MODALES EVALUATION PLAN

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MODALES innovation solutions



Retrofits

6. Diesel-saving technologies for cars & vans 7. NOxBUSTER for buses and trucks 8. Diesel particulate filter servicing

CHECK ENGINE

On-Board Diagnostics

9. More robust & durable emission control systems 10. Enhanced OBD functionality as an anti-tampering measure



Periodic inspections 11. Enhanced inspection

procedure to trap tampering 12. Roadside emissions testing

Driver

1. Low-emission driving style & training 2. Guidelines for regular maintenance 3. Use of adaptive cruise control & navigation to avoid congestion 4. Increased awareness of emissions 5. Real time indication of emission (app)

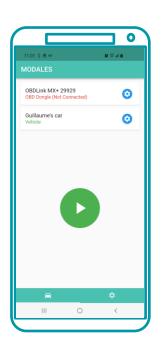
Exhaust emission

CO2, CO, HC, NOX, PM, PN

Brake and tyre/road wear Fine and ultrafine particles (PM, PN)

MODALES technology solutions: DRIVER

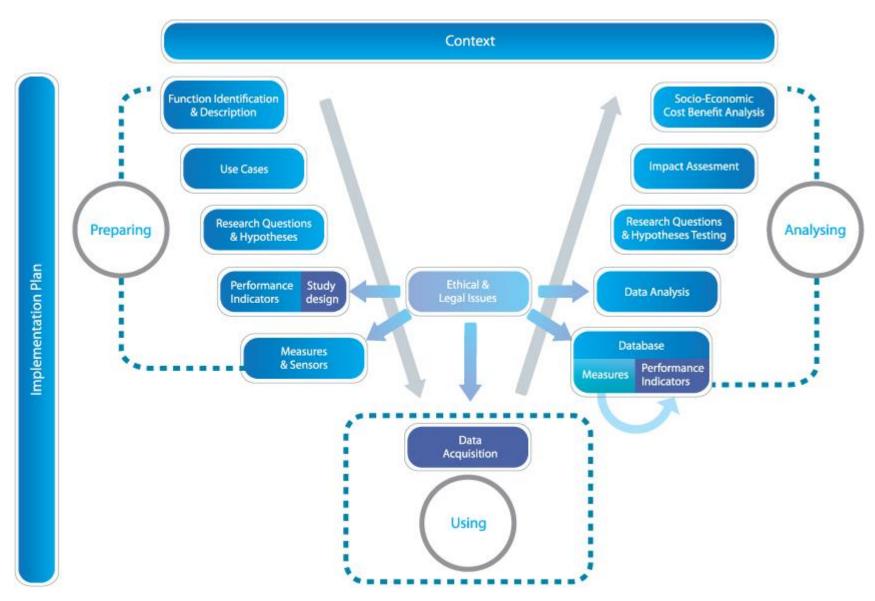




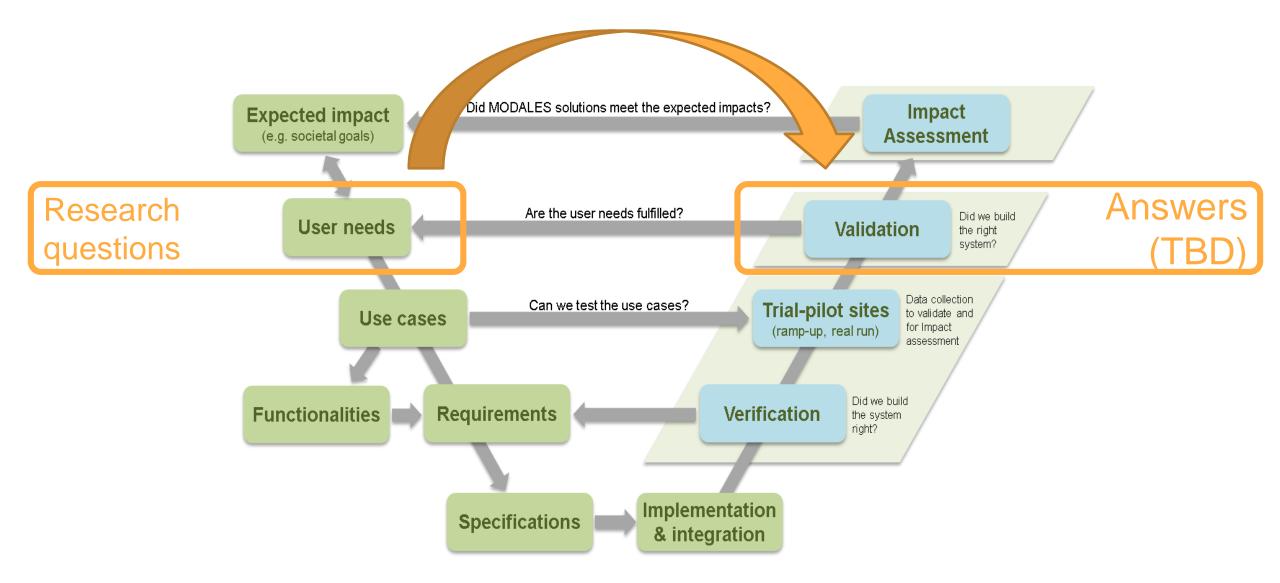
Personal driving assistant implementing real-time recommendations to reduce emission levels

