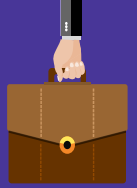# KPMG

Results matter: Improving supply chain resilience

Leveraging advanced data & analytics to improve
operational efficiency during times of disruption

April 2020

Surviving disruption

The new challenge

Supply chains have become more globalized and complex in recent decades. The greater efficiencies arising from this have played a crucial role in generating the abundance of more affordable products and services the world now enjoys.

But, as the Covid-19 crisis highlights all too clearly, operating models tuned to maximum efficiency have turned out to be hugely sensitive to external disruption. The complexity of global supply chains has opened the way for unanticipated events causing a cascading array of unintended consequences, among them the rapid breakdown of many supply chains.

This lack of agility and resilience poses major risks not just to businesses, but to society at large.

We believe that the right equilibrium between operating-model efficiency and supply-chain resilience can best be found by using models derived from advanced data & analytics.

Our approach

Advanced data & analytics facilitates business decision-making by using comprehensive analytical models to stress-test corporate processes. Our models:

1. Capture the impact of disruptions on cost and stock levels.
2. Show the impact of disruptions on the viability of an entire supply chain.
3. Allow for the visualisation of alternative scenarios.
4. Help identify potential contingency measures.
5. Aid the prediction of possible recovery times. Applying their findings allows a company to increase resilience across its entire supply chain and operating model.

Data inputs required

Cost structures
- Cost of all parts, including fixed and variable components.
- Nominal overall equipment effectiveness (OEE) for all production assets in your supply chain.
- Cost of all stock handling (warehousing, logistics)
- Exchange rate exposure across your operation.
- Alternative sourcing options and their costs.

Lead times
- Production and transit lead times.
- Logistic routes, step by step, for all parts.
- Impact of any likely changes in your supply chain.

Stock levels
- Stock levels held at warehousing and production facilities.
- Levels of safety stock across your operation.
- Average production run-rates and stock consumption at each step of production.

Contractual terms of suppliers
- Supply- and demand-side terms.
- Impact of volume volatility.
- Agreed levels of service; penalties for missing them.

Financial stability of suppliers
- Average profitability and cash reserves held by each supplier in the supply chain.
- Cost of financing and ability of suppliers to fund themselves.
- Level of dependency on the products of each supplier.
- Potential for diversification to other suppliers.

Demand
- Possible range of changes in demand from buyers and sellers across your entire supply-chain ecosystems.
- Seasonality effects.
- Peaks and troughs of demand.
- Possible rates of production wind-downs and ramp-ups.

Leveraging the power of data & analytics

- Our approach leverages comprehensive data-rich predictive models aimed at driving decision-making based on scenarios of potential disruptions.
- The insights envision an optimal equilibrium between efficiency, resilience and agility.
- The models incorporate statistical analysis based on randomized demand and supply input data to define potential disruption scenarios. They highlight the impact in terms of cost, lead times and on the entire operating model.

Data-driven capabilities

Our models

Our data & analytics capabilities are designed to offer a transparent understanding of the underlying resilience, cost sensitivity and agility of corporate operating models under a range of disruption scenarios. Outputs are visualized using KPI indicators and dashboards.

Our approach typically incorporates the following elements:

Demand disruption volume		Effects of disruption on the value chain
Demand disruption price		
Supply disruption lead time		Recovery capacity
Supply disruption volume		
Supply disruption geography		Value-chain intermission
Global disruption		

