job Descriptions & Process Maps
			What activities do we need to undertake to build the capabilities?	Leverage the skillset identified in the previous stage to identify key activities	Define the tasks to be undertaken to enable the identified capabilities	Activities identified to develop key capabilities **Output**: Skill & capability development plan
			What team structure and cross-functional communication channels do we need?	Based on the identified activities and skill sets, put teams in place to support the transformation process	Review the need for new communication channels & restructure teams as required	Unobstructed & proactive exchange of information to tackle issues **Output**: Org. Restructuring Plan
E	**Develop Implementation Roadmap**	**How Do I Synthesize and Develop the plan?**	*What is the sequencing that will drive results and adoption?*	List down all the activities and tasks to be performed for transformation	Identify quick wins based on implementation effort vs impact matrix	Dashboard with an implementation roadmap and major milestones **Output**: Project Roadmap
			What metrics will we use to measure progress and success?	Study the identified activities and the relevant business and operational metrics	Refer to the relevant SCOR metric section to identify suitable metrics	Defined metrics for each of the activities / capabilities **Output**: Performance Tracker
			What are the key milestones to track the implementation progress?	Leverage the metrics and implementation roadmap identified in the previous steps	Define deliverables for each phase of the implementation	Project milestones (E.g. Creation of Data Framework, Building Analytical capability. Pilot Execution) **Output**: Project milestones & success factors

Overview

References

- Digital Capabilities Model for Supply Networks (DCM)
- DCM — Executive Overview
- Explore InVision Prototype
- DCM Content Style Guide — PowerPoint
- DCM Style Guide
- DCM Dependency Matrix
- DCM-Supply Chain Operations Reference Model Process Elements
- DCM Glossary

Leadership Team

Chris Richard
Deloitte ASCM DSN Integration Team
Contact: chrisrichard@deloitte.com

Mrugank Desai
Synchronized Planning Lead
Contact: mddesai@deloitte.com

Carlos E. Castillo
Connected Customer Lead
Contact: carlcastillo@deloitte.com

Adam Mussomeli
Deloitte DSN Lead
Contact: amussomeli@deloitte.com

Alex Bredemus
Smart Operations Lead
Contact: abredemus@deloitte.com

Jeremy Chad Mancke
Dynamic Fulfillment Lead
Contact: jemancke@deloitte.com

Mike Deng
Deloitte ASCM SCOR Contact
Contact: mikdeng@deloitte.com

Vinod Phalak
Intelligent Supply Lead
Contact: vphalak@deloitte.com

Benjamin Kim
Digital Development Lead
Contact: benjkim@deloitte.com

Imran Dalwai
Deloitte ASCM DSN Integration Team
Contact: idalwai@deloitte.com

Fazal Shariff
Deloitte ASCM DSN Integration Team
Contact: fshariff@deloitte.com

Jeroen Kusters
Deloitte ASCM DSN Integration Team
Contact: jekusters@deloitte.com

Deloitte.

Thank you