Restore
Digital

Train of thought Automotive & Transport Whitepaper

Smart data driving innovation and agility in the transport and automobile sector.

Whitepaper

www.restore.co.uk/digital

Smart People.
Smart Processes.
Smart Data.

#RestoreAnswers

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Data is moving at speed

The transport industry and its data are getting smart. From airlines to automobiles. From transport authorities to mobile-as-a-service (MaaS) giant Uber. Data is being collected, analysed and used. This data allows:

The personalisation of customer experiences.

The power to innovate and inform for the greater good.

Organisations to be more agile and cost effective.

Yet, this rich data has the backdrop of the revised Data Protection Act and GDPR. These increased the bar for consent, with positive opt-in crucial to be able to collect this Big Data.

This paper looks at the positive ways data is helping to transform the transport and automobile sector. It takes into consideration the regulatory backdrop and the inherent risks this provides. A data strategy is essential to maximise the benefits of connectivity and analytics.

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The Scale of Data

- 40 Zettabytes of data has been created as we enter 2020.
- 5bn people own mobile phones worldwide.
- Over half are smart phones.
- Companies average 163 terabytes of data.

It is hard to store and process the massive amount of data in a conventional database. It's hard to make sense of this data without Ai.

Variety of Data

- Facebook generates four new petabytes of data per day.
- 3.25bn hours of video watched monthly on YouTube.
- 500 million tweets daily.

The conventional relational database is not able to store unstructured and heterogeneous data such as signal data generated by a sensor, free text data collected through social media, image data generated by satellite and video data streamed by closed-circuit television.

Uncertainty of Data

- 1/3 of business leaders don't trust their data to decide
- Some data is still trapped on paper.
- 27% unsure of the accuracy of their data.

The last challenge is veracity, which means uncertainty and incorrectness. This characteristic emerges because big data is not bounded to the relational database management system. Therefore, there is a risk data quality is poor.

Analysis of Data

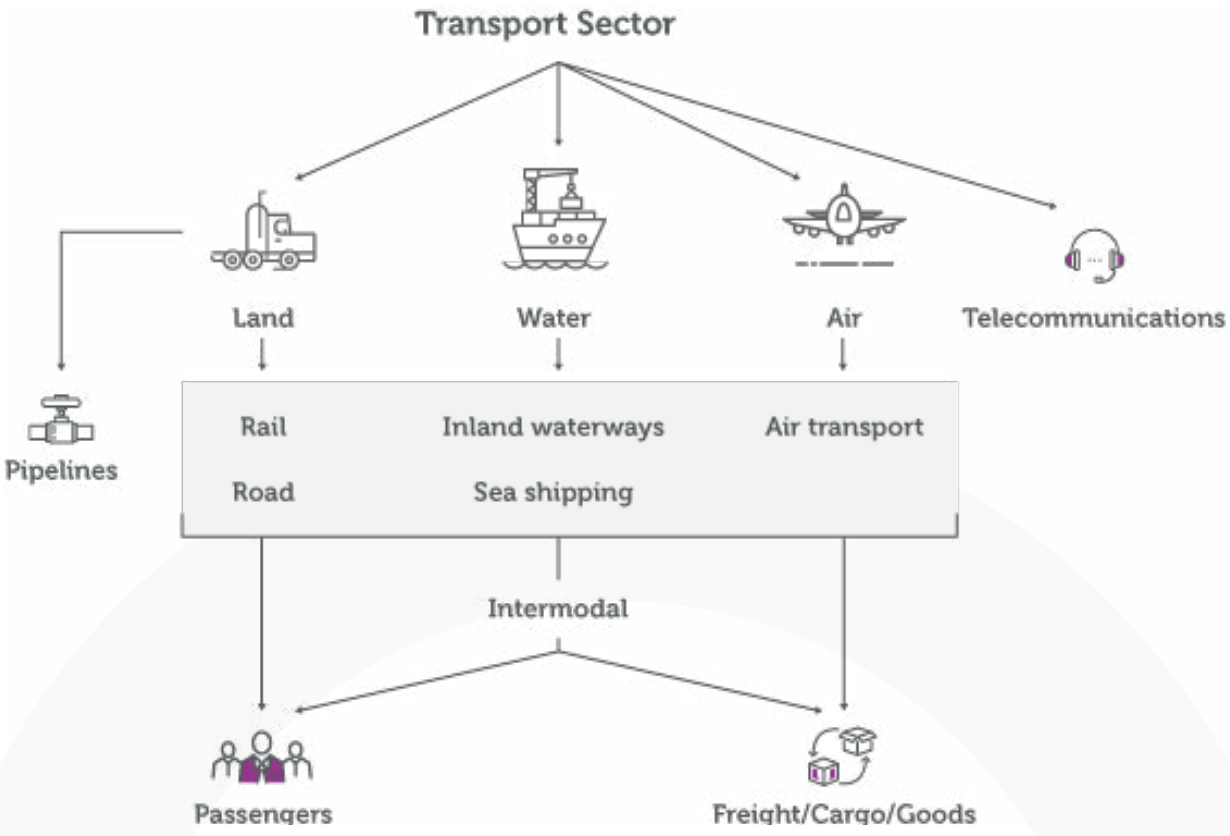
- 18.9bn network connections worldwide.
- 73% of business data goes unused.

The third challenge is velocity. The conventional database cannot ingest streaming data generated by multiple sensors in real time.

From traffic patterns to the music we listen to in the car – data is recorded, feeding into the Big Data landscape. Pulling this information and overlaying with external information, like social media, allows companies to leverage data to improve service, and increase profits.

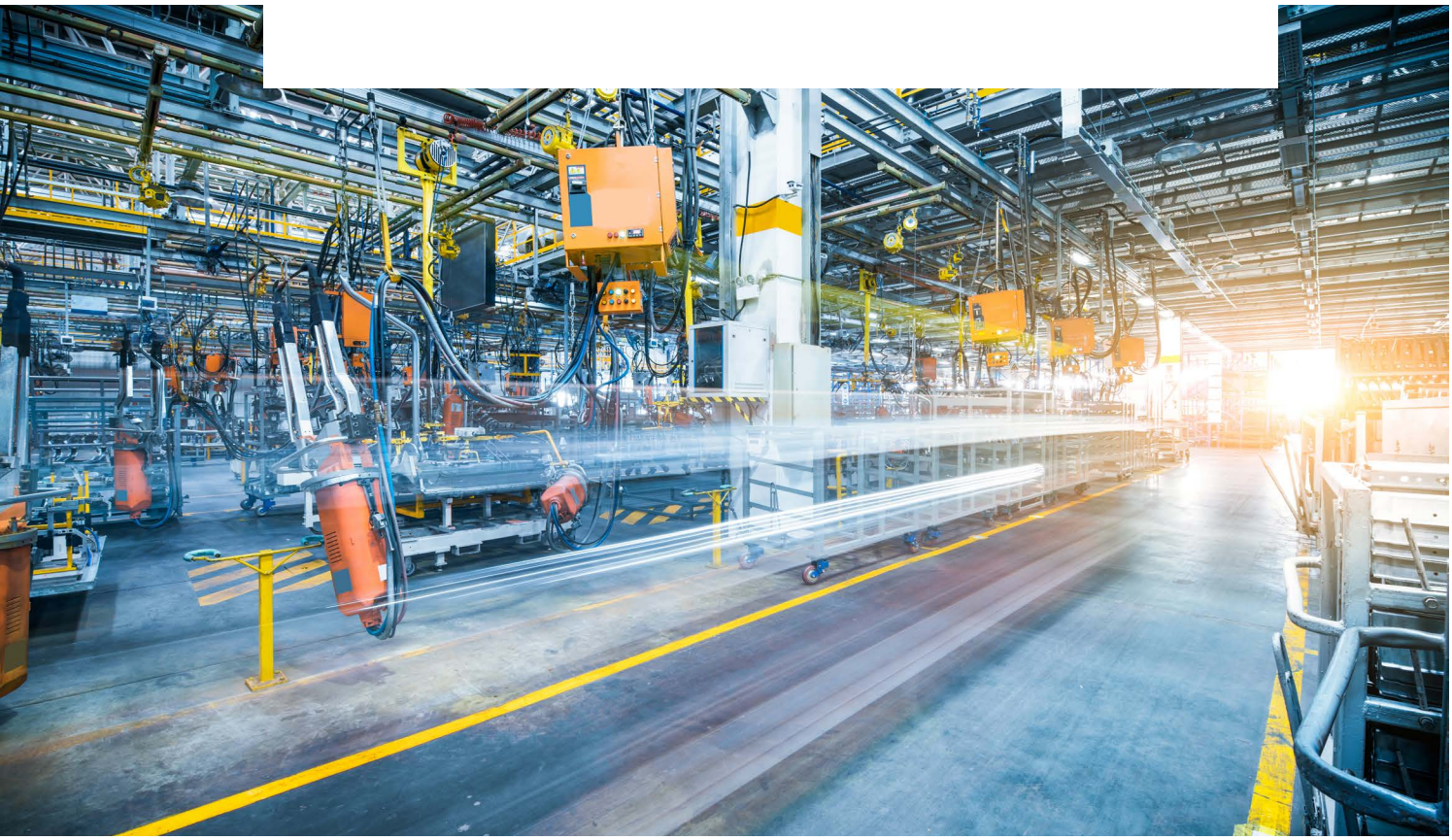
Chapter one:
Main factors of digitalisation driving intelligent mobility

The transport sector is a category of companies. It provides services moving people, goods, or the infrastructure to do so.