- Material to understand, become aware of and learn lowemission driving (i.e. guidelines, training courses)
- Data correlation module to study the relationship between driving variability and:
 - Exhaust emissions
 - Brake emissions
 - Tyre mass-loss emissions.
- Driver profiling methods, considering data flows collected from his/her personal equipment

FESTA V



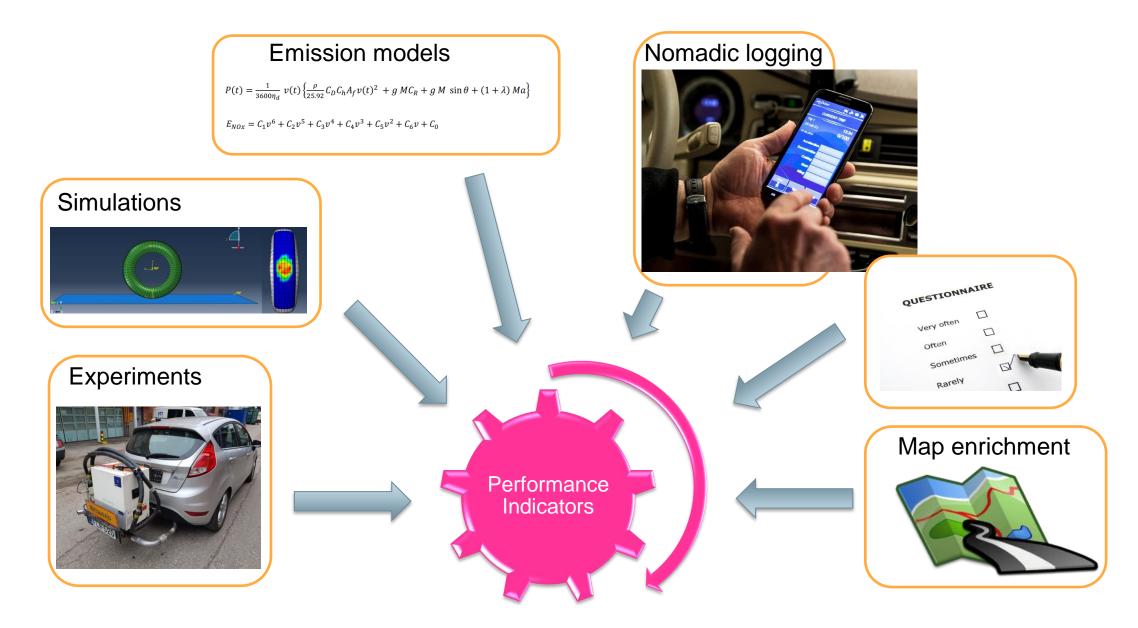
FESTA in MODALES (Driver App)



Validation of the driver app: Global research questions

- Do drivers using the app and training reduce emissions?
- How well do drivers accept the app and follow the recommendations?
- Do drivers using the app and training reduce energy consumption?
- To what extent does using the app affect the speed of the user?
- Can exhaust-brake-tyre emissions be correlated with driving variability?

From research questions > data collection > PI's



Performance Indicators

- Extracted from literature & previous projects
- Tested through simulations
- Ranked according to their impact on emissions change (simulations, GT-Suite)

Main categories

- Driving behaviour PIs for exhaust emissