ASCM CASE COMPETITION

In collaboration with Deloitte.

ASCM CASE COMPETITION 2020 VIRTUAL REGIONAL ROUND

Singapore University of Technology and Design
Team ID: 2165514

Executive Summary

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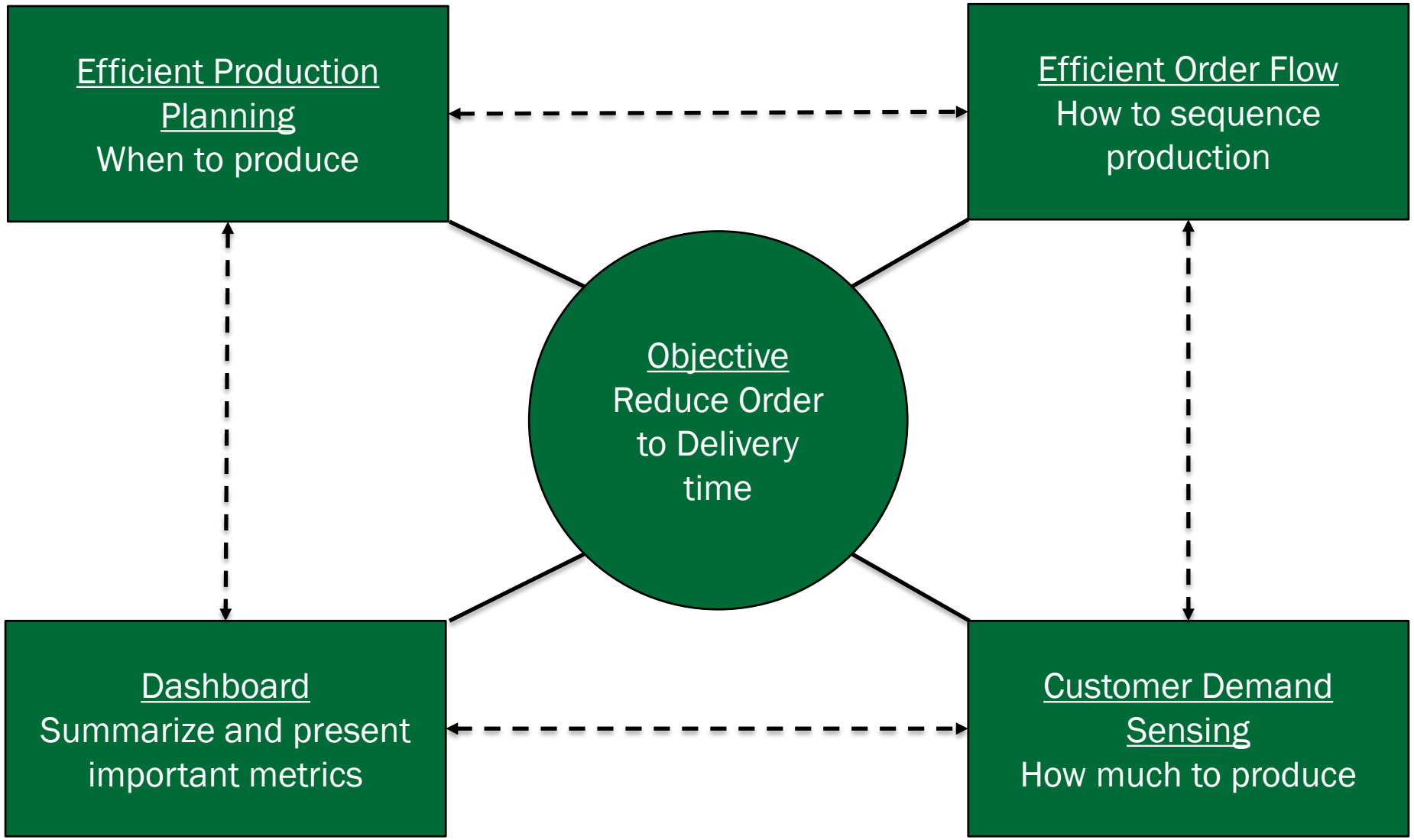

Current Situation

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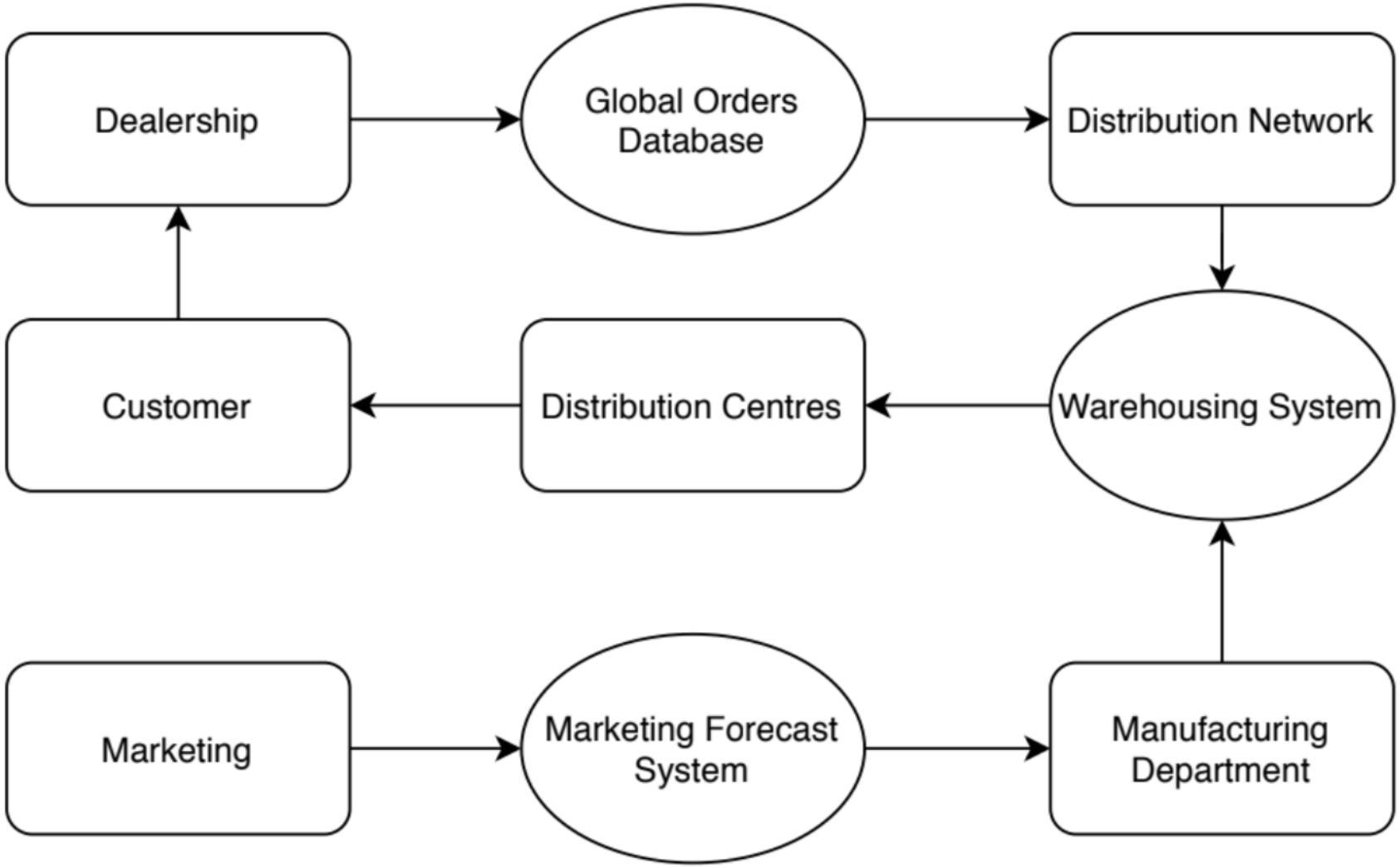

Data Analysis

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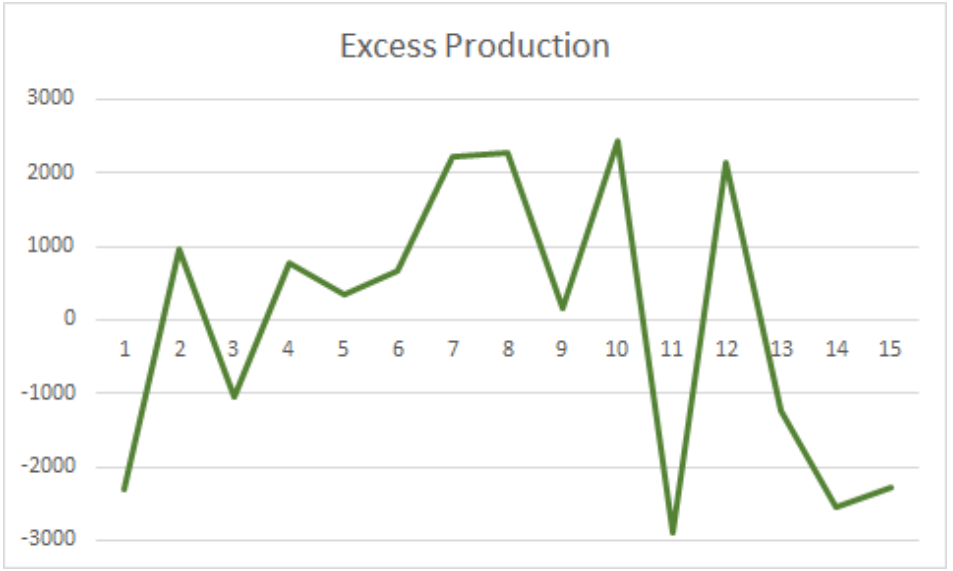
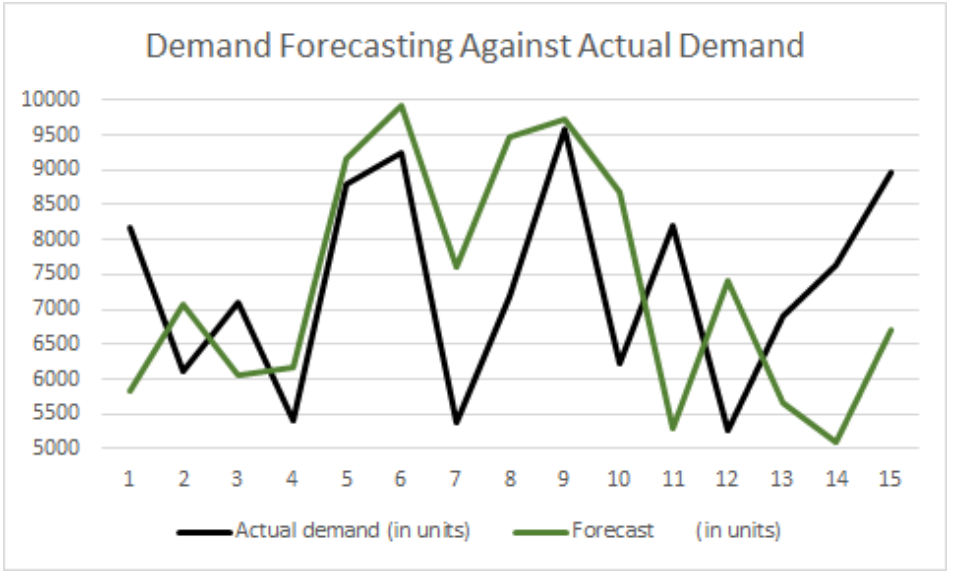
	KB	MR	BB	GG	WW
SE	4	3	0	0	1
SU	0	2	3	0	0
HA	6	4	0	1	4

	Pigment Changeover time
Paint Shop Process	12 Minutes
Body Shop Process	6 Minutes





Mean Excess Production: -20.9

Standard Deviation: 1839.8

Conclusion:

Overall Underproduction

High variance in meeting demand

Blockchain – A Proposal

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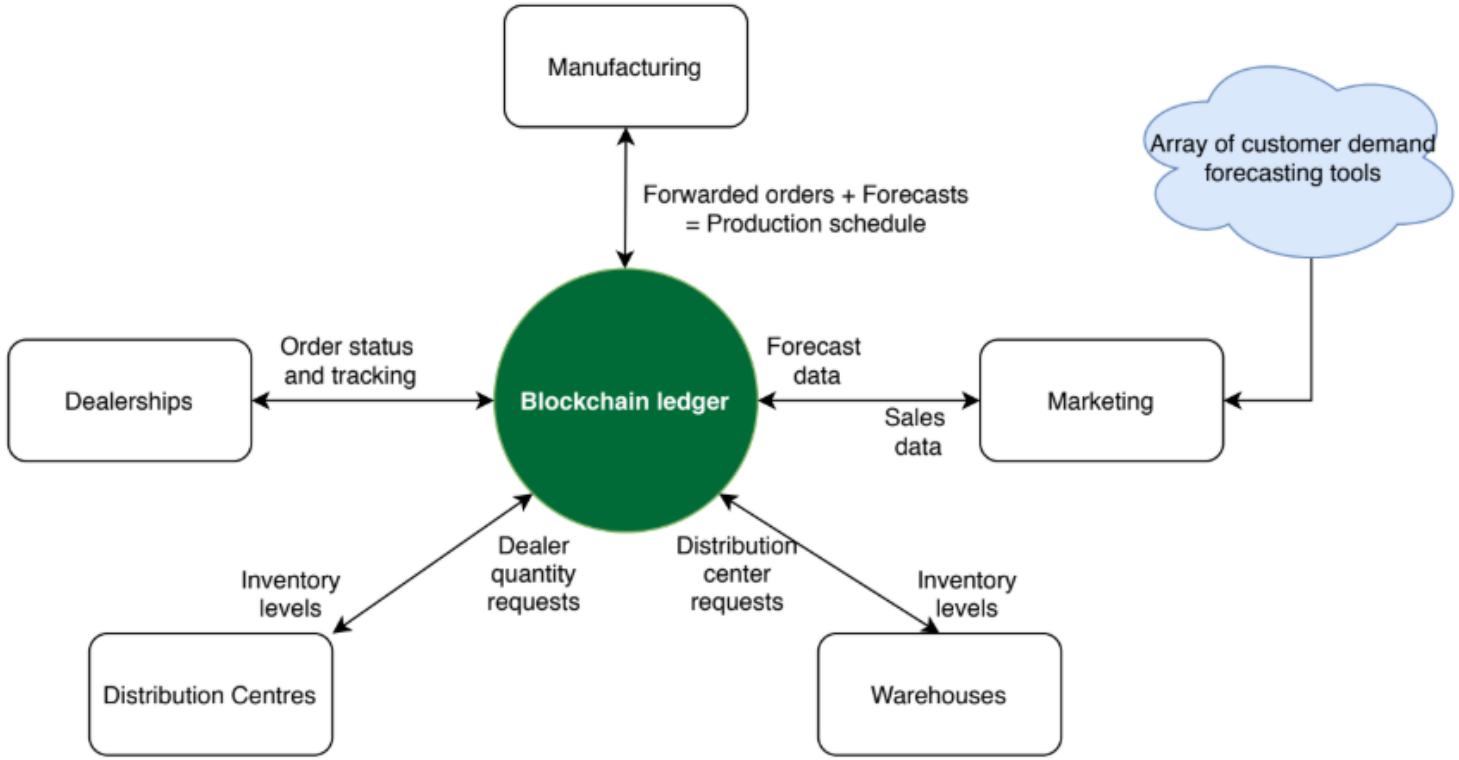

System map of blockchain ledger and the stakeholder roles

2 key problems with current system:

1. Too many databases
2. Lack of coordinated information exchange

Advantages of blockchain ledger:

1. Highly connected Digital Supply Network
   a. Instantaneous information update
   b. RFID tracking
   c. Smart contracts
2. Incorruptible and highly secure

Customer Demand Forecasting

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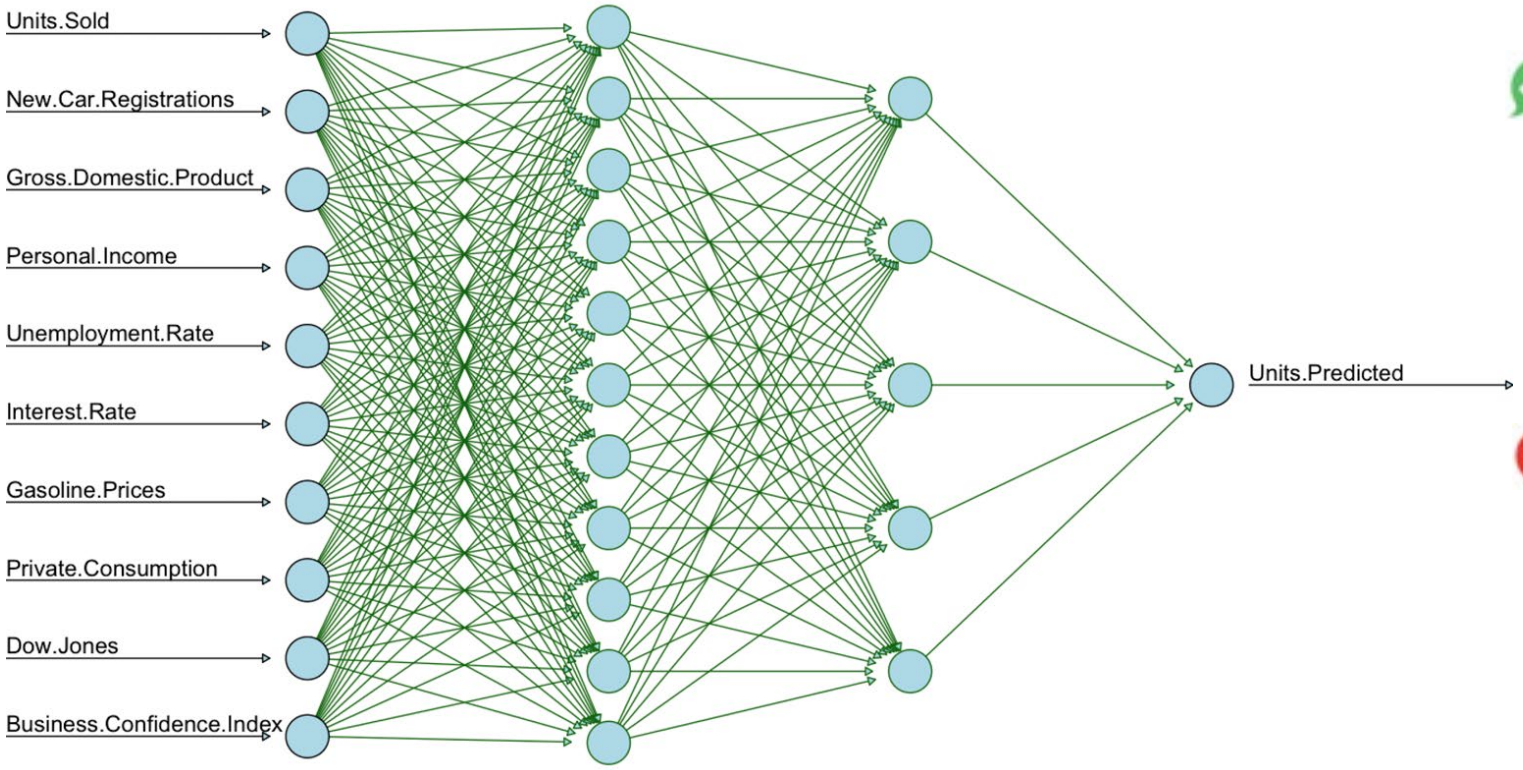
Methodology, Infrastructure and Data

Recurrent Neural Network

Automobile and Exogenous Data



Integration

Pooling of Actual Weekly Sales Records

Benefits

Takes into account time series data and recent development cycles

Problems

Software / Hardware requirements

Constant Retraining of Model

Bullwhip Effect

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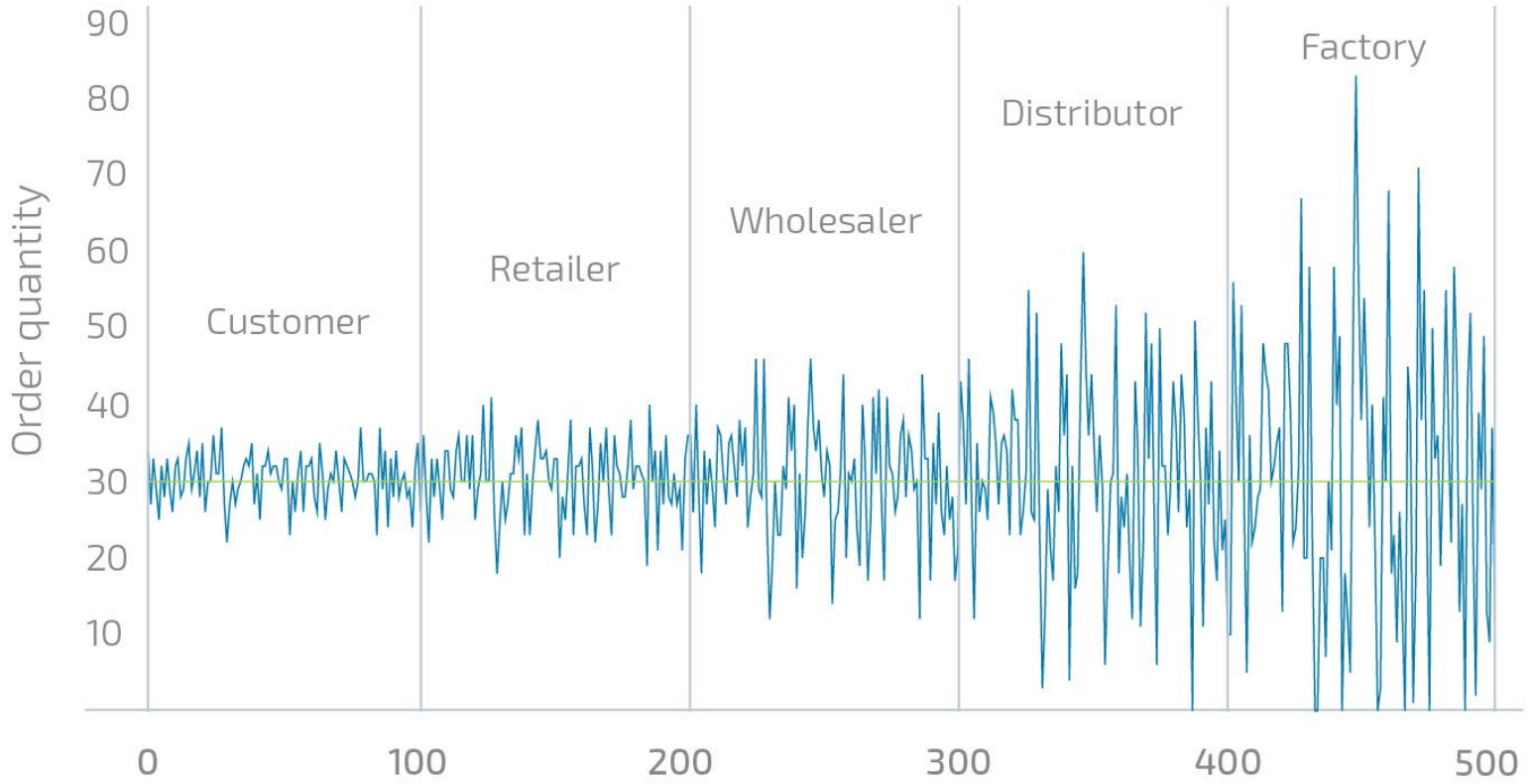
Graphical representation of the bullwhip effect



Production Logic - Sequential Batching Queues

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Arrival from upstream body shop

Red, Green, Green, Blue, White…

Downstream to paint shop

Upstream rule:

1. Cars go into their respective colour queues
2. Express cars skip to the front of their respective colour queues
3. Priming is colour agnostic - all cars can be primed similarly while queuing

Downstream rule:

(Assume 1 painting machine.)

We will **keep painting the current colour** unless change criteria met:

1. Express score (Appendix 6)
2. Length of other queue

In the two cases above it will respectively:

1. Switch to handling the queue with the highest express score
2. Switch to the queue with the longest length

Production Logic - Sequential Batching Queues

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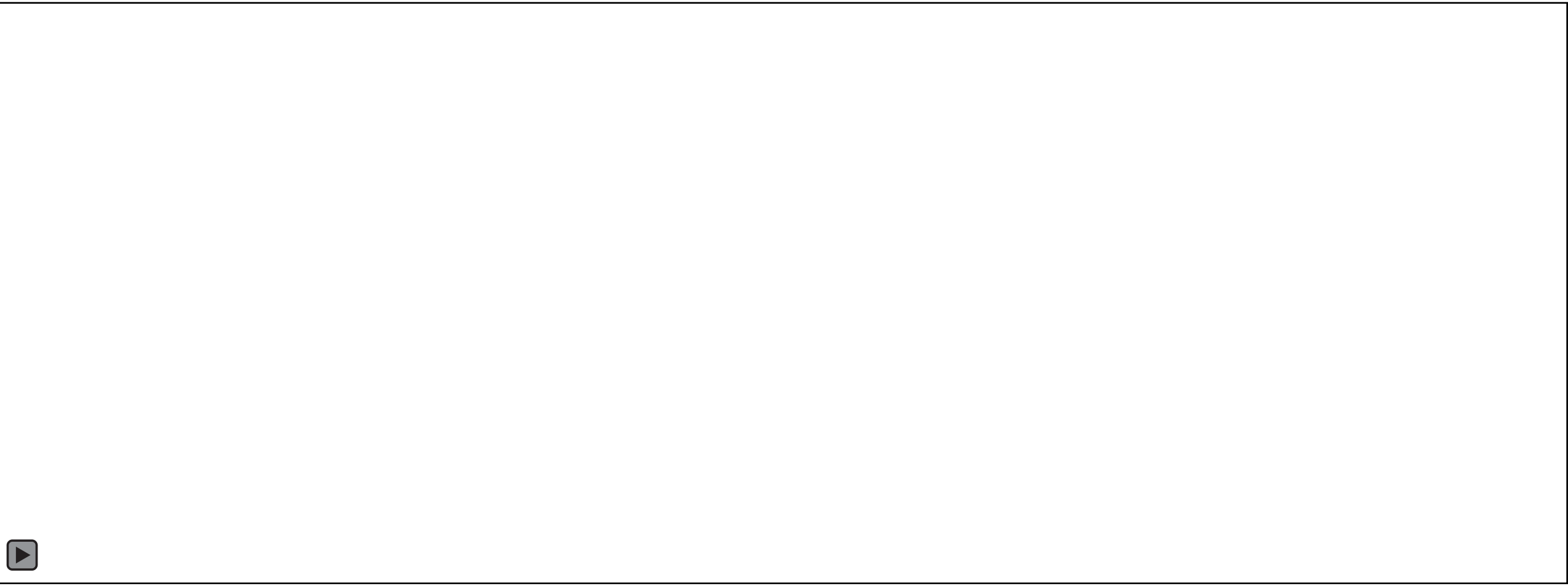

Dashboard

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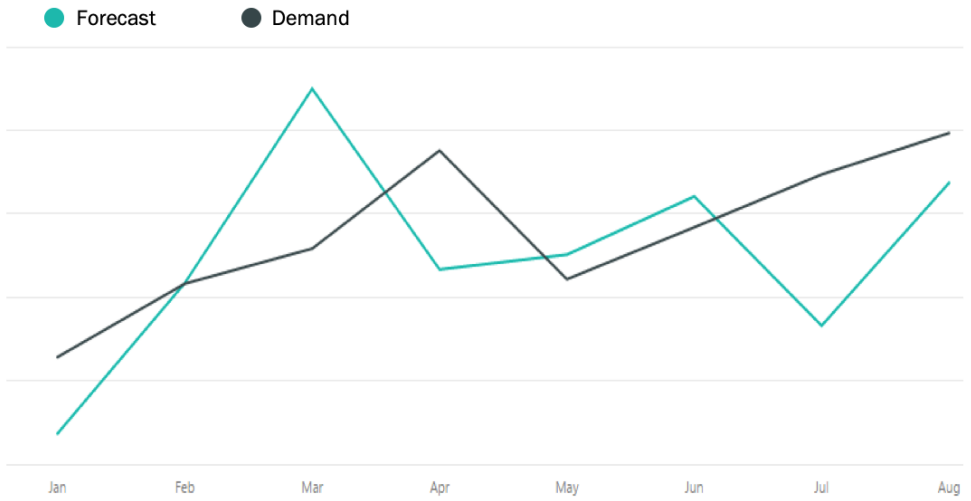
AUTOCORP

Forecasted demand	Actual demand	Forecast accuracy	Ave OTD (days)
1473	1280	68.5%	23

Forecast vs. Actual demand



Client	Component	Region	Average of Performance	Average of Reliability
Mobile	Page1 load	EMEA	353.00	99.52%
Mobile	Page1 load	NA	172.00	99.61%
Mobile	Page2 load	EMEA	329.00	99.76%
Mobile	Page2 load	NA	182.00	99.45%
Mobile	Page3 load	EMEA	323.00	98.50%
Mobile	Page3 load	NA	383.00	99.67%
Mobile	Page4 load	EMEA	390.00	99.42%
Mobile	Page4 load	NA	275.00	99.37%
Web	Page1 load	EMEA	201.00	98.08%
Web	Page1 load	NA	483.00	99.10%
Web	Page2 load	EMEA	276.00	99.40%
Web	Page2 load	NA	106.00	99.47%
Web	Page3 load	EMEA	148.00	99.69%
Web	Page3 load	NA	402.00	98.03%
Web	Page4 load	EMEA	203.00	99.03%
Web	Page4 load	NA	284.00	99.30%
Total			**281.88**	**99.21%**

Order Date

01/01/2018 — 31/12/2019

Location

- [ ] Select All
- [ ] Australia
- [ ] China
- [x] Singapore
- [ ] Thailand

Dealership | Warehouse | Manufacturing | Marketing

Conclusion

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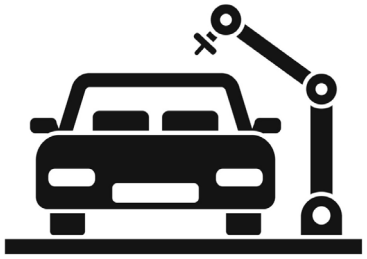
Problems

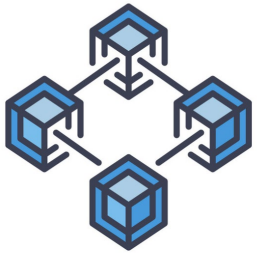
Databases



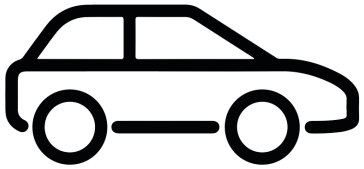
Production Sequencing

Demand Sensing

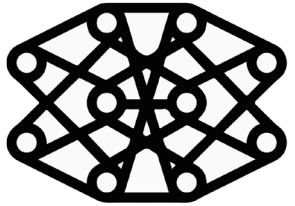
Solutions



Blockchain



Sequential Batching



Artificial Intelligence

Interactive Dashboard

Objective

Reduce Order to Delivery Time

THANK YOU

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APPENDICES

Appendix 1a:
The Automotive Revolution - 4 macro trends

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1. Shifting markets and revenue pools

   a) Automotive revenue pools to increase by ~**30 percent**, adding up to ~USD 1.5 trillion by 2030

   b) Vehicle unit sales will continue to grow but at a **slower** rate of ~2 percent p.a. (Due to **shared mobility**)

Source: Deloitte, McKinsey

Appendix 1b:
The Automotive Revolution - macro trends

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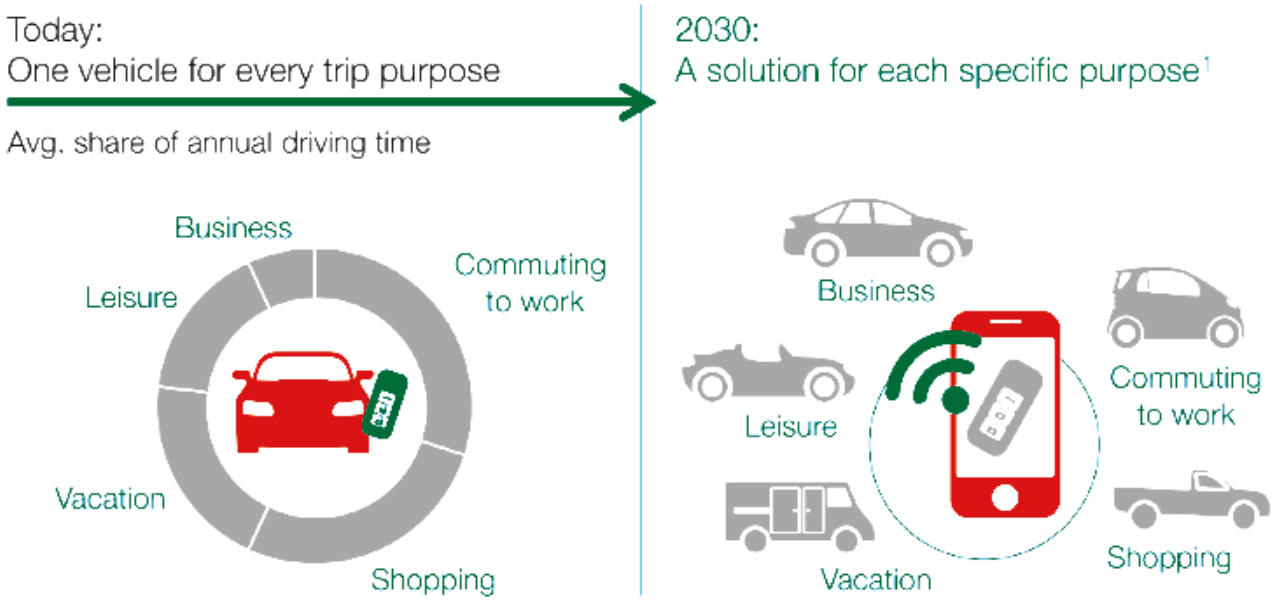
2. Changes in mobility behavior

   a) **1 of 10** cars sold in 2030 is a **shared vehicle** → the rise of a market for fit-for-purpose mobility solutions

   b) **City type** will replace country or region as the most relevant segmentation dimension that determines mobility behavior (e.g. Congested cities such as Singapore / London will drift towards shared mobility instead of car ownership)



Source: Deloitte, McKinsey

Appendix 1c:
The Automotive Revolution - macro trends

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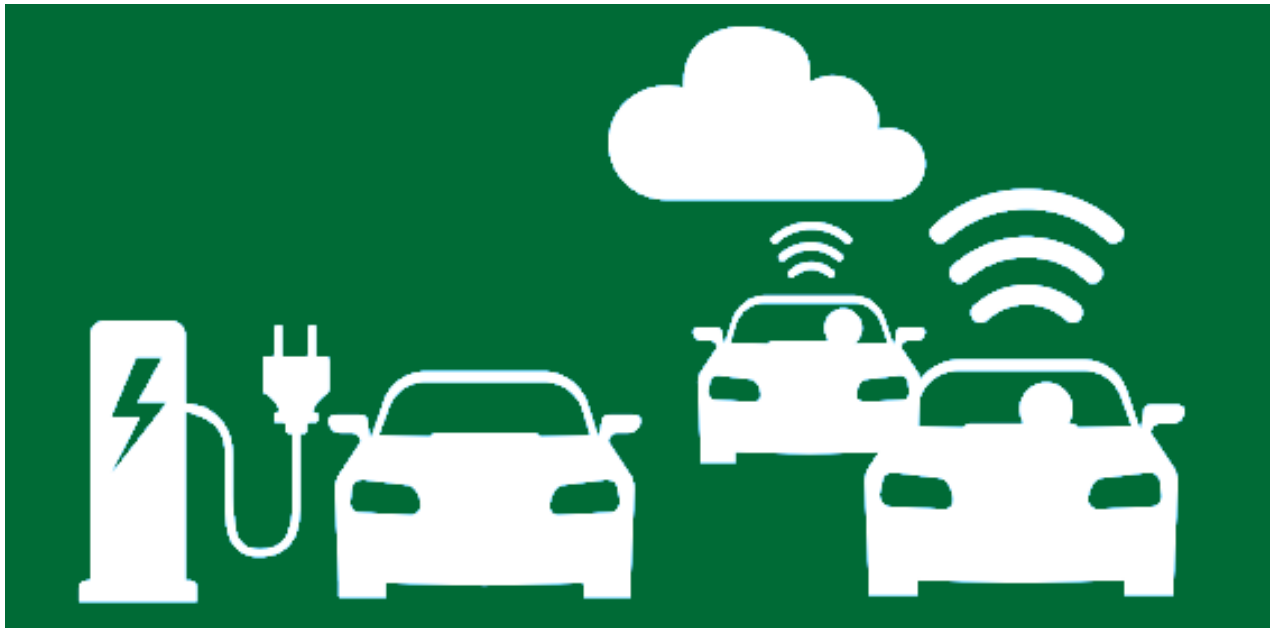
3. Diffusion of advanced technology
    a) Up to 15 percent of new sold cars sold in 2030 could be fully autonomous
    b) Electrification of vehicles



Source: Deloitte, McKinsey

Appendix 1d:
The Automotive Revolution - macro trends

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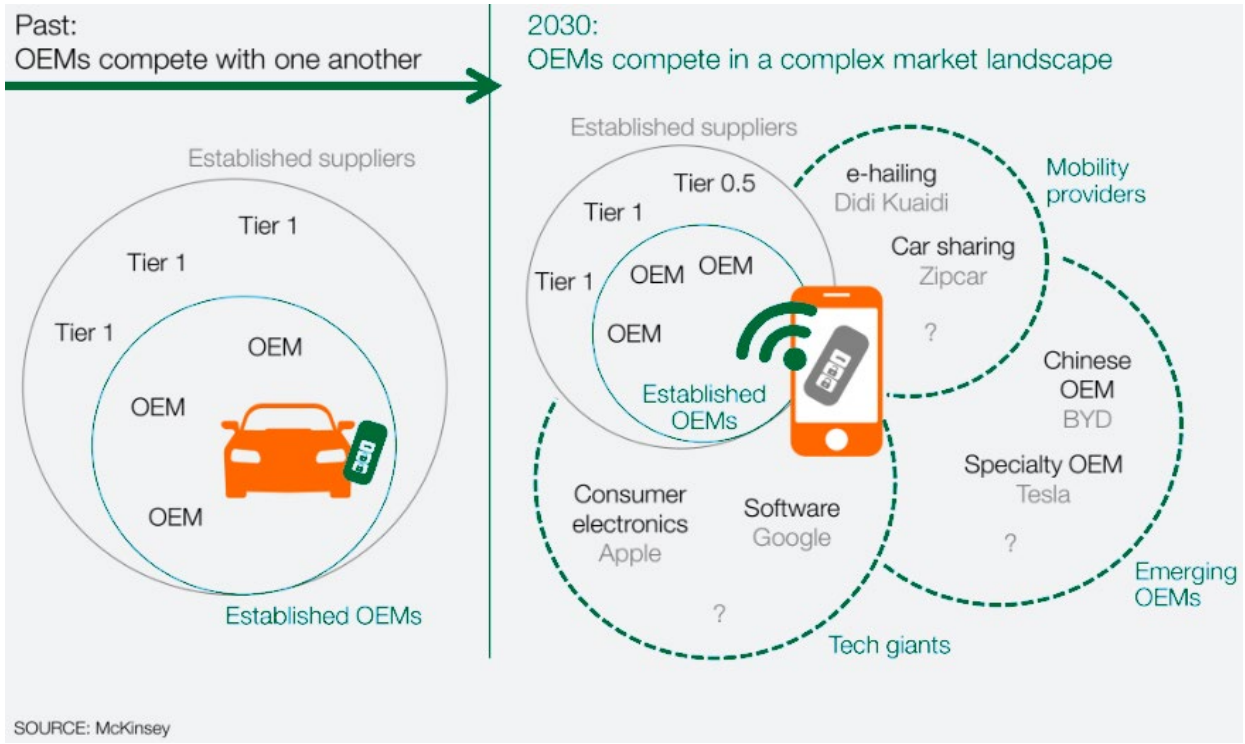
4. New competition and cooperation

   a) Within a more complex and diversified mobility industry landscape, incumbent players will be forced to simultaneously compete on multiple fronts and cooperate with competitors

   b) New market entrants are expected to initially target only specific, economically attractive segments and activities along the value chain before potentially exploring further fields



Source: Deloitte, McKinsey

Appendix 2:
Scenario thinking gives 4 outcomes of the automotive value chain in 2025