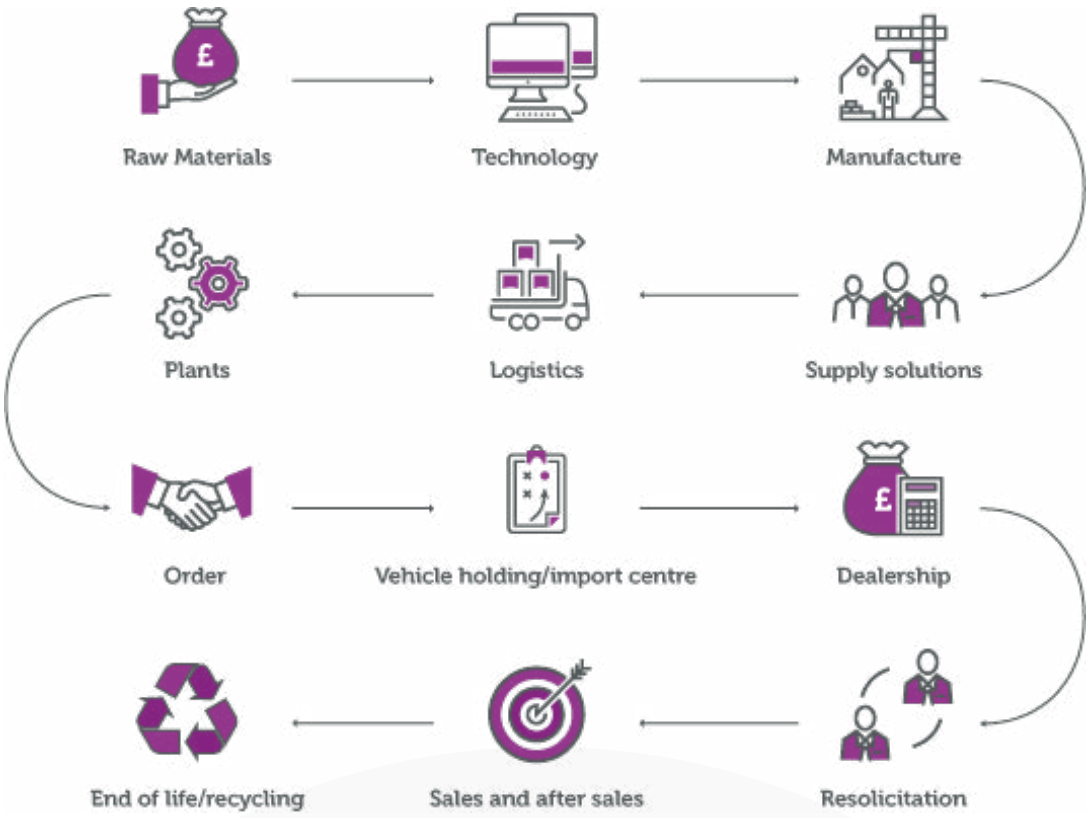


The automotive industry comprises a wide range of companies and organisations involved in:

- **Design**
- **Marketing**
- **Development**
- **Selling**
- **Manufactoring**



A simplified structure of the automotive industry



Evaluation

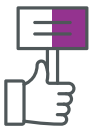
* Long term perspectives
* Decision support methodologies
* Environmental impacts
* Economic and regional impacts
* Accessibility, social and equity impacts

Policy

* Financing, pricing and taxation
* Regulation, competition and public services
* Infrastructure and TEN-T transport planning
* Climate policy and energy efficiency
* Security and safety
* International and EU co-operation
* Awareness information and user rights

Technology

* Intelligent transport systems
* Innovation technologies
* Transport management



Sector

* Passenger transport
* Freight transport

Mode

* Air
* Rail
* Road
* Urban
* Water
* Multimodal

The main micro themes that are driving Big Data and strategic decisions linked to it.

Data protection and security

Digital sources of buying

Autonomous driving

Automotive and Transport Digitalisation & Big Data

Mobility as a service

Connected supply chain & improved manufacturing

Predictive maintenance

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Key Definitions

1. Mobility as a Service (Maas): Combines different transport and complementary services. Purchased as a package, tailored to individual's needs. Demonstrate a range of technical and digital innovation.
2. Connected and autonomous vehicles (CAVs): Self-driving vehicles.
3. The Internet of Things (IoT): the interconnection of the internet to everyday objects.
4. Portability of data: The right to data portability allows individuals to obtain and reuse their personal data for their own purposes across different services. It allows them to move, copy or transfer personal data easily from one IT environment to another in a safe and secure way, without affecting its usability.
5. Transport: the whole ecosystem of moving people and goods from place to place
6. Mobility: An individual's journey from location to location through the transport system.
7. Big data: Extremely large data sets that may be analysed computationally to reveal patterns, trends, and associations, especially relating to human behaviour and interactions

Chapter two:
Data protection and security

The management of all the data collected will be a key role within the evolving transport sector. Navigating the great benefits of big data, while being mindful of:

The General Data Protection Regulation (GDPR)

The EU directive on the security of networks and information systems

Location data, for example, has obvious industry and wider social benefits. But, is quite revealing of a personal identity. So, fraught with regulatory minefields. GDPR considers personal data to include location. Developing trust between individuals and organisations is essential to gain active consent.

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An example of the interpretation of GDPR within the transport sector

GDPR outlines guidelines on the right to data portability. This appears to be broadly interpreted. "Raw data processed by a smart meter or other connected objectives, activity logs, history of web usage or search activities" falls within portability right.

This leads to difficulty when collected data through intelligent cars. Allowing portability, can expose manufacturer IP.

Managing Risk

The more the transport sector needs data, the more it needs to manage the risks associated with this data. The collection and storage of personal data needs to be constantly assessed and managed proactively. Both to manage regulatory risk, but also to maximize its benefits. As data becomes more important the risk becomes not just reputational, but operational and strategic. Building a data strategy is essential. It needs to support innovation, but also follow three core principles:

1. Use data ethically. This will earn trust and protect individuals from unfair, discriminatory or misleading use.
2. Access and benefits must be fair. This allows for fair competition, and informed and empowered customers.
3. Organisations need to make big data work for all. Meeting the needs of communities working collaborate and transparently.

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GDPR and the management of Big Data

Accountability
Technical and organisational measures to demostrate compliance

Consent
Clear affirmative action and can be withdrawn at any time. Need to be able to prove consent given

DPO
Where sensitive data involved a Data Officer must be appointed

One stop shop
Report to the Data Protection Authority of their main establishment

BIG DATA

Data Breach
NDPA must be notified within 72 hours unless breach unlikely to result in a risk

Privacy by design
Privacy considered at all stages.

PIA
Privacy Impact Assessment must be completed before any high-risk data processing

Enhanced rights
Individuals, SARs, right to be fogotten, data portability, right to object profilling

Chapter three: Digital sources of buying

Cars

Today car buyers use independent websites and consumer reports to inform and negotiate. Consumers can understand how low a dealer can drop the price while still making a profit.

Reliability reports allow consumers to be more informed before entering a showroom. They are spending less time in there. You can build your ideal car websites, virtually. It allows you to understand features and options and ballpark costs.

The showrooms and manufacturers can use smart data to predict consumer demand and plan for it. They can also better profile who buys which cars. This information allows sales teams to more accurately sell the right benefits.

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Digial engagement allows a better buyer experience through omnichannel marketing, a collaborative supply chain, collaborative innovation and MaaS

Omnichannel buying experience

Multiple ways of researching and interacting with the dealership. Buying power shifting towards the more informed consumer.

Joined up innovation

Broad network of partners, sharing information and encouraging innovation.

Collaborative supply chain

Dynamic, agile infrastructure within the supply chain providing innovation and better demand management.

Data sharing, real time infomration etc. provides better visability and understanding to make strategic decisions.

MaaS

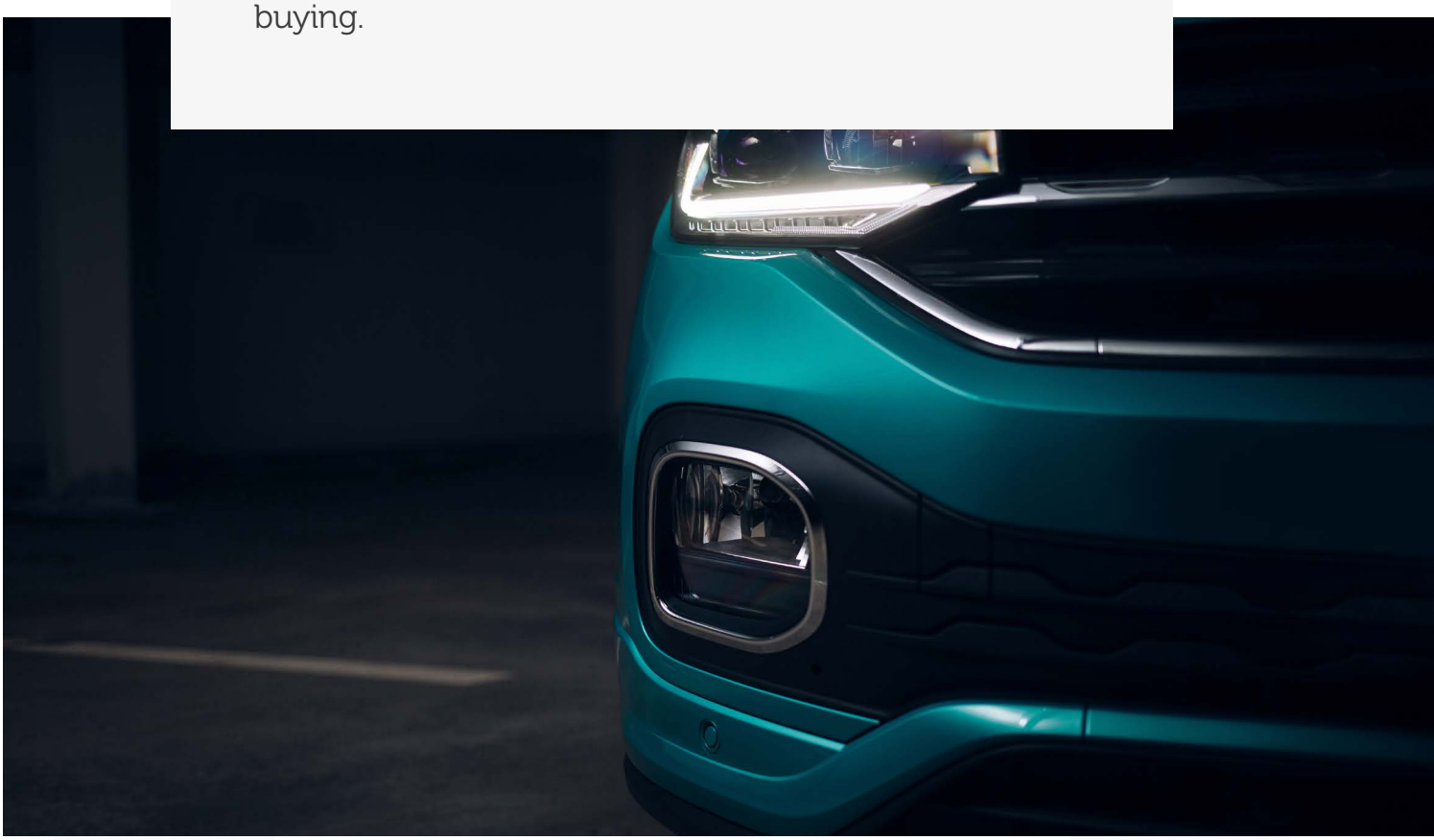
Provides additional insights for consumer and organisation.

Potential to monetise data and/or the analysis. Provides insight into behaviour.

Volkswagen

Volkswagen has seen profitable results by combining predictive analytics into its sales activities. They use behavioural analytics and prediction analysis. Providing dealerships with increased opportunities for boosting their sales and improving customer retention.

The dealer's management system captures data. This is then combined with big data by Volkswagen. This includes social media profiles, product, consumer lifecycle, financial records. This provides a behaviour prediction score, ranking customers on likelihood of buying.



