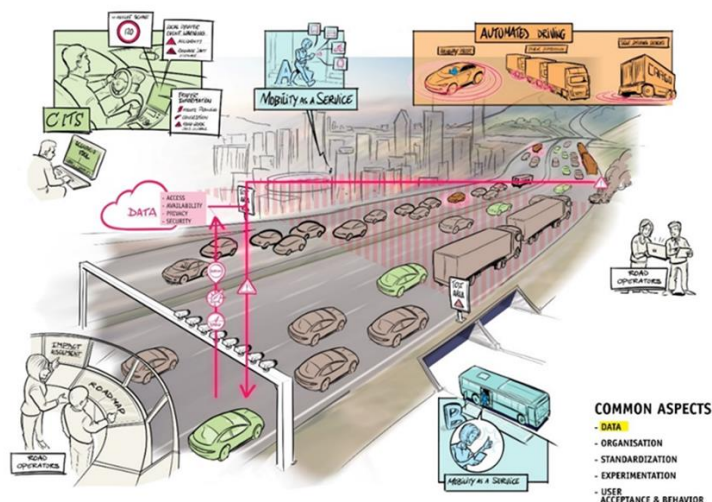# DIRIZON

advanced options for authorities in light of automation and **DI**gitalisation ho**RIZON** 2040

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TNO - Netherlands Organisation for Applied Scientific Research

Joint dissemination of H2020, CEDR projects and other initiatives related to CAVs and Infrastructure

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DIRIZON

- Two-year research project commenced in September 2018

- Funded under the **CEDR 2017 Automation** call (www.cedr.eu/call-2017-automation/)
  - A. How will Automation change the core business of NRA's?
  - **B. What new options do NRAs have from Digitalisation and   Automation?**
  - C. Practical learnings for NRAs from test sites

- **Consortium**
  - TNO (coordinator)
  - ROD-IS;
  - Albrecht Consult
  - AustriaTech
 - HERE (Associate Partner)

- https://www.dirizon-cedr.com/

Objectives & Approach

In light of the step-by-step transition towards the full digitalization of NRA's road networks, for 3 no. Specific Use Cases;

- Provide a concept for a technical data-exchange platform, defining data issues & requirements

- Provide corresponding business model archetypes for the exploitation of the data-exchange platform,

- Identify the stakeholder field, how they perceive their roles and responsibilities and how these can involve

- Identify the NRA's current and future relationships with stakeholders
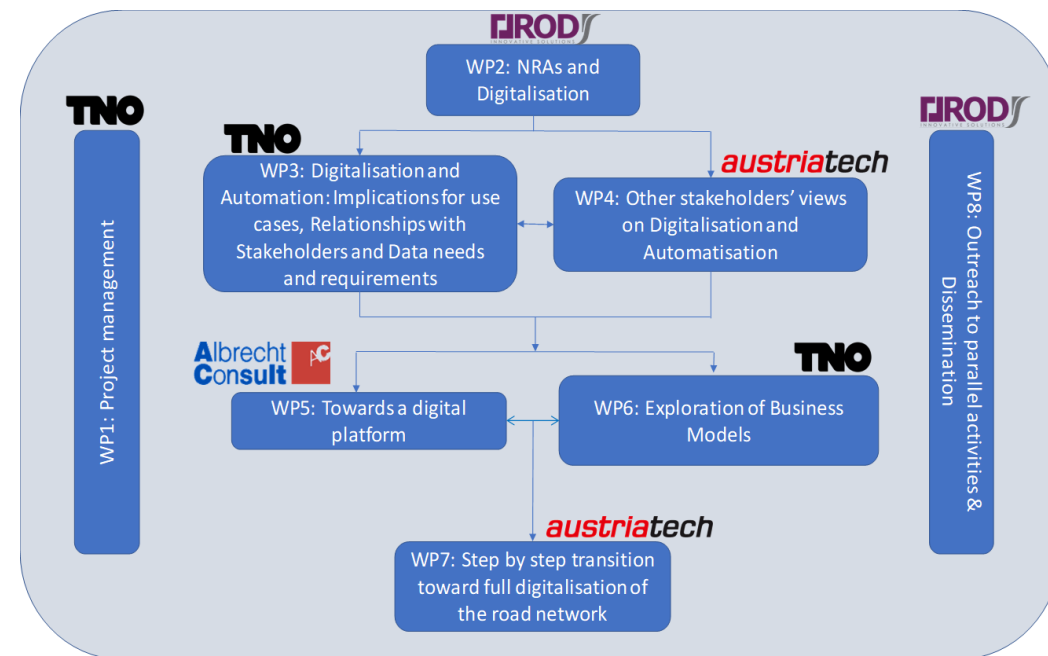
Outputs

