



# Webinar Introduction to FESTA

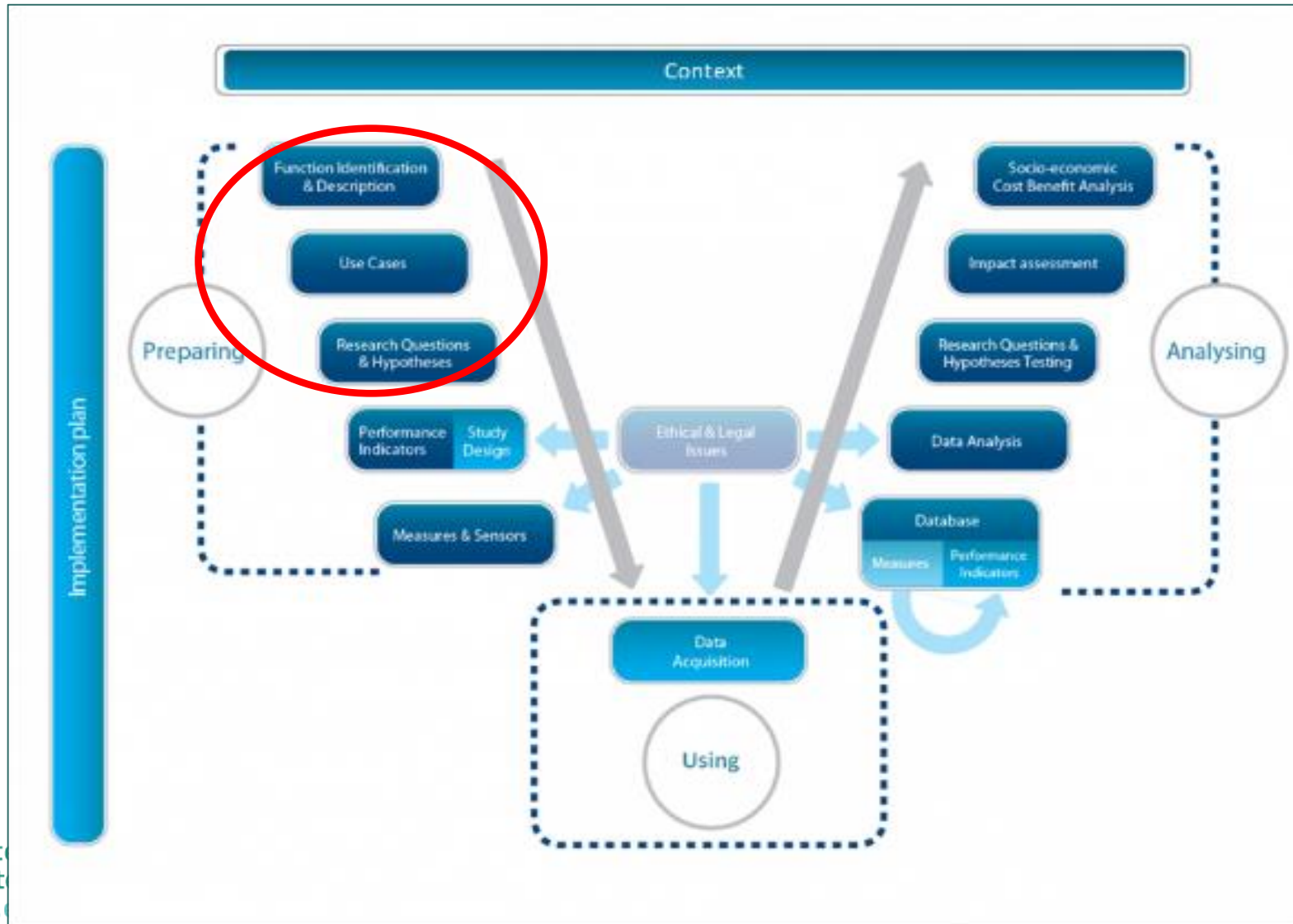
Use cases, research questions and hypotheses

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# Use cases, research questions and hypotheses



# Context

An FOT can always be related to a wider perspective than is defined by just a description of the function to be tested

Could be:

- Problem area being addressed
- Policy objective of the study

For vehicle automation, we are talking about something that could be a societal game-changer, what are the wider lifestyle, transport, economic and social impacts?