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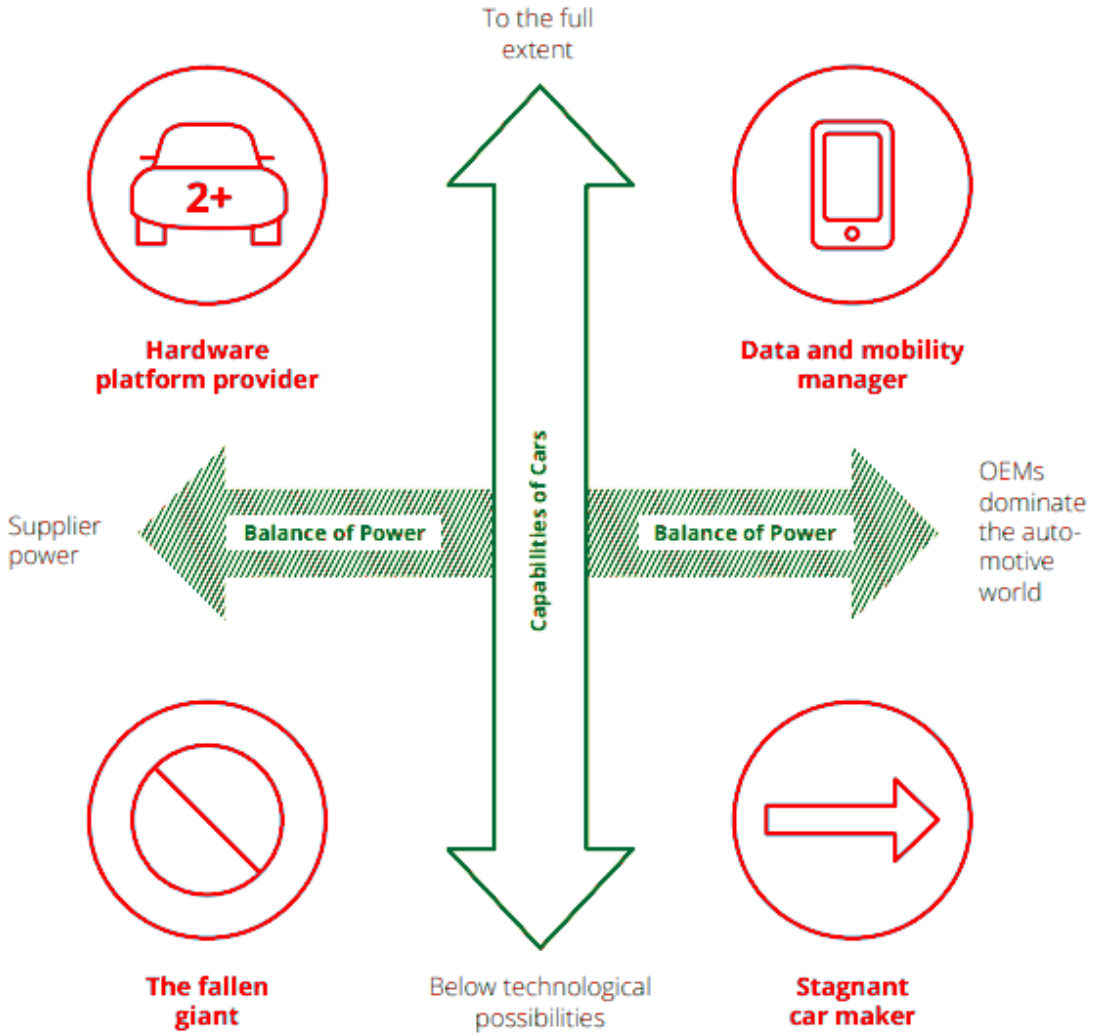
Scenario 4:
Hardware platform provider
IT players have disrupted the automotive value chain. OEMs are the suppliers of white-label cars to Internet Giants. Margin decreases for OEM.



Scenario 1:
Data / mobility manager
Connectivity has become a differentiator. Electric mobility, autonomous driving have become a common reality. OEMs set the standard and offer a range of products and services.

Scenario 3:
The fallen giant
Tech hype has mellowed nad car is a mere means of transport. Mobility has become a commodit and profit margins have dropped. OEMs focus on improving processes and cost efficiency.

Scenario 2:
Stagnant car maker
Massive lobbying by OEMs have prevented high-tech players from entering the market. Dramatic accidents with autonomous driving has reulted in total loss of consumer acceptance.

Source: Deloitte, McKinsey

Appendix 3:
Digital supply networks - moving from sequential chain to a network

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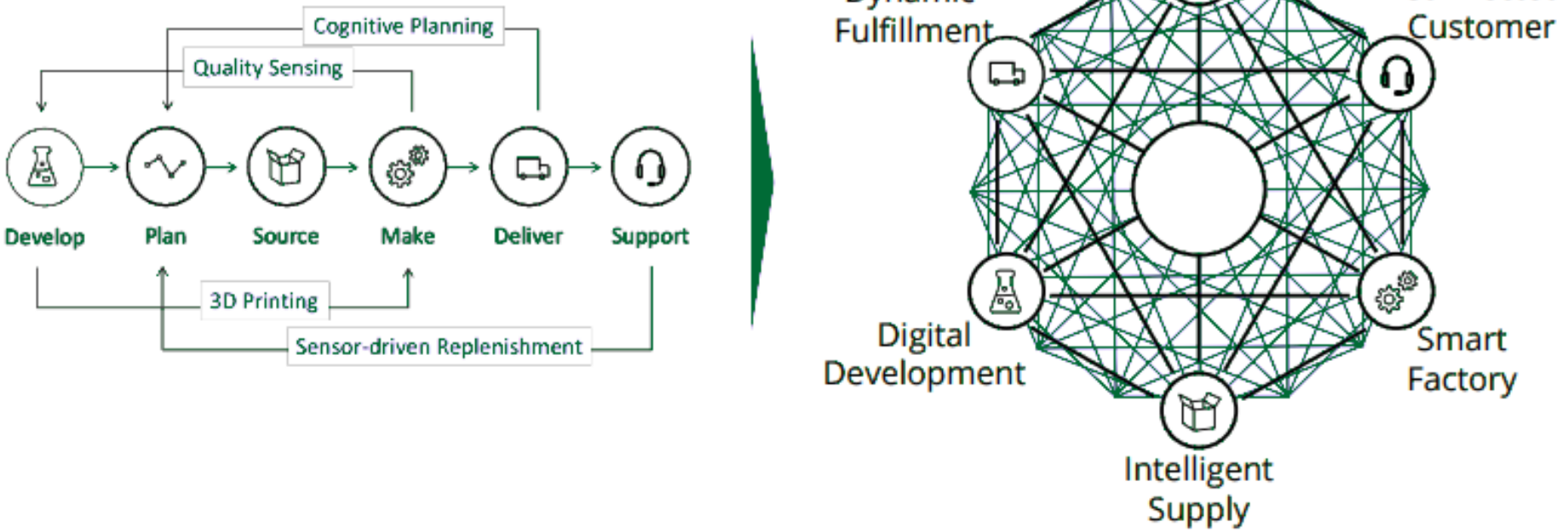
DSNs Allow Us to Move from Sequential Chains to Concurrent Networks



Source: Deloitte

Appendix 4a: Industry 4.0

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- Industry 4.0 is a **technology-based strategy introducing the concept of integrated industry** (Brettel et al. 2014), **relying on information which is both highly integrated and available across the entire product life cycle** (Stock and Seliger 2016).
- Its roll-out has **significant impacts on how supply chains are managed** (Alicke et al. 2017).
- Facilitated by Information Systems (IS), Industry 4.0 relies on an **information-heavy system of agility**.
- Organisations with agile supply chains can **better respond to uncertainties and changes** since they are better able to synchronise supply with demand through high responsiveness along the supply chain and **convert changes into business opportunities** (Swaford et al. 2008).