- A strategy for NRA's digitalisation of their assets, that includes relevant stakeholders, data needs and requirements;

- A practical roadmap (with a critical path) for step-by-step development and transition of road operation to digitisation (i.e. an implementation roadmap);

- A proposal for a set of business models for co-financing and organize data-exchange between public and private sectors;

- Proposal for data-exchange (platform) options;

- Dissemination of findings at national and international levels.

NRAs and Digitalisation

Key Findings

- **_Collaboration_** is a significant barrier which can only be improved through the NRA's direct involvement in projects with other relevant actors. Through collaboration 'trust' will be built between the actors, particularly in relation to data
- **_Holistic approach_** is required with involvement of all actors, including but not limited to NRA's, Governments, third parties, road operators and other stakeholders
- **_Testing_** is a significant prerequisite for the implementation of C-ITS and even more so for automated driving
- **_Disparity_** in levels of Digitilisation & Automated Driving across countries (planning, development, implementation/deployment)
- **Others** include;
  Financial barriers/uncertainties; Roles and responsibilities unclear; legal/regulatory issues; public acceptability; Interoperability; Data issues (privacy, cybersecurity, sharing, quality, ownership etc.); Skills requirements

DIRIZON USE CASE 1	
Use Case Name	Provision of HD Maps for Automated Mobility
Use case reference /id	DIRIZON-UC-1
Description	The provision of detailed mapping in a machine-readable format supports a connected automated vehicle's (CAV) ability to understand its precise positioning, plan beyond sensor visibility, possess contextual awareness of the environment and local knowledge of the road rules. Hence, HD Maps can assist automated vehicles to optimize:

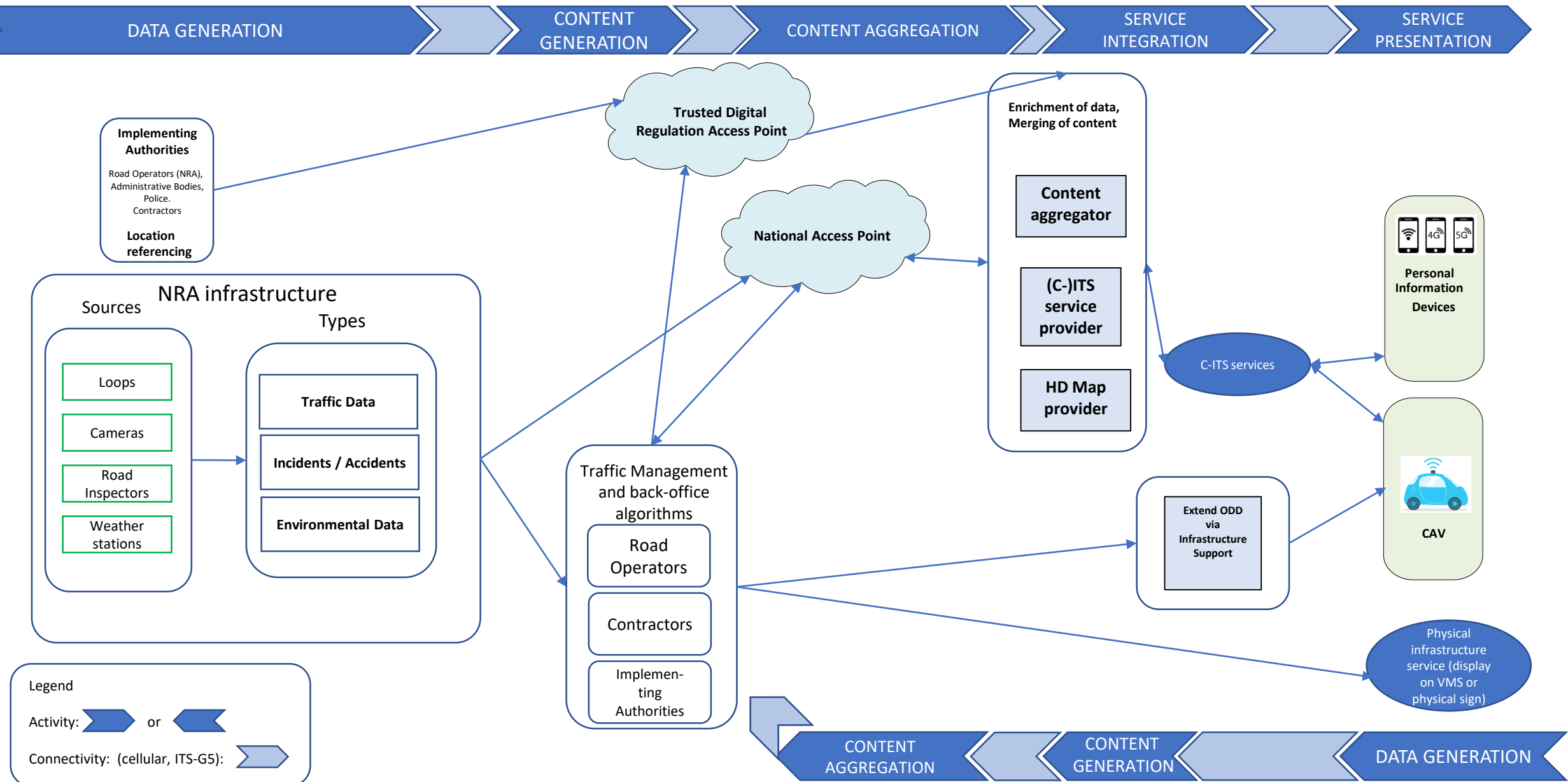| DIRIZON USE CASE 2	
Use Case Name	Distribution of Digital Traffic Regulation
Use case reference /id	DIRIZON-UC-2
Description	Distribution of digital traffic regulation becomes more and more relevant for CAM (Connected and Automated Mobility as well as for other areas such as smart cities, and is currently being addressed in more detail within CEN/TC 278 WG17. It has been found that, currently legal responsibilities and authorisation schemes vary a lot between countries, states and cities.

DIRIZON USE CASE 3	
Use Case Name	Infrastructure Support Services for CAD
Use case reference /id	DIRIZON-UC-3
Description	Infrastructure support for Connected and Cooperative Automated Driving (ISAD) is digitized information, including representations of the physical environment, to support CAD functioning. Map data could be complemented by physical reference points (landmarks, signs, beacons). This Use Case provides digital and physical infrastructure support (including traffic management measures) of vehicles in a mixed environment, supporting CAVs by extending their ODD's and improving safety, traffic flow and environmental impacts.

Digitalisation and Automation

- Refinement of use case definition
  - Relationship among use cases
  - Extension of description
  - Process flow diagram, "story line"