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Digial engagement allows a better buyer experience through omnichannel marketing, a collaborative supply chain, collaborative innovation and MaaS

Trains

Train companies increasingly collect data at the point of purchasing tickets. This identifies patters and abnormalities that can help them service customers better. For example, AI could analyse ticket prices and demand. Then provide warnings, as people search for tickets. Advising when advance fairs are likely to increase.

Ticket sellers with access to train operating systems would allow better costumer services. Real time updates. Disruption notifications etc.

UK Government

The UK government has invested in smart ticketing. This helps collate more accurate journey data. Operators found ways to increase engagement with customers and address service gaps. For example, it overlaid anonymised journey data to understand platform and carriage overcrowding. Done ethically, this can help reduce these pressures. Incentives provided to customers might adapt their plans to ease overcrowding.

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How data could support rail customers

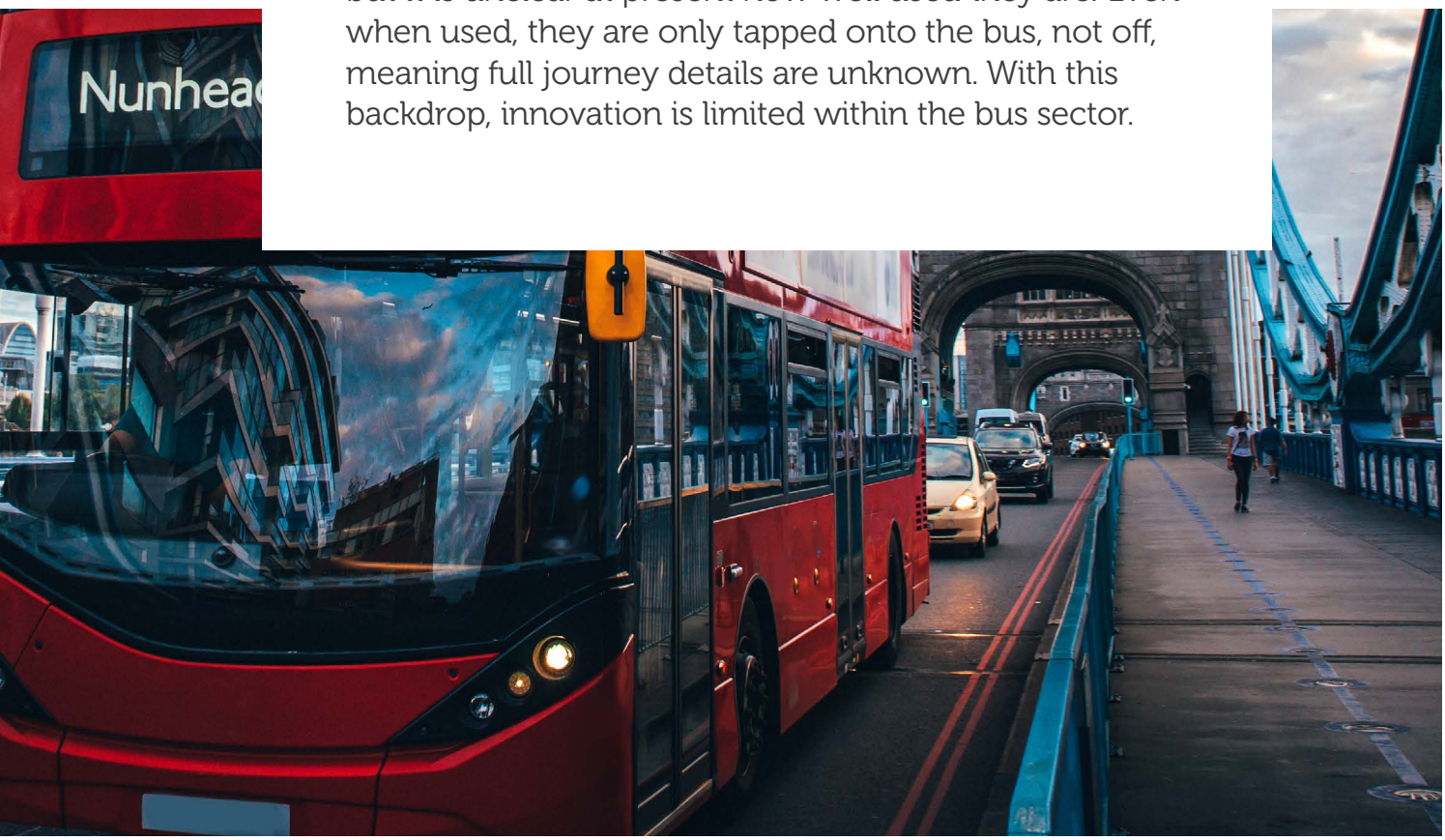
Data providing a benefit for passengers	Examples of what the rail industry could offer	Live examples (not necessarily rail industry)
Integrated planning tools	Cross transportation journey planning tool	Kayak: KAYA K searches hundreds of other travel sites at once to find the information you need to make the right decisions on flights, hotels & car hires.
	Mobility check	Tripit: Free online trip planner and free travel itinerary website for organizing vacations, group trips or business travel.
	Advice, including traffic forecasts	Google: Find and manage your trips. Explore. Explore a destination. Explore FAQs. Flights. Find plane tickets on Google Flights.
Information bundles complementing the journey	Up-to date news (weather, events etc) about your destination	TripAdvisor: World's largest travel platform. Browse hundreds of millions of traveller reviews and opinions.
	Point of interst finder (landmarks, museums etc)	Gate Guru: Check your flight status, find and explore airport amenities, book rental cars and track your travel stats all on the GateGuru app.
	Orientation and navigation for boarding, alighting, changing trains etc	Flight View: Look up flight status of any flight & see live flight status maps on iPhone Android BlackBerry Palm or any mobile phone with FlightView's real time flight tracker.

Data providing a benefit for passengers	Examples of what the rail industry could offer	Live examples (not necessarily rail industry)
Service and comfort	Notifocation when to leave for train, based on traffic	Car2Go: car2go is hourly car rental without rental offices or return stations. Grab a car from the street and leave it anywhere in our Home Area in your City.
	Dining offers	
	Parking spot finder	DriveNow: DriveNow was a one-way carsharing service wholly owned by the automotive manufacturer BMW.
Social and entertainment	Games and audio books	Audible: Audible is a seller and producer of spoken audio entertainment, information, and educational programming on the Internet.
	Friends finder in destination location	TripTrace: TripTrace is a software tool for travel planning. It uses information provided by its users to offer better recommendations on what places they should check out.

Buses

Bus services are generally fragmented. This makes it harder to collect enough data to drive the big benefits found in car and train industries. Access to a wider collaborative pool of data may be beneficial here. For example, historically bus operators do not share information consistently. Whether this is timetables and fare data, bus lanes or bus stops. If they pooled this information, it could be better disseminated. Benefiting the consumer and the public sector bodies manging the bus network.

Smart cards are a new initiative, that do collect data, but it is unclear at present how well used they are. Even when used, they are only tapped onto the bus, not off, meaning full journey details are unknown. With this backdrop, innovation is limited within the bus sector.



2020 Launch of bus open data service

Buses Minister Baroness Vere has announced a project to standardise and publish information from bus operators. This will enable bus users to:

- Plan routes
- Estimate journey times
- Understand costs in advance

It will provide real-time location data so that passengers can travel with confidence. Information on routes and timetables will be available from early 2020. Followed by location and fares data by 2021. This should encourage more people to choose buses by making them easier to use than ever.

Developers will be able to add the information into existing apps. Or develop new products to improve connectivity for communities.

The Bus Open Data Service is supported by new regulations. Bus operators will be legally required to provide route and timetable data by the end of 2020. Fare, ticket and location data mandatory by 2021.

Bus open data benefit, as outlined by the department for transport

Single source of accurate, up-to-date data on local bus services.

Fully compliant with legislation.

Open data leading to product development, innovation and better communication.

Meets user needs.

Accessible, modern user interface.

Ability to respond quickly to changing needs.

Will meet currently un-met needs.

Reduced costs for bus operators and local transport authorities, improved administration, less duplication, no vendor lock-in.

Logistics

Akin to an individual buying a car; an organisation expects to get shipments:

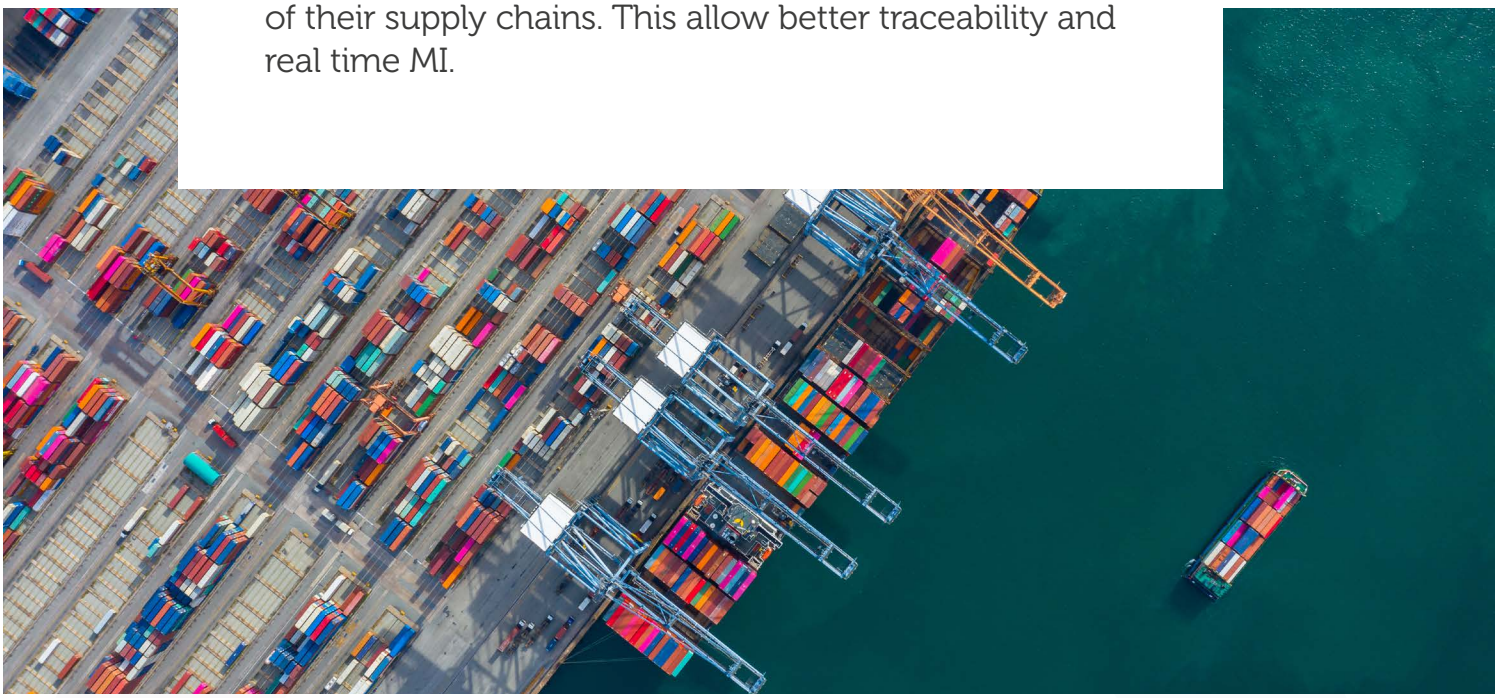
Faster

At a low price

Flexibly

We can link some pressure on the logistics industry to pressures within manufacturing. Customers want personalisation, customisation and speed.