Source: Book, Achieving supply chain agility by Yi Wu

Appendix 4b: Industry 4.0

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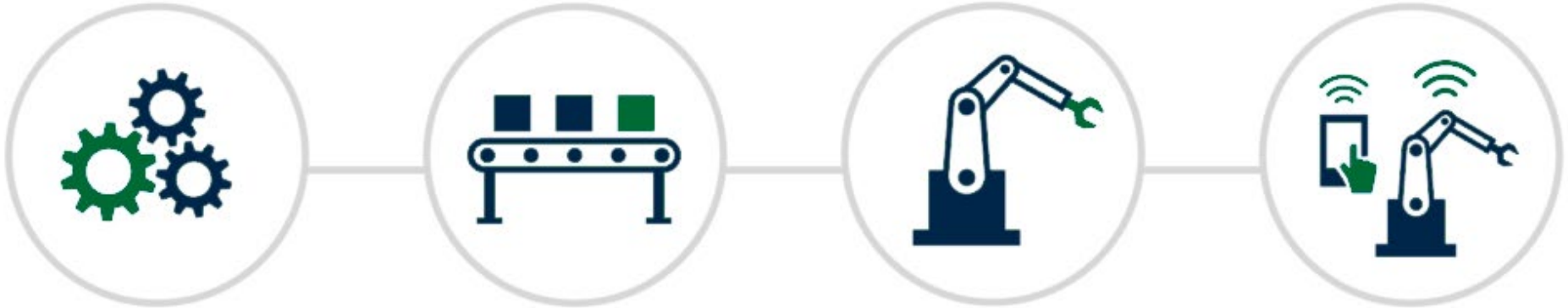
The Four Industrial Revolutions



Industry 1.0

Mechanization and the introduction of steam and water power

Industry 2.0

Mass production assembly lines using electrical power

Industry 3.0

Automated production, computers, IT-systems and robotics

Industry 4.0

The Smart Factory. Autonomous systems, IoT, machine learning

Source: Internet, Spectral Engines

Appendix 5a: Hyperparameter Tuning

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Hyperparameters	
Units	Activity Regularizer
Activation	Kernel Constraint
Use Bias	Bias Constraint
Kernel Initializer	Input Shape
Bias Initializer	Batch Input Shape
Kernel Regularizer	Batch Size
Bias Regularizer	

Appendix 5b: Hyperparameter Tuning

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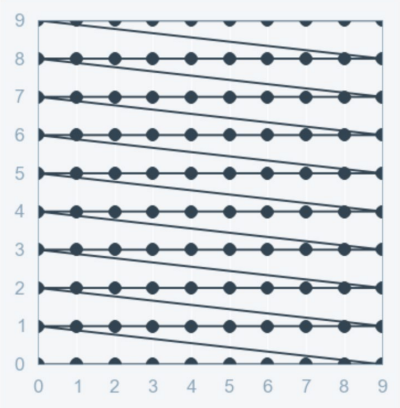


Fig 1. Grid Search

Guaranteed to find the optimal combination of parameters supplied

Very time-consuming and computationally expensive

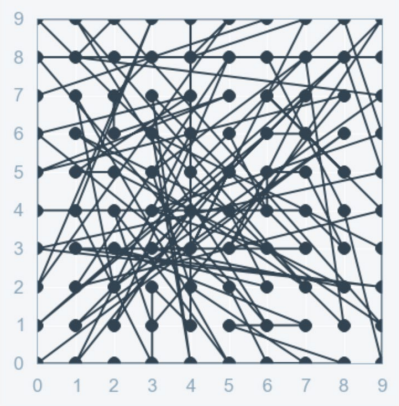


Fig 2. Random Search

Decreased processing time

Not guaranteed to find the optimal combination of hyperparameters

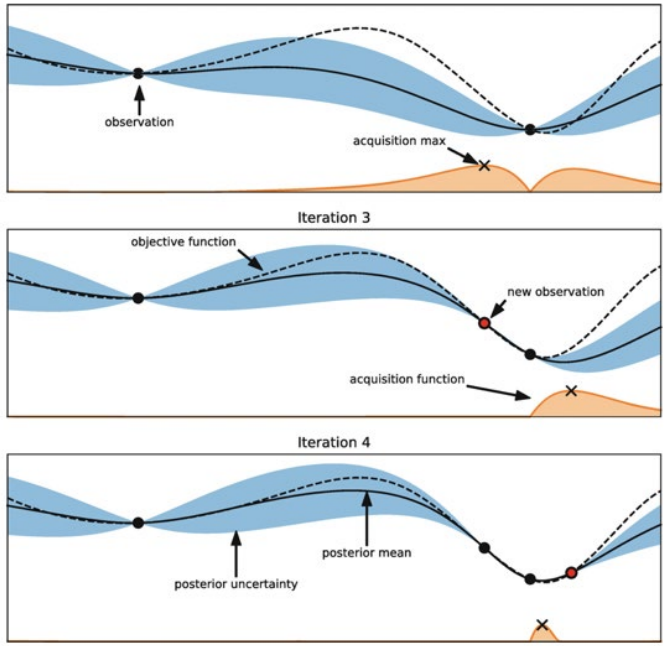
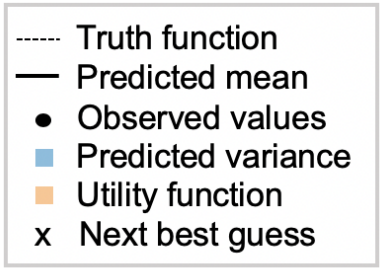


Fig. 3 Bayesian Optimisation



A more consistent and efficient approach that mostly requires fewer iterations than Random Search

More complex to implement and configure properly

Bayesian Optimization is a model-based method for finding the minimum of a function (e.g. model validation error). It **uses past evaluation results** to choose the next best values to evaluate (e.g. next point with the highest expected improvement).

Appendix 6:
Calculation of Express Score

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- We will calculate an express score for each of the 5 colour queues

- We require these parameters:
  - Number of express jobs in that queue, J
  - Sum of days till delivery date for that queue, D
  - The express score is calculated as J / D

END

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