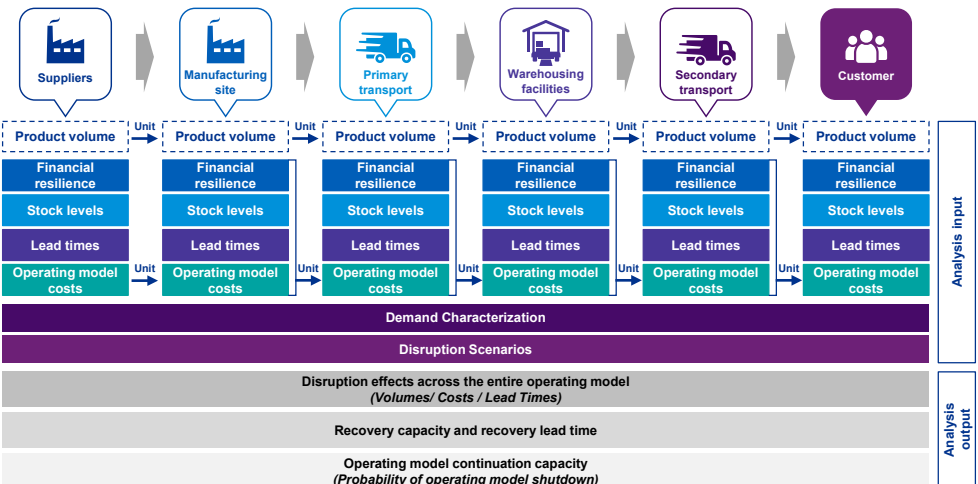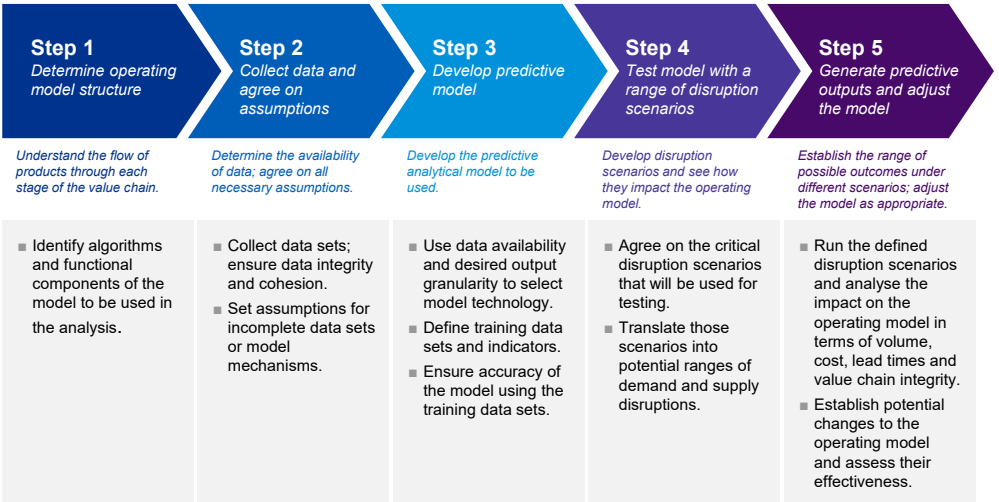| Data sources and data collection	Predictive models and scenarios	Steady state and sensitivities	Disruption scenarios and alternatives	Outputs, conclusions and decisions
■ Identify critical questions to be addressed. ■ Understand operating model and determine cost and lead time drivers. ■ Confirm data availability, and address lack of data by agreeing on reasonable operating model assumptions. ■ Establish analysis to be performed and granularity of output to be generated.	■ Determine flow of product volumes / services through each stage of the value chain. ■ Establish an accurate allocation of costs by part, defining lead times and average levels of stock across the entire value chain. ■ Analyse financial resilience of all players in the value chain. ■ Analyse demand and demand behaviours.	■ Ensure robustness of the model by analysing cost dispersion for each part of the value chain. ■ Test the model by analysing volumes, costs, lead times and stock levels against factors such as utilization rates and ranges. ■ Develop a set of indicators that accurately describes the main operating variables.	■ Create and apply disruption hypotheses in order to analyse how individual disruptions affect behaviour across the operating model. ■ Test the validity of hypotheses to explain output variability under different scenarios.	■ Run the model according to the agreed disruption scenarios; identify all individual and compiled effects arising from variables such as volumes, unitary costs or value-chain lead times. ■ Simulate the impact of supplier breakdowns or bankruptcies. ■ Identify recovery capacity and lead times needed to return to steady state situation.

Key operating elements of the supply chain

	Suppliers	Manufacturing site	Primary transport	Warehousing facilities	Secondary transport	Customer

| | Product volume | Unit | Product volume | Unit | Product volume | Unit | Product volume | Unit | Product volume | Unit | Product volume |

Financial resilience (all columns)

Stock levels (all columns)

Lead times (all columns)

Operating model costs (all columns)

Analysis input

Demand Characterization

Disruption Scenarios

Disruption effects across the entire operating model
(Volumes/ Costs / Lead Times)

Recovery capacity and recovery lead time

Operating model continuation capacity
(Probability of operating model shutdown)