The industry is under pressure to provide data analytics of their supply chains. This allow better traceability and real time MI.



Many logistics companies also serve the individual consumer. Here, there is next to no brand loyalty. Flexibility and price are the decision-making drivers. They also have no interest in dynamically pricing parcels on size. No matter the size, the price should remain flat.

Slowly more and more data is being harvested within the logistics industry. To make real gains they need to start exploring AI and machine learning over this data. Releasing the power of this data, may introduce:

Scale

New Business models

Flexibly

Agility

Factors which are putting pressure on the logistics industry, to embrace big data and provide an enhanced customer experience

Regulatory Environment

IT standards

Internet standards

GDPR and Data Protection

Data analysis and security

Data analysis

Cloud logistics

Blockchain

Automation of workflows

Robotic process automation

AI

Competition

Drones

3D printing

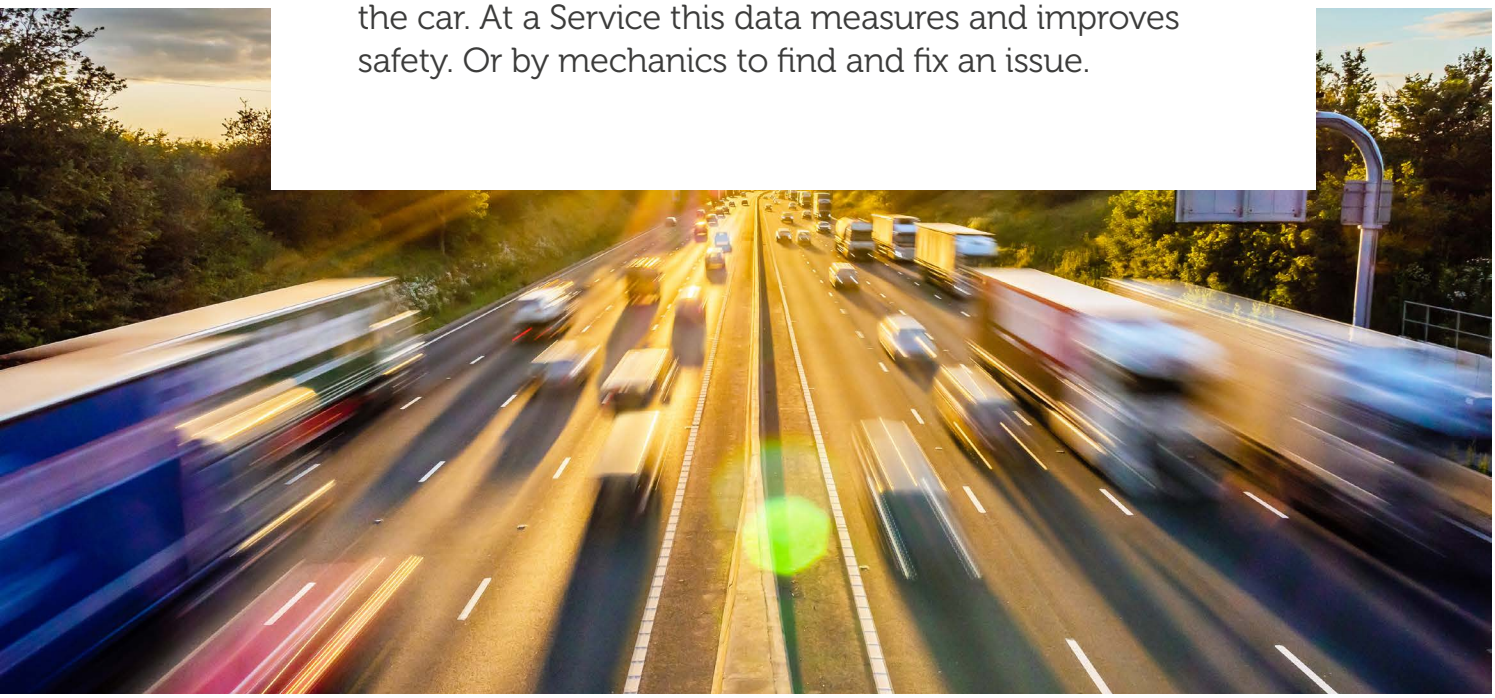
Autonomous vehicles

Chapter four: Autonomous driving

Since the 1990s most cars have collected data. Whether:

Speed **Location** **Emissions**

This data was usually retrieved via physical access to the car. At a Service this data measures and improves safety. Or by mechanics to find and fix an issue.



Car owners then began to connect devices like phones to their cars. Or black boxes to help reduce insurance premiums.

The data cars collect has increased since the 1990s. Cars are currently estimated to collect 25gb of data an hour. This could grow to 4 terabytes with autonomous vehicles.

A self-driving car will need:

GPS

Cameras

Sensors

Radar

Sonar

LIDAR

Cloud Server

AI

A self-driving car needs to understand the world and its context within it. To understand a map of its current location. And interpret road signs, lines, markers and obstacles.

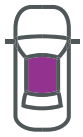
Data sharing between autonomous cars will allow:

- Better management of traffic jam avoidance
- Adaptation to upcoming weather conditions
- Better planning around emergencies.

Store information on:
- Multimedia content
- HD map
- Traffic Information
- Vehicle control

The Cloud

To enable:
- Entertainment
- Self driving
- Path planning



You in the Car

Store information on:
- Vehicle sensors
- GPS
- Camera, LIDAR
- User generated info
- Games, videos etc.

To enable:
- Entertainment
- Self driving
- Road safety
- Navigation
- Social networks

You interacting with other vehicles

Store information on:
- Vehicle sensors
- Overcrowding
- Edge caching

To enable:
- Entertainment
- Self driving
- Cooperative driving

Chapter five: Mobillity as a service (MaaS)

MaaS requires the integration of traditional data (e.g. public transport timetables) with emerging data (e.g. social media). This will need careful navigation, combining public information with private datasets.

Car rental

As cars become autonomous, people are likely to rent them for specific journeys. A rental model suggests the government or business own cars rather than people.

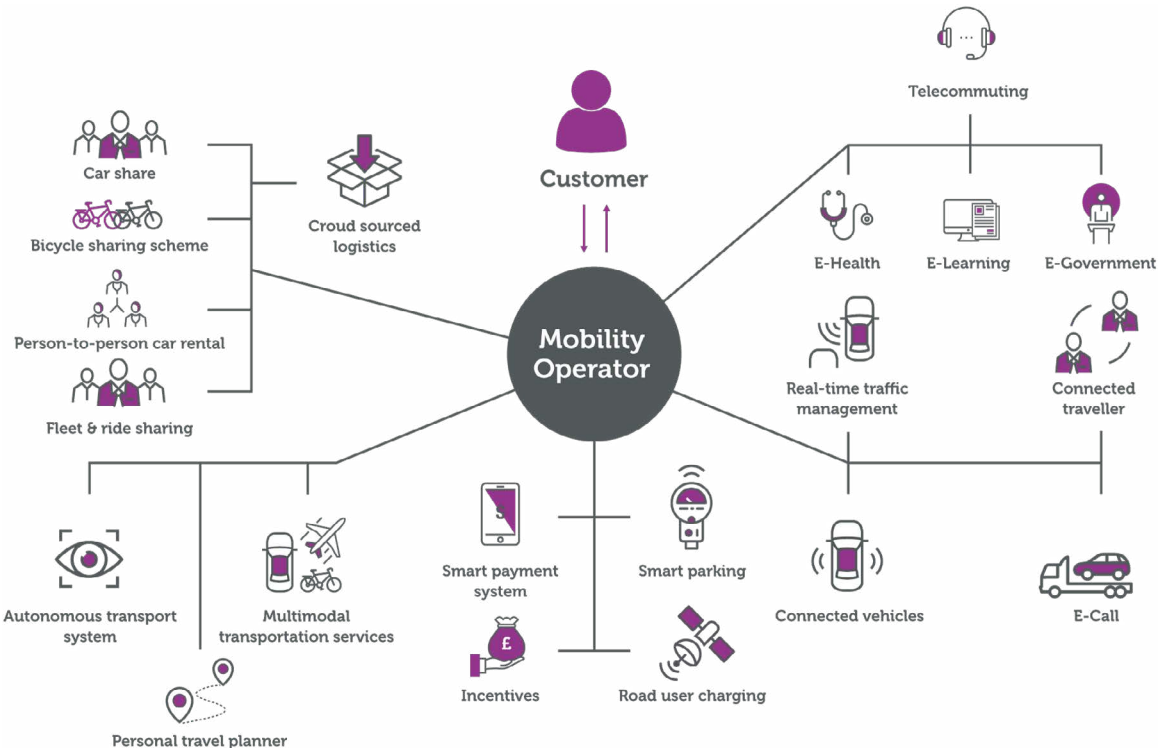
Ridesharing

Companies like Uber and Lyft collect journey data, user ratings, contact details and bank details for both passengers and drivers. This data is also linked and used for other services, for example food delivery. They may also share and sell this data to third parties.

These services are beneficial to the customer. Taking taxis when abroad is much easier with the Uber app.

Yet, there is a risk that current benefits of big data in MaaS is restricted to those who can afford to access it. Government pressure helped introduce Uber Movement. It shares aggregated, anonymised data for Paris, Sydney and serval other cities. Helping policymakers from those areas.

Rideshare services could ease the pressure on infrastructure and climate. Zipcar co-founder created a "Shared Mobility Principles for Liveable Cities". This supports collaboration and open data.



Chapter six: Connected Supply Chain and improved manufacturing

Automotive industry

As with all manufacturing industries, value from big data is in:

Workforce analytics

Operational planning

Inventory management

Procurement analysis

Supply chain optimisation

Process risk analysis

Advanced analytics overlaying a supply chain, makes organisations less reactive and more proactive.

Analysing but also blending data sources can get real insight. Some companies are currently overlapping data on product configuration with emerging trend reports. Allowing them to make decision on automatic gearboxes, and colour options.