# From functions to performance indicators

- Step 1: Selection and description of functions
- Step 2: Definition of use cases and situations
- Step 3: Identification of the research questions
- Step 4: Creation of hypotheses
- Step 5: Link hypotheses with indicators for quantitative analyses

# Functions and use cases

## Functions

- Single or combination of functions
- Cooperative systems: add complexity of infrastructure and multiple vehicles
- Connected and automated vehicles: could be even entire vehicles in interaction with infrastructure

## Use cases

- A specific event in which a system is expected to behave according to a specified function
  - For example: when is valet parking supposed to be operational? In what situations and under what conditions?

# Research questions

## Address stakeholder issues

Examples:

- Is it good for
  - Safety
  - Environment
  - Mobility
  - Traffic efficiency
- What is the usage of the system?
- How well is it accepted?
- Does it work under all real-life conditions?



# Research questions ideas

## *LEVEL OF SYSTEM USAGE*

- What factors affect usage?
- How do driver characteristics affect usage?

e.g. traffic density

e.g. age

## *IMPACTS OF SYSTEM USAGE*

- What are the impacts on safety, mobility, efficiency, environment...?

e.g. accidents

## *IMPLICATIONS OF MEASURED IMPACTS*

- What are the implications for policy?
- What are the implications for business models?
- What are the implications for system design and development?
- What are the implications for the public?

e.g. for emergency services

e.g. pricing models

e.g. HMI

e.g. changes in legislation

# Hypotheses

“A specific statement **linking a cause to an effect** and based on a **mechanism linking the two**.

It is applied to one or more functions and can be **tested with statistical means** by analysing specific **performance indicators** in specific **scenarios**.

A hypothesis is expected **to predict the direction** of the expected change.”

- Example of **research question**: “Does having a Forward Collision Warning system improve safety in driving?”
- Example of a **hypothesis**: “Forward Collision Warning will have the direct effect of an increase in minimum Time to Collision.”



# Hypotheses generation

- Top-down: starting from expected **direct** and **indirect** effects on users and non-users, and **interaction** between users and with systems
- Top-down: starting from impact areas (safety, mobility etc.)
- Bottom-up: starting from use cases by defining specific scenarios

From hypotheses performance indicators can be defined, e.g. the definition of time-to-collision

**Generating** and **prioritizing** research questions and hypotheses is an **iterative** and **collaborative** activity

# Top down example from safety impact area

- Primary measure affecting safety would be the

**Number of events**

- Secondary factors affecting the number of events:

**Exposure of the vehicle on the road**

- Exposure can be measured with variables:

**Length of journey, Road type used**

- These variables lead to research questions:

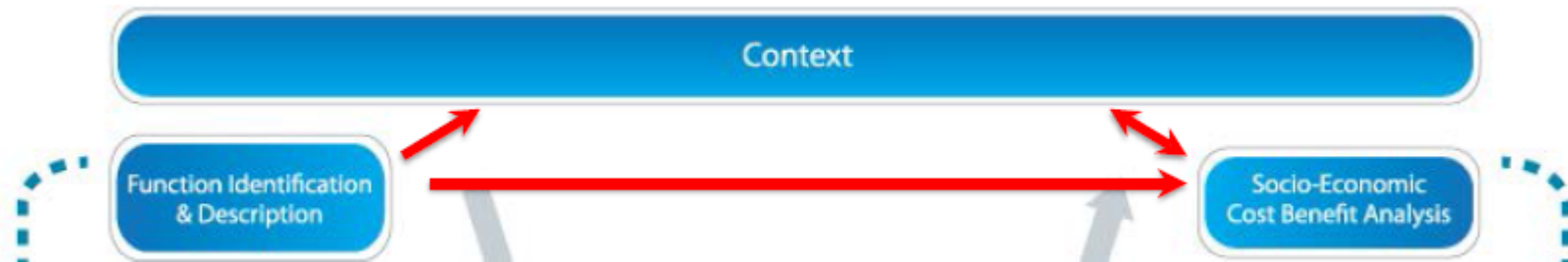
**Does the system affect the length of journeys?**

- Hypotheses that can be tested in a statistical manner (combined with use case approach):

**Journey lengths will increase, The use of urban roads will increase**

# Relevance for automation pilots

- For vehicle automation, we are talking about something that could be a societal game-changer
- So, the issues are what are the wider lifestyle, transport, economic and social impacts?
- New impact areas to be defined
- And many questions to be answered....





# Thank you!



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