- Focus in on data quality criteria and possible levels for Connected Automated Driving
  - Sources: EU-EIP, C-Roads, TNO report (Calvert, Soekroella) and INFRAMIX / ISAD, contact with L3 Pilot project
 - Data Quality Criteria are influenced by the Data Platform Architecture and Business Models
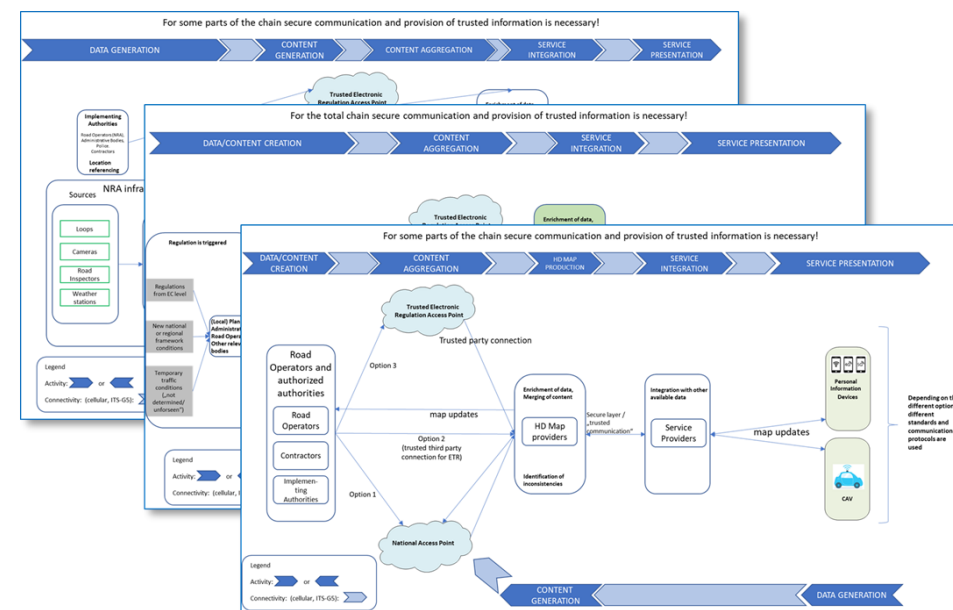
For some parts of the chain secure communication and provision of trusted information is necessary!

DATA GENERATION → CONTENT GENERATION → CONTENT AGGREGATION → SERVICE INTEGRATION → SERVICE PRESENTATION

Trusted Digital Regulation Access Point

Implementing Authorities

Road Operators (NRA), Administrative Bodies, Police, Contractors

Location referencing

National Access Point

Enrichment of data, Merging of content

Content aggregator

(C-)ITS service provider

HD Map provider

NRA infrastructure

Sources

- Loops
- Cameras
- Road Inspectors
- Weather stations

Types

- **Traffic Data**
- **Incidents / Accidents**
- **Environmental Data**

Personal Information Devices

C-ITS services

Traffic Management and back-office algorithms

- Road Operators
- Contractors
- Implementing Authorities

Extend ODD via Infrastructure Support

CAV

Physical infrastructure service (display on VMS or physical sign)

Legend

Activity: ▶ or ◀

Connectivity: (cellular, ITS-G5): ▶

CONTENT AGGREGATION ← CONTENT GENERATION ← DATA GENERATION

Data categories based on use cases (plus examples)

- Static data: digitized information about the road and traffic regulations
- Traffic data: traffic volume, speed, occupancy, and travel times per lane, plus vehicle types and the SAE levels
- Events or conditions are primarily safety-related (SRTI)
- Dynamic regulations: include dynamic speed limits; road, lane and bridge closures; and road works
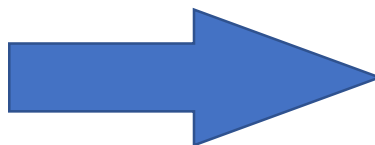
DATA CATEGORIES ➡ *DATA QUALITY CRITERIA*

Data Quality Criteria
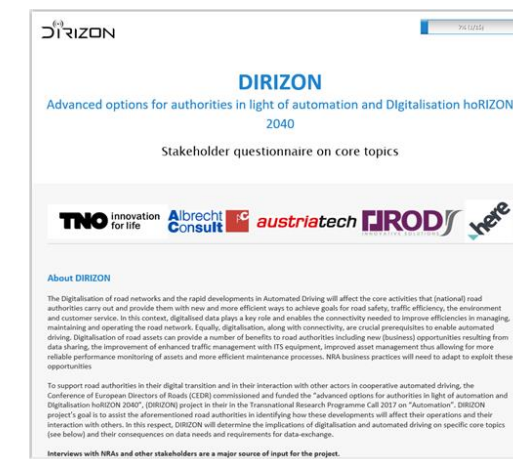
Criterion	Definition
Geographical coverage	Road classification in the road network covered by the service
Refreshment rate	The rate at which the data are updated in the vehicle, regardless if there has been a change in the data provided or not
Availability	Percentage of the time that the service is available with fresh data. Expressed as a percentage of the time
Timeliness/ Latency	the total time between the detection of a change and the delivery to the user
Location accuracy	Accuracy to within a specific distance
Classification correctness	Correct identification of, e.g., a static road element, a vehicle type, event or condition, or a dynamic regulation
Event coverage	Percentage of the actually occurring events which are known to be correctly detected and published by type / class, time and location
Variance	for many or all of the criteria, a variance should be provided
Predictability	use of information in forming predictions (this criterion results from the experience of Service Providers with data provided for Green Light Optimal Speed Advisory (GLOSA)).

Quantification of data quality levels and realization of the process flow

- Learn from the Proof-of-Concept of the Data Task Force and other pilots: determine additional standards for data exchange, agree on standards for access, and explore where the quality checks need to take place and by which actors.

- Use pilots to refine data needed, data quality standards, implementations and profiles: implementations should be correct, taking into account the coverage and range of communication.

- Engage with OEMs to achieve Operational Design Domain extension of connected and cooperative automated vehicles.

- Consider the use cases in a pan-European context.

Other Stakeholder Views

- **Collecting views of *other* stakeholders (based on the 3 Use Cases) on:**

  – Activities and actors

  – Data needs

  – Data exchange (incl. prerequisites)

  – Roles and responsibilities

  – Security, Data protection, Privacy

  – Governance

  – Challenge the views of NRAs with the results of other stakeholder groups

Towards a digital platform

- **Provide data-exchange (platform) options by focusing on connected stakeholders**
  - Any future Cooperative Connected and Automated Mobility (CCAM) scenario will generate a need for substantial improvements in data exchange between backends of road authorities, service providers & OEM backends (cloud-to-cloud services).
  - Appropriate services would pave the way for providing data services directly into vehicles, mobile devices or aftermarket devices used inside vehicles and, vice versa, providing sensor-data back to the connected backends.

- **Current focus on**
  - Current developments and transferable, decentralized platform concepts like the International Data Space.
  - Potential cooperation models between NRAs, service providers and OEMs like the Data Task Force Proof of Concept (PoC) and further developments regarding National Access Points.
  - Derivation of data exchange requirements and related data exchange options.

Exploration of Business Models

- **Identify which roles and business models drive the exploitation of the data-exchange concepts.**
  - Digital services in any future CCAM scenario will be created and delivered by an ecosystem of international and national, governmental and commercial, small and large service providers using in-car, mobile or aftermarket devices.
  - The data-exchange concepts and their governance must ensure that these service providers (*including* NRAs) are optimally facilitated in the creation and proper functioning of these services is, e.g. by providing added value elements, e.g. by enriching services, toolkits, good governance and consistent access in all countries
  - From the perspective of the service providers, whose use determines the value of the data-exchange, a seamless and uniformly available platform for building their services on top of would be ideal. But how to realise that decentrally, with which governance and conditions?
- **Current focus on**
  - Current developments and transferable, decentralized platform concepts like the International Data Space (IDS).
  - Potential governance models between NRAs among themselves and service providers and OEMs.
  - Linking scenarios, data-exchange concepts, international heterogeneity, implications for exploitation and future pathways to facilitate

Step by step transition towards full digitalisation of the road network

- **Analysis of the outcomes of previous work(packages) elaborations into consideration with focus on the transition steps towards full digitalisation**.

  - Elaborating a sequence of actions/measures, ensuring a proper sequence from a technical, as well as process point of view

  - Identification of recurring patterns to identify areas for synergies or faster need of action

  - Elaborate recommendations for short-, medium- and long-term actions

  - Suggest an agile and flexible process to adopt uncertainty (also with respect to other actors)

  - Draw a consolidated picture

Thank You

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