As with all Big Data projects, sharing data in the supply chain increases benefits. Blockchain provides the security needed to do this. Protecting the information movement across organisations.

End-to-end blockchain enabled supply chain

Logistics industry

1. Demand forecasting and facility planning

Organisations realise strategic decisions are better where Big Data has informed of variables. A great asset to this analysis has been Ai.

Many organisations have many years' worth of data on:

Transactions

Customers

Locations

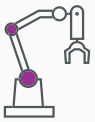
Buying history etc.

Analysing this with Ai can help organisations forecast demand. Allow more agility operationally, and in turn reduce costs.

2. Connected infrastructure for more proactive maintenance and operational awareness

The Internet of Things is the web connectivity of items such as:

HVAC systems



Robotic sorting mechanisms

Electronic forklifts

For transport companies this information can be vital. E.g. to deploy maintenance in advance of critical failure.

3. Analytics for intelligent and efficient freight software

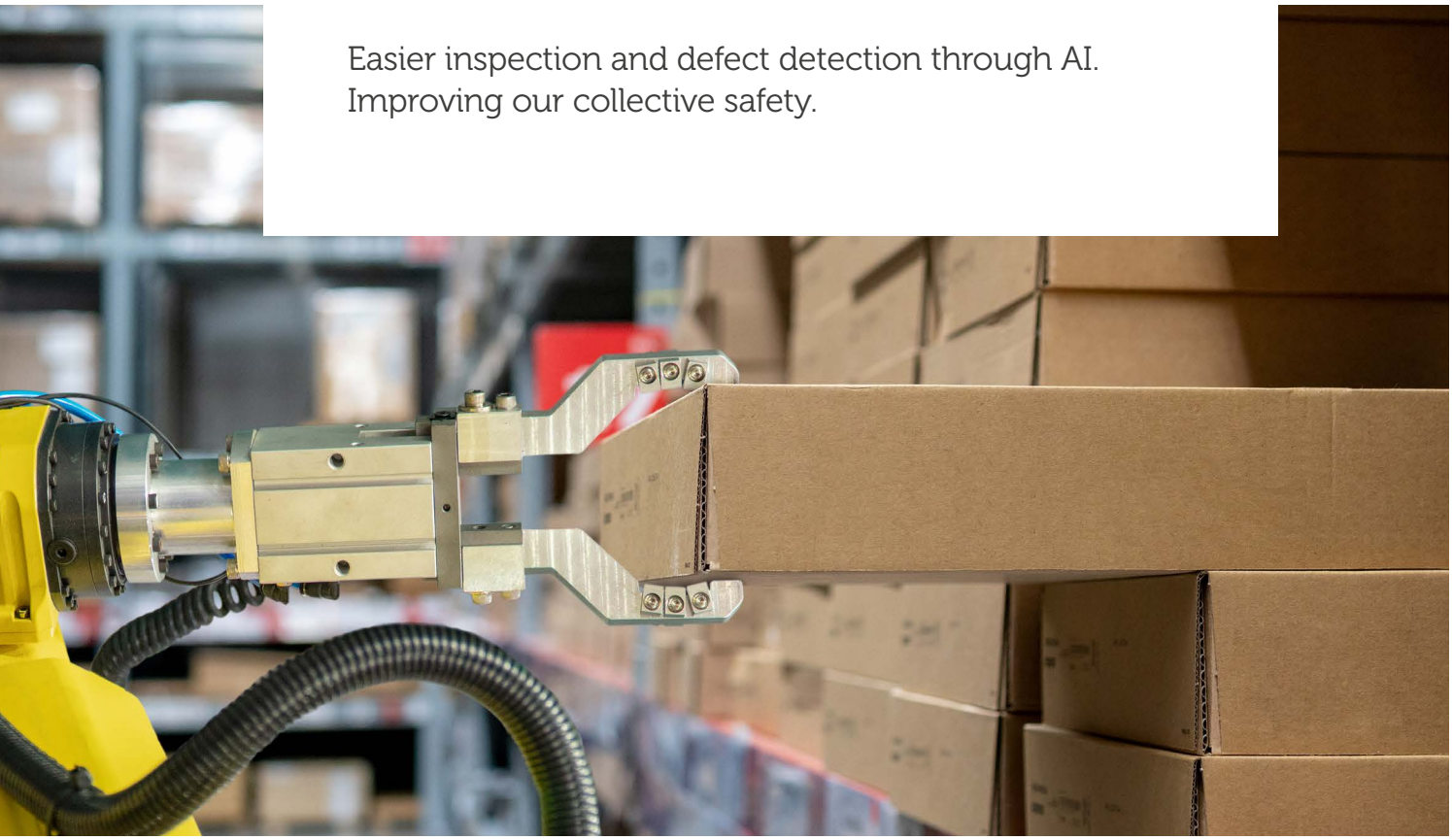
Warehouse Management Systems perform a large proportion of freight decision making than ever. This is thanks to intelligent automation. Robotic sorting in warehouses reduces human error.

4. Machine learning for next level order picking

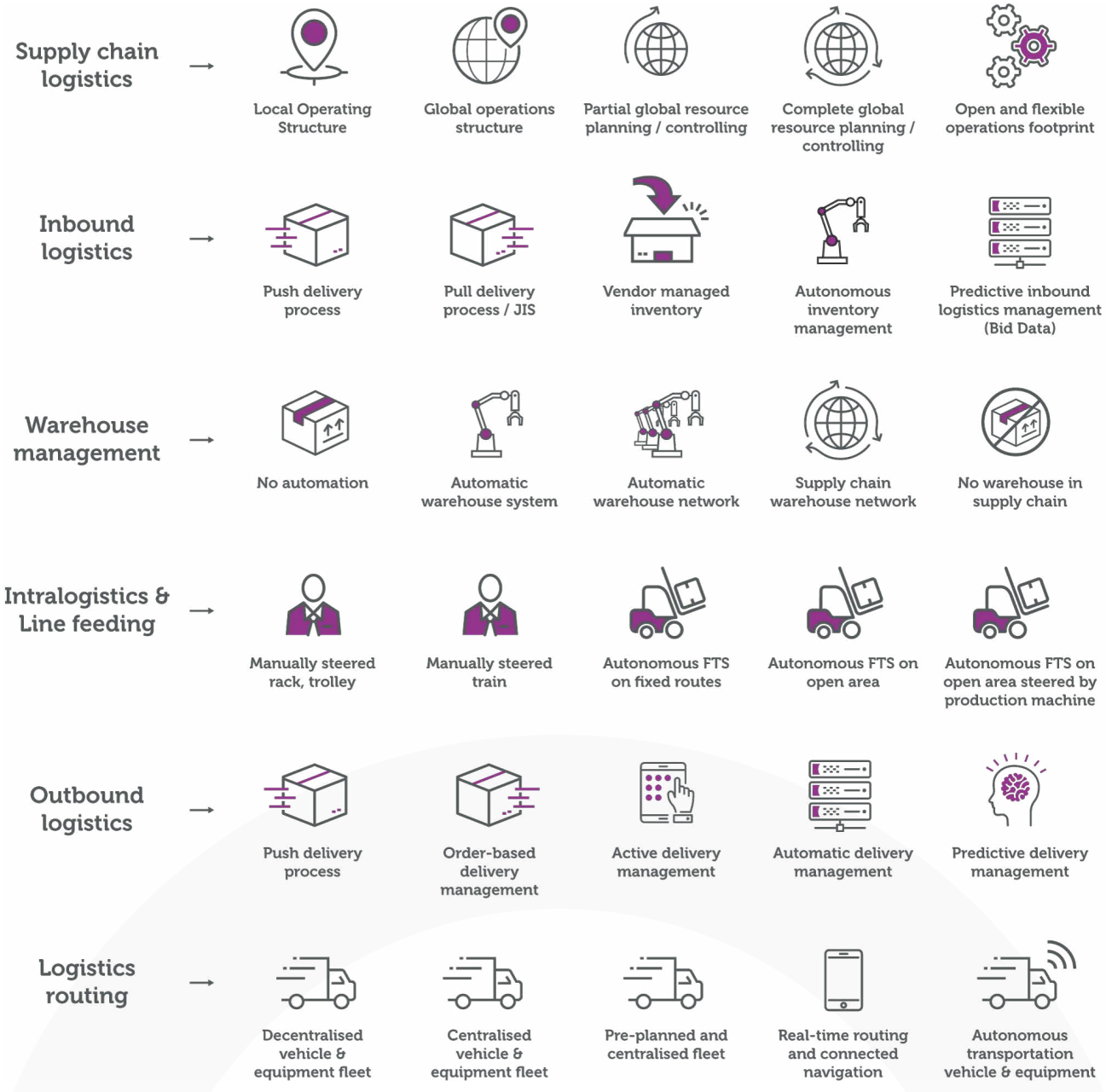
For logistic companies, automating order picking helps manage stock rotation. It makes “first in first out” easier.

5. Automated inspection and defect detection

Easier inspection and defect detection through AI. Improving our collective safety.



Understanding the logistics supply chain and the development path of each element