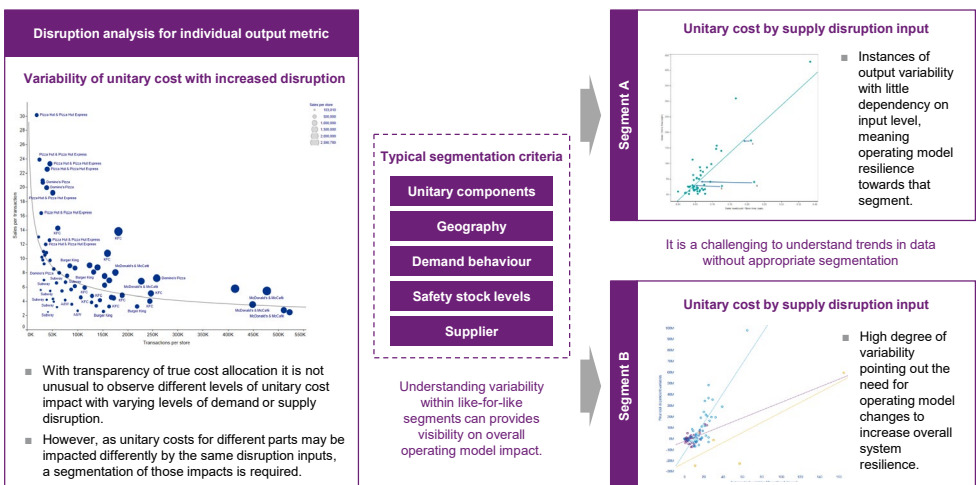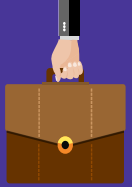Analysis output

Predictive models

Predictive model development - our approach

At the core of our approach to understand the resilience of the supply chain. The model simulates different global disruption scenarios, allowing us to analyse the sensitivity of different segments of the value chain to a range of impacts. Implications for required operating model changes can be understood, risks mitigated, and resilience can be increased.

Step 1 Determine operating model structure	Step 2 Collect data and agree on assumptions	Step 3 Develop predictive model	Step 4 Test model with a range of disruption scenarios	Step 5 Generate predictive outputs and adjust the model
Understand the flow of products through each stage of the value chain.	Determine the availability of data; agree on all necessary assumptions.	Develop the predictive analytical model to be used.	Develop disruption scenarios and see how they impact the operating model.	Establish the range of possible outcomes under different scenarios; adjust the model as appropriate.
■ Identify algorithms and functional components of the model to be used in the analysis.	■ Collect data sets; ensure data integrity and cohesion. ■ Set assumptions for incomplete data sets or model mechanisms.	■ Use data availability and desired output granularity to select model technology. ■ Define training data sets and indicators. ■ Ensure accuracy of the model using the training data sets.	■ Agree on the critical disruption scenarios that will be used for testing. ■ Translate those scenarios into potential ranges of demand and supply disruptions.	■ Run the defined disruption scenarios and analyse the impact on the operating model in terms of volume, cost, lead times and value chain integrity. ■ Establish potential changes to the operating model and assess their effectiveness.

At the heart of our process is the ability to assess the impact a range of disruption scenarios have on a company's operational model. The findings can be used as the foundation for creating a more agile and resilient model.

Disruption analysis for individual output metric

Variability of unitary cost with increased disruption

- ■ With transparency of true cost allocation it is not unusual to observe different levels of unitary cost impact with varying levels of demand or supply disruption.
- ■ However, as unitary costs for different parts may be impacted differently by the same disruption inputs, a segmentation of those impacts is required.

Typical segmentation criteria

- Unitary components
- Geography
- Demand behaviour
- Safety stock levels
- Supplier

Understanding variability within like-for-like segments can provides visibility on overall operating model impact.

Unitary cost by supply disruption input

Segment A

- ■ Instances of output variability with little dependency on input level, meaning operating model resilience towards that segment.

It is a challenging to understand trends in data without appropriate segmentation

Unitary cost by supply disruption input

Segment B

- ■ High degree of variability pointing out the need for operating model changes to increase overall system resilience.
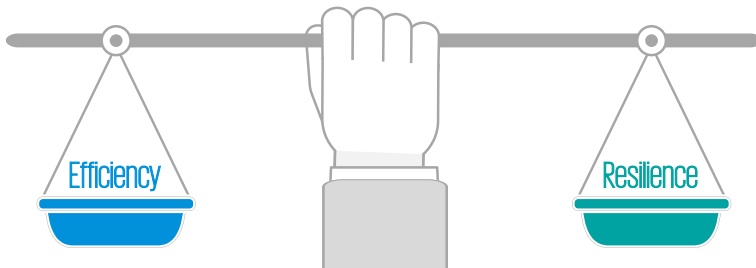
Enhancing your ability to cope with disruption

Our approach focuses on finding the right equilibrium between operating model efficiency, resilience and agility while also allowing you the flexibility necessary to cope with external shocks.

1. **Global supply chain efficiencies** have risen steeply in recent decades. Key to this has been leveraging the benefits of economies of scale and lower production costs across global geographies.
2. **Global disruption events** are becoming more frequent, complex and harder to predict. This increases the need for scenario-based assessments that can help businesses improve their resilience and agility.

Efficiency

Resilience

Efficiency attributes	Resilience attributes
▪ High dependency on a value chain that uses a specific set of mission critical suppliers. ▪ Supply base tailored for steady state volume of production with little variation. ▪ Tightly negotiated contractual mechanisms aimed at lowering costs of volume production rather than ensuring flexibility.	▪ Scope and breadth of your supplier base. ▪ Degree of supplier redundancy. ▪ Availability of alternatives across different geographies. ▪ Contracts and/or hedging strategies that allow for the absorption of volume and/or price shocks.

Our approach:

Tailored to specific operating models
▪ Methodology based on the specific characteristics of a range of different operating model options.
▪ All findings are based on the simulation of disruptive events using data taken from clients' actual operations.

Data-driven
▪ Analysis draws on inside-out data, outside-in data and relevant benchmarks.
▪ Data cubes and scenarios as basis for expert discussions.

Probabilistic
▪ Statistical models display the effects of different disruptive events on operations.
▪ Different outcome probabilities are explored through scenario modelling.

Iterative and dynamic
▪ Applied iteratively, our predictive models assess the impact of disruption across a range of scenarios.
▪ Dynamic stress-testing procedures identify the weak links in supply chains.

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Tailored to specific operating model	**Uses data-driven scenarios and outcomes**
Probabilistic approach towards disruption	**Iterative and dynamic findings**

Defence and recovery measures

Build defence and recovery readiness into your operating model

Our approach focuses on finding the best equilibrium between operating model efficiency, resilience and agility. We believe this combination best allows you too:

1. **Defend against global disruptions** without suffering severe impacts on your operations by both protecting your business from negative impacts in the first place and finding ways of absorbing and mitigating any damage that occurs.
2. **Recover from any disruptions** by putting in place measures giving your organization the agility to recover rapidly or switch to an alternative scenario.
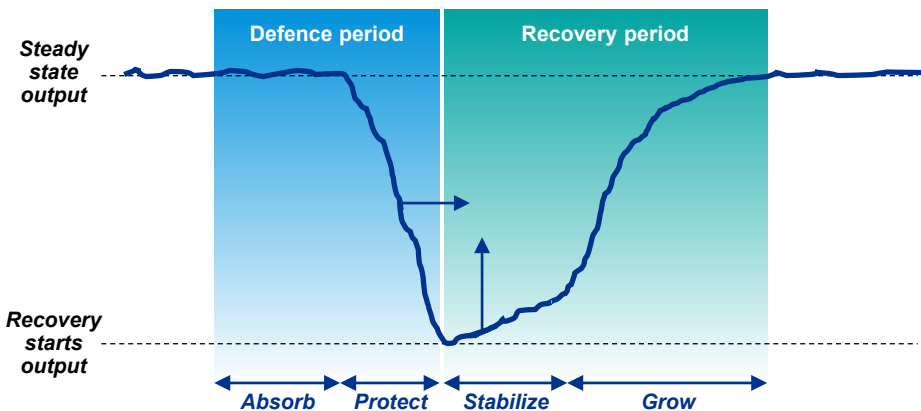
Both defence and recovery capabilities need to be developed with an understanding of the nature and effects disruption may cause to the value chain:

Defence capacity
- What potential mechanisms do you have that could defend against or absorb the impact of disruption on your operations?
- Which ones could best a) protect against that impact, b) slow it down, and c) mitigate its negative effects?
- What time horizon will be required to adjust to any new normal that might emerge?
- What abilities do you have to protect your client base? Will your relationship management systems be able to cope?
- What secure sources of financing do you have to access in the event of disruptions? What precautions should you take to ensure these remain in place?

Recovery capacity
- What mechanisms could stabilize operations through a disruption and the initial stages of recovery?
- Does your organization have the agility to make a rapid recovery?
- What levers could accelerate recovery? What would be the financial cost of those levers?
- What KPIs would you use to assess the situation and measure success? What feedback processes and emergency communication systems could you put in place?
- Will you be able to define any new normal that might emerge as a result of the disruption?

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