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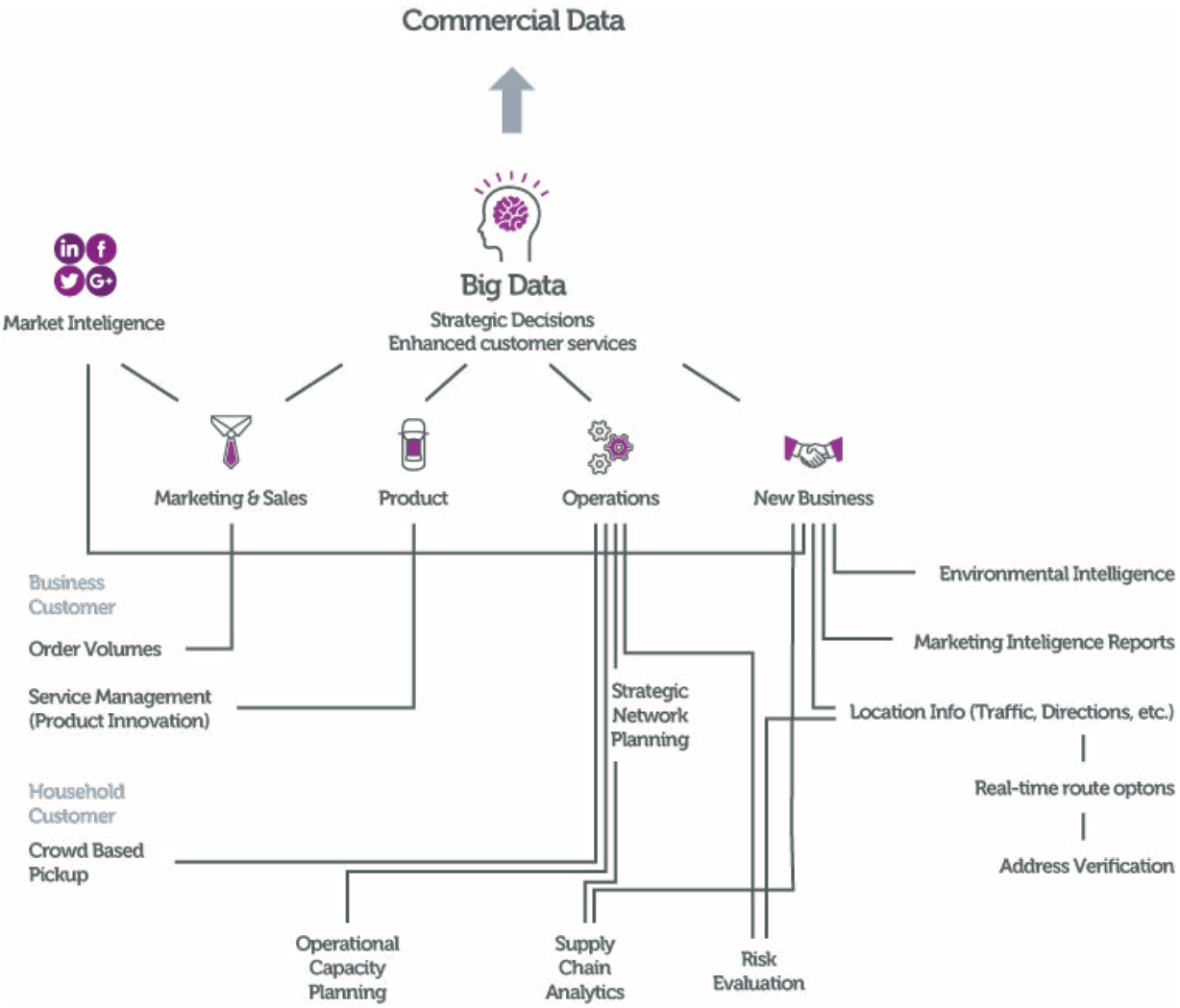
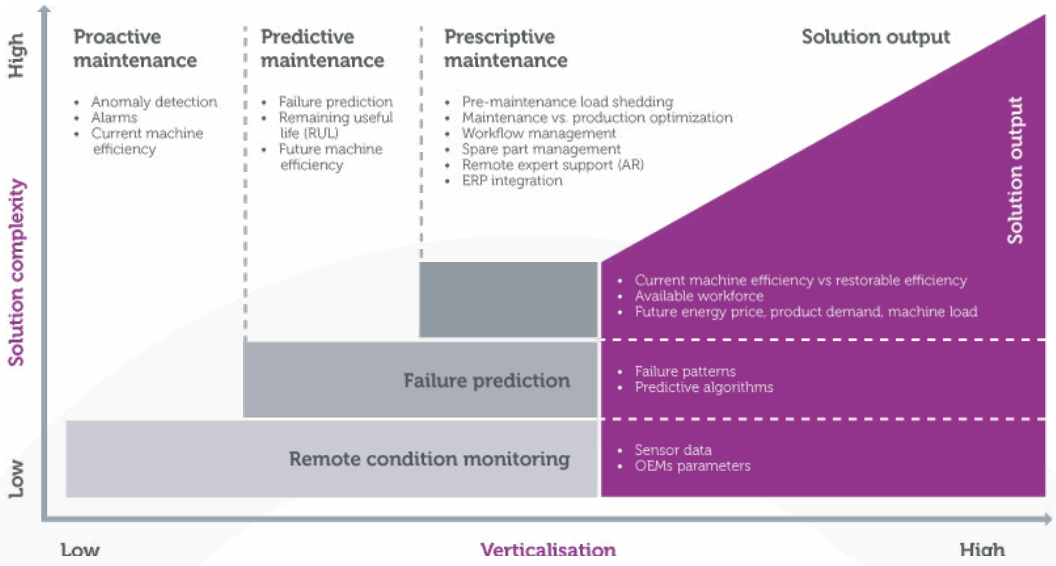
Understanding how big data can drive the business model for the logistics industry business model and operating structure



Chapter seven: Predictive maintenance

The world of transport has been calendar based when it comes to maintenance. For example, "Change your oil after every 3,000 miles". However, we all know things don't break to schedule. Predictive maintenance can aid this process using real time data. Understanding of your vehicle and its parts. And linking to the internet to suggest the best solution or part.



Within the rail industry, big data has been helping with maintenance and in turn safety for quite a while. "Close call" reporting systems allow any worker to report safety hazards at any time. This averages 650 hazards a day. This information is critical to be able to predict serious issues before they happen.

With this number of hazards, it is impossible for someone to read every single report. Let alone decide serverity, and spot trends. Yet this system contains a lot of valuable information.

Advanced computer techniques can anlayse this information on behlaf of the railway industry. The computer can read through every single report. And perform millions of calculations to sort the data and identify patterns in the text.

Machine learning and Ai support this analysis. The programme learns health and safety specific words and phrases to enhance anlaysis. The computer also learns from the analyst's actions. Then it updates its search results based on what the analyst has told it. The computer and the analyst work together to understand the information. And in turn, grow their understanding of the railway. Over time, the computer becomes more effective at finding the right data.

Chapter eight:
Restore and the transport sector

Transforming the paper heavy credit and purchase process of cars

Restore Digital work with many organisations within the automotive supply chain, including dealerships. The process of purchasing a car is complex due to regulatory requirements and the pressure to sell responsibly.

Paperwork created can include:

Ownership papers

Credit papers

Service history

Identification papers

Signature pages

Warranty claims

Other back office paperwork. E.g. HR and Accounts.

On top of this, it is increasingly important to ensure that the person getting credit for a car can genuinely afford to pay it.

When we work with dealerships the paper created onsite is transferred to Restore to digitalise and upload into our document management system DocuWare. DocuWare allows you to manage these documents as well as automate workflows.

Some dealerships also get a high amount of completed forms posted to them. In this case dealerships tend to reroute these forms to a PO Box which Restore collects directly. This saves paper entering the dealership at all. Working to strict SLAs all post collected at 8am is uploaded into DocuWare for the dealership to view at midday.

Search and access your archive records instantly

Reduce your reliance on paper

Increase productivity, manage costs and ensure compliance

Respond with speed and efficiency to enquiries

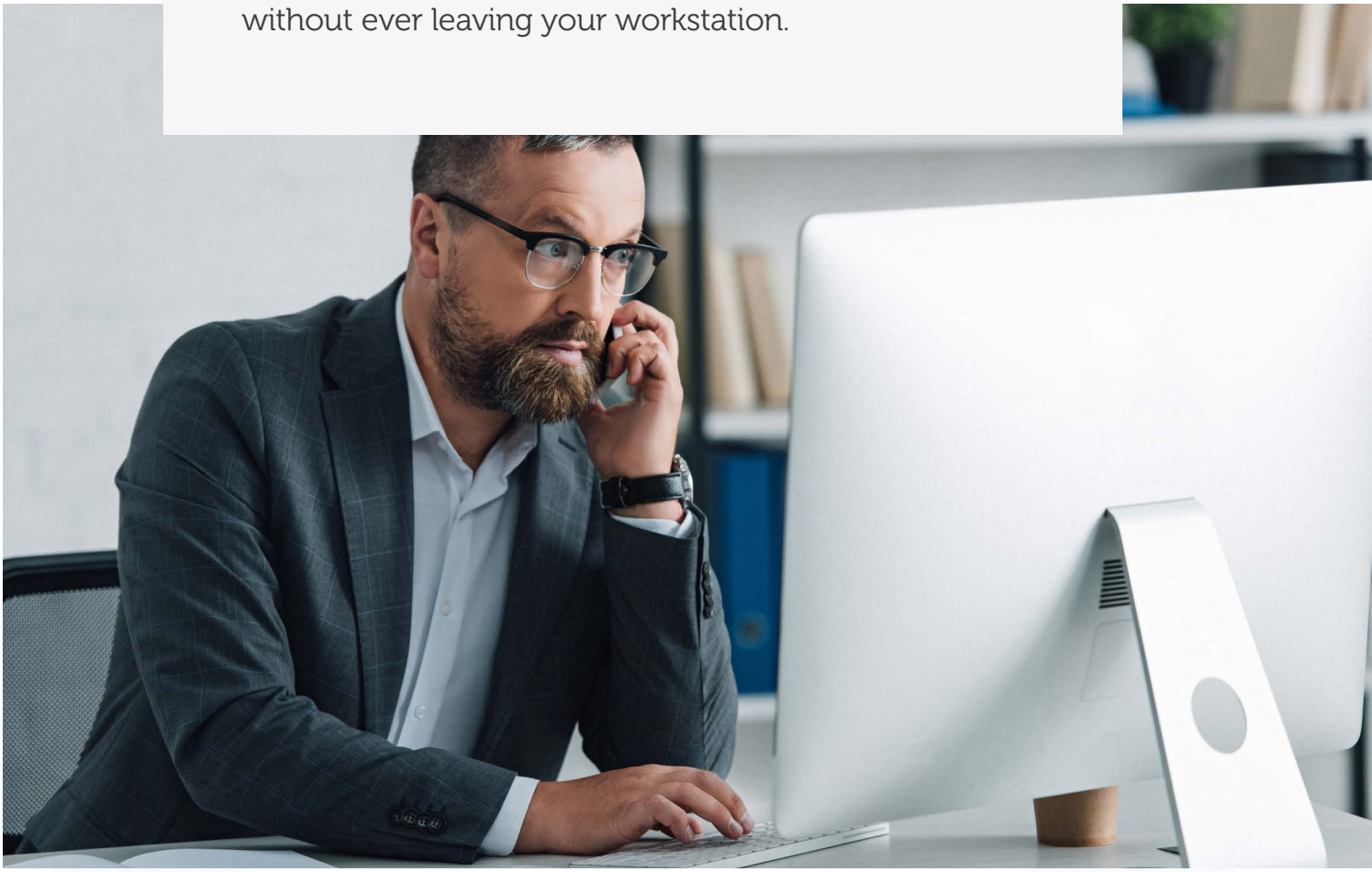
Save time. Save space. Save money.

More secure, enhance DR and have your files mobile whether laptop, tablet or phone.

Secure data storage

Store confidential customer and business data in a secure system. Grant security-based permissions for quick, easy web-based access to view, print and email necessary files within seconds.

Intuitive for all employees to use comfortably anywhere. Whether speaking with a customer or performing an accounting audit, find critical data within seconds without ever leaving your workstation.



Logistics

Despite many large logistics companies having quite sophisticated digital workflows, paper processes still creep in when third party, smaller companies are involved. Many logistic companies are supported by a large long-tail supply chain of local smaller logistic companies, which can introduce not only paper processes but also not a standard way of presenting information.

It's here that Restore support logistic organisations, not only digitalise this paperwork, but extract the information to be entered directly into internal systems, with the original scanned document stored as an attachment.

Rail

Whether it is the paperwork that supports rail maintenance checks or health and safety – Restore work with the rail industry to digitise these documents, allowing them to be available as needed on mobile devices; and easily searchable and auditable.

Complaints process

Complaints can enter a business in various ways. Postal complaints are still prevalent, presumably because 'putting it in writing' literally feels like the most formal and official way to raise a complaint to an organisation.

However, they can also be received through a telephone conversation, email, or increasingly social media.

Collating them through a mailroom workflow, and then digitalising this information can not only speed up the processing of complaints, but can ensure that they are all digitalised, that a copy of the complaint is stored digitally and that the complaints gets allocated to a claims handler as quickly as possible.

By using Robotic Process Automation (RPA), the electronic complaint can then be scanned, and the relevant information can be added to an internal database, with a PDF of the original attached. A suitable claims/case handler can be allocated, and automated emails can be sent to the claim's handler, but also to the complainant informing them of:

Receipt of the complaint

Name of the claims handler and relevant contact details

The next steps and time frames

How you'll be kept informed and when

A copy of the Complaints Handling Procedure

Asking the question of preferred contact method

AI also allows a computer to read unstructured data, gleaming information from handwritten letters, or ones that don't involve completing pre-defined boxes etc. One of the easiest things to do to make the complaints process better, would be to keep the complainant up-to-date and meet all time sensitive KPIs.

Establishing a digital complaints workflow, ideally overlaid with RPA and AI, this would be achievable and automated.

Convert complaints to tickets

When a customer is unhappy, they will definitely reach out through any channel available to them. You can keep tabs on all the customer complaints by converting every interaction with your customers into tickets. This creates order and an audit trail.

Automate for quicker resolution

Automate the process of complaint management right from categorising and prioritising to assigning the customer complaints to the right complaints handler. You can also add pre-formatted responses for repeated use, frequently reported issues or when there's a sudden spike in complaint volume.

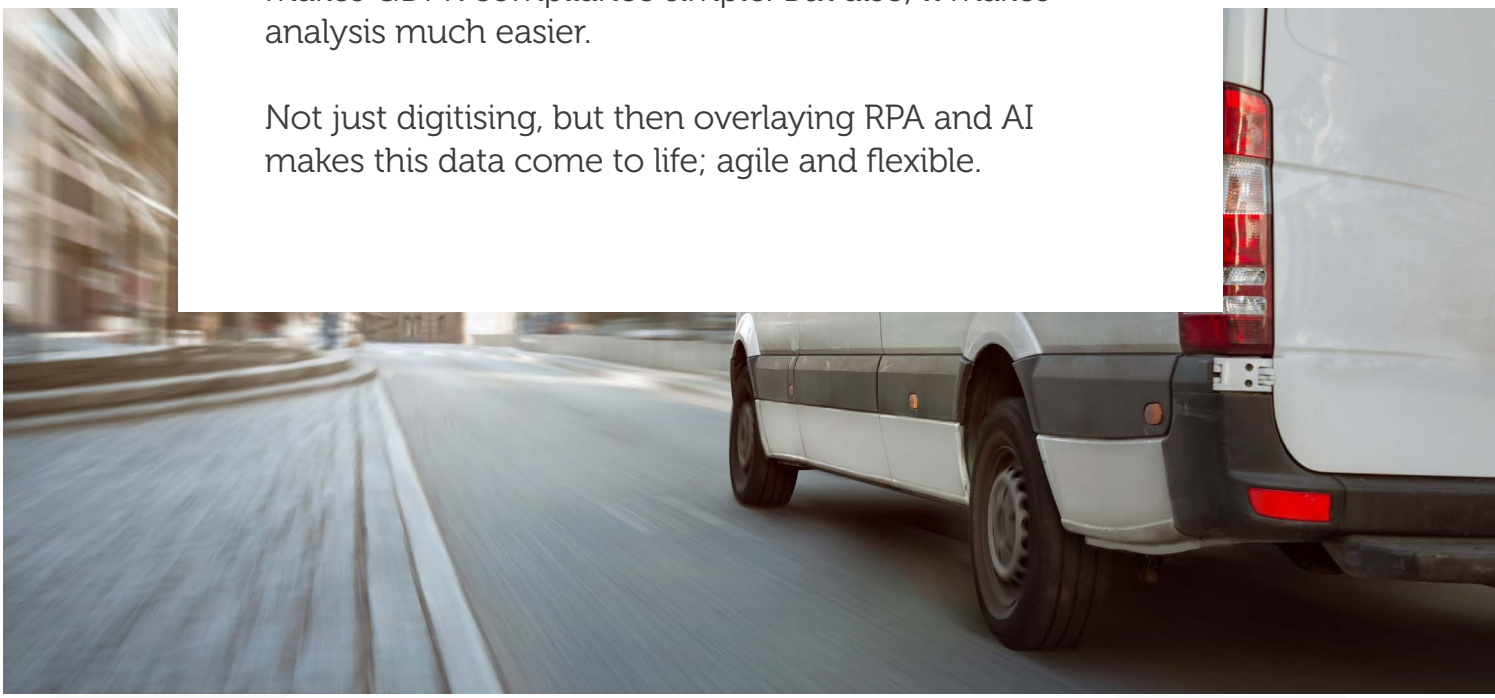
Chapter nine: Conclusion

Data is transforming all industries, but especially so within Transport and Automotive. Big Data is available to provide real insight and help make transformational strategic decisions.

However, stumbling blocks tend to appear as regulation around data is navigated; and data is collected in a way that makes analysing it realistic.

Restore support organisations digitising their data. Digitising archives and day forward paper generation makes GDPR compliance simple. But also, it makes analysis much easier.

Not just digitising, but then overlaying RPA and AI makes this data come to life; agile and flexible.



Restore
Digital

Descriptive technology driven trends and how they could radically change the transport sector

Electrification

Autonomous Driving

E-connectivity

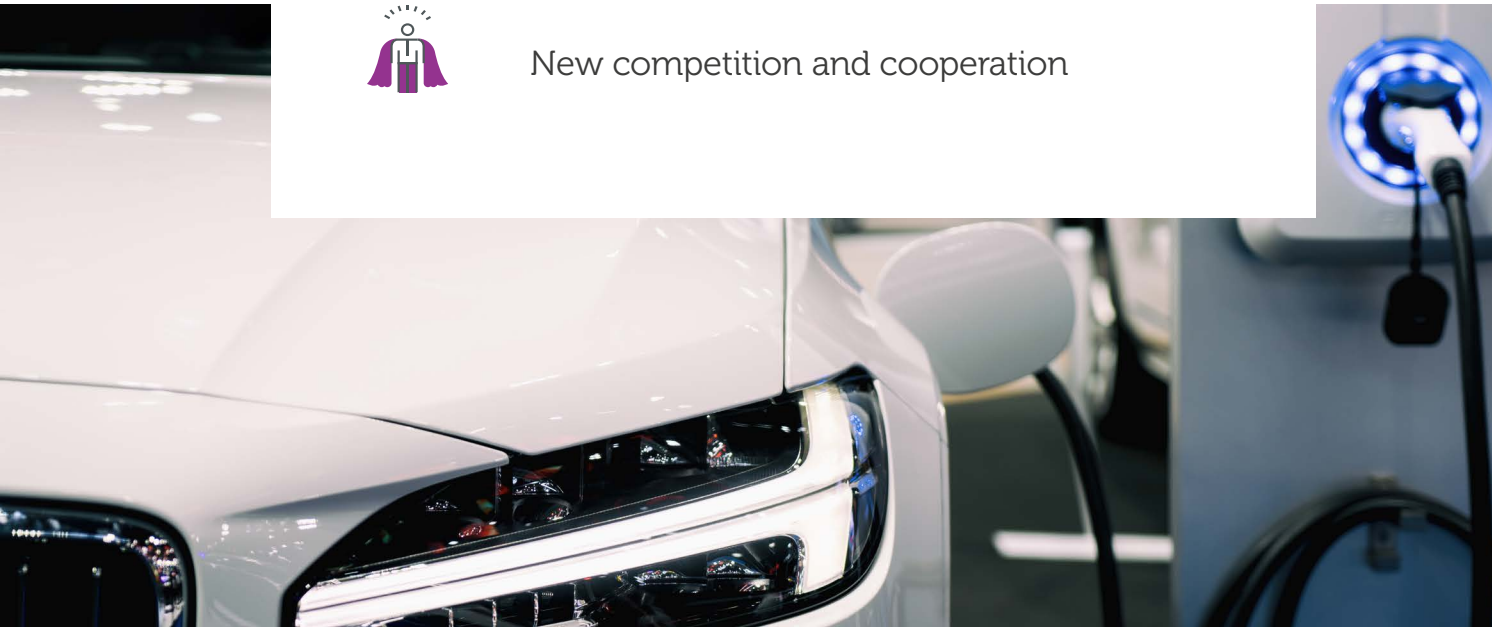
Diverse mobility

Shifting markets and revenue

Change in mobility behaviour

Diversification of advanced technology

New competition and cooperation



There are many factors shaping the future of this industry, and organisations will undoubtably need to change and adapt to remain relevant. Whether this being preparing for autonomous driving or MaaS, both of which we have discussed in this whitepaper.

Big data is only part of the changing landscape bit an important that feeds into the other factors, like smart sensors, the internet of things/vehicles and blockchain.

Automotive Industry - Startups

1,500+ Emerging startups analysed.
2020: Global automotive industry profits increase to 79billion euros.

Internet of Vehicles

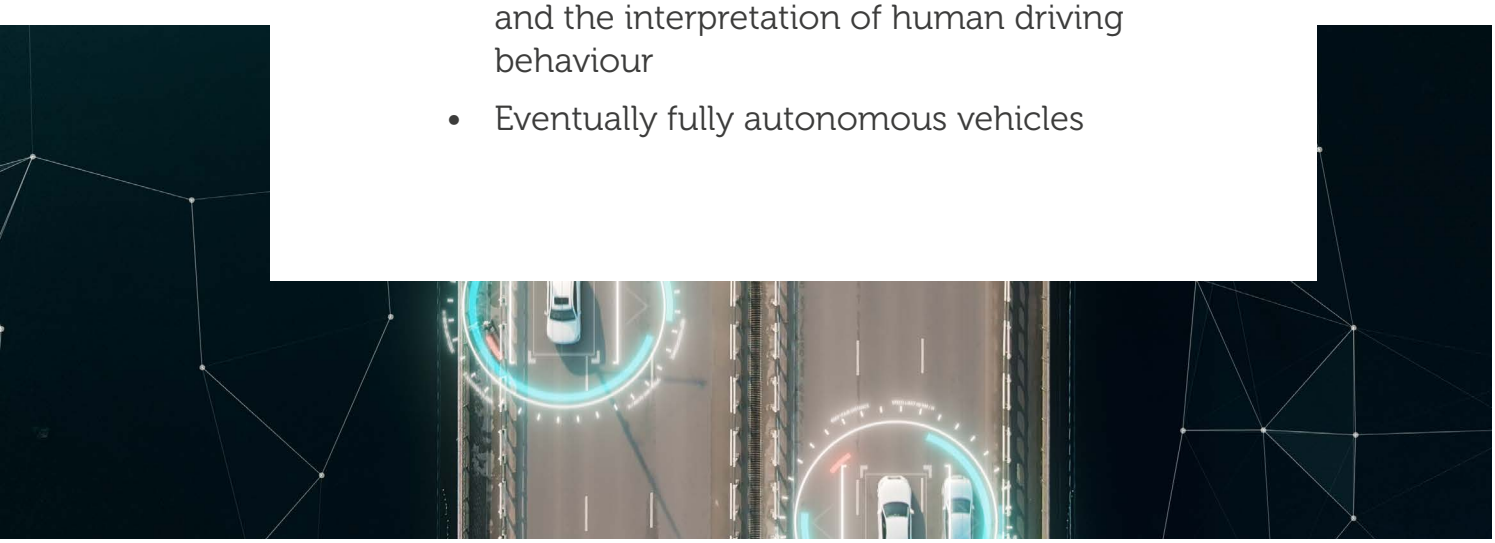
- Connecting Vehicles to smartphones, public infrastructure and other vehicles
- Enabling remote diagnostic services
- Empowering V2X, V2V & V2I communications, vehicle monitoring and self-parking
- Production side: IIoT improves efficiency & productivity

Smart Sensors

- Collecting data (radar, engine, camera) in real-time enabling vehicles to get precise & long-range view of it's surroundings
- Regulating the operation of vehicles and paving the way for autonomous driving
- New sensor-cleaning applications required (deicing, dust or mud removal)
- Soon capable to pre-process & filter data
- Paving the way for a coherent flash automotive LiDAR

Autonomous Driving

- Striving for level 5 autonomy using LiDAR, radar, ultrasound and cameras
- Involving the programming and management of sensors, actuators and car networks
- Advanced sensors, parking assistants, emergency braking, advanced cruise control, and the interpretation of human driving behaviour
- Eventually fully autonomous vehicles

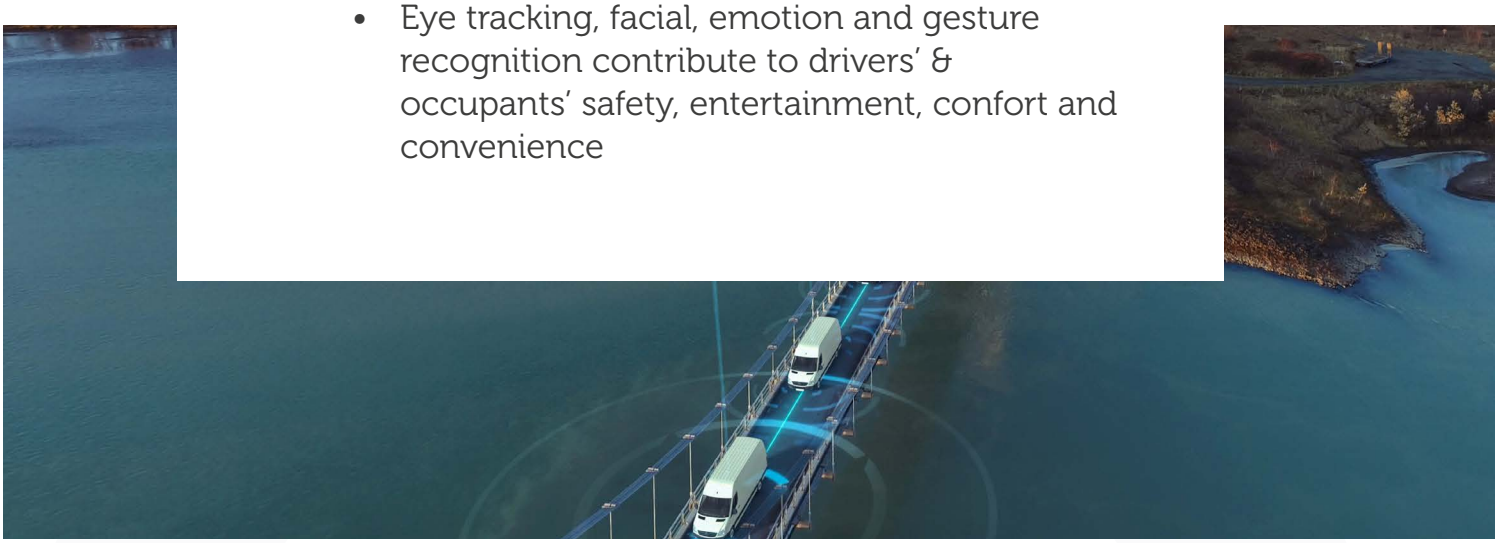


V2V and V2I

- Key challenges are communication, reliability, security, positioning accuracy and vehicle installation
- Solving the coordination challenge between manned and autonomous vehicles
- V2V: sharing data on location, direction, speed, road condition etc.
- V2I: communicating with smart roadway infrastructure (traffic signals, roadway signage, borders, etc.)

Artificial Intelligence (AI)

- Transforms driver monitoring, in-vehicle experience and in-cabin intelligence
- Driver monitoring to detect fatigue and distraction
- Incorporating AI Assistants with advanced natural language capabilities
- Eye tracking, facial, emotion and gesture recognition contribute to drivers' & occupants' safety, entertainment, confort and convenience



Electrification

- Vehicles powered exclusively by electricity and rechargable batteries (EVs) will fully replace fuel-based vehicles
- Challenges remain: infrastructure & battery life; can be solved by startups
- Multifunction electrodes (MFE) incorporate high-power, rapid-charging rate capability with high-energy storage ability

Blockchain

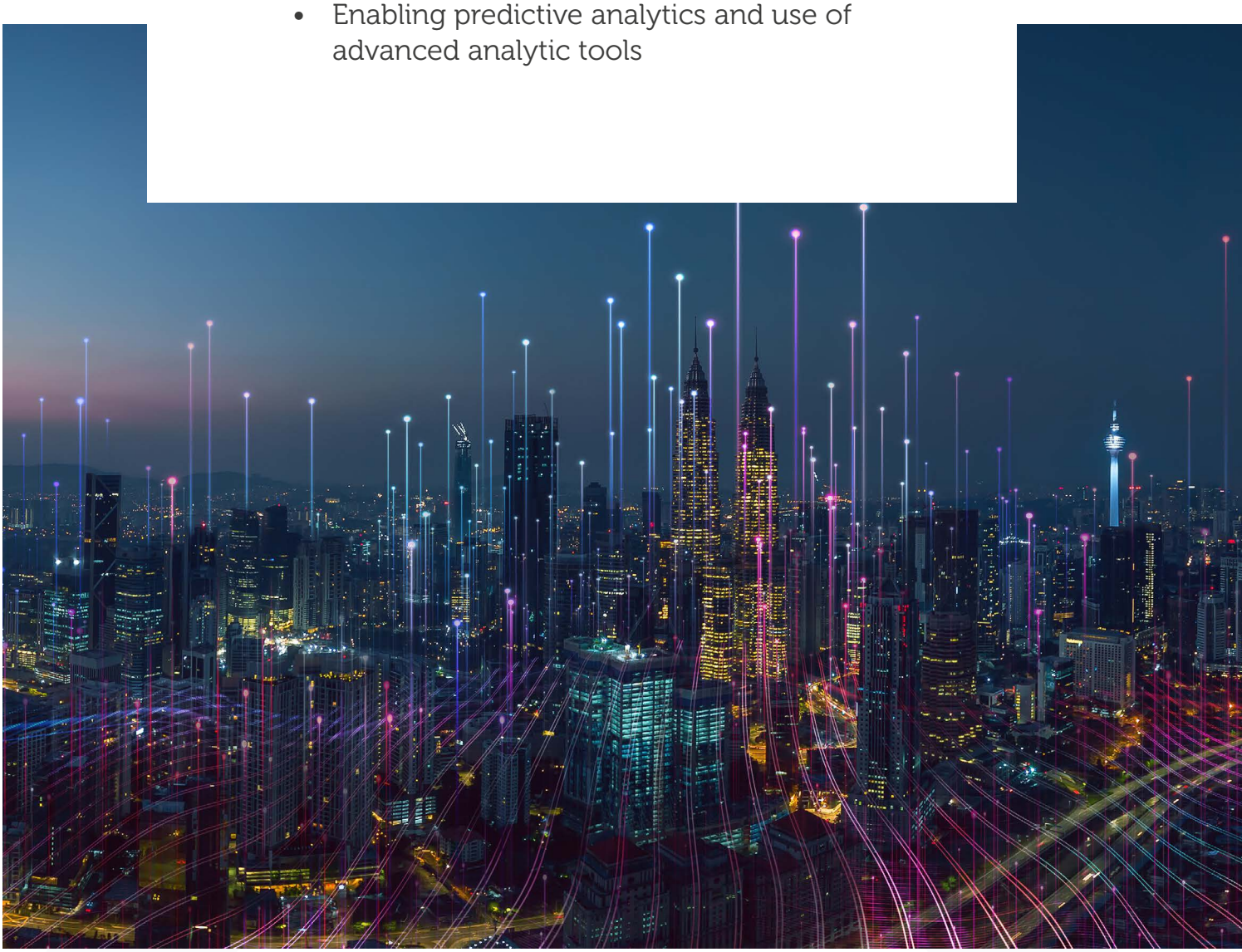
- Creating new business models and cooperation potential for OEMs, manfactures and mobility companies
- Preventing international undesirable inferference in vehicle data
- Creating an accurate protocol enabling the tracking of parts of the supply-chain
- Bundling and storing car data in a way that data integrity is incontrovertible

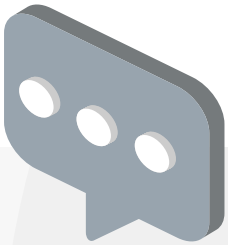
Augmented Reality

- Playing is an essential role in the transition to level 5 autonomous vehicles
- HolographicAR technologies such as heads-up displays (HUDs) for connected vehicles: navigation system, emergency alerts & personalised content

Big Data

- Big Data collected from sensors, IoT and mobile devices creates opportunities for new business models and applications
- Enabling engineers to design road flows according to actual traffic patterns
- Fleet learning, data-enabled features, and car data monitisation
- Enabling predictive analytics and use of advanced analytic tools





If you have any questions, or would like to discuss anything further either give us a ring or pop us an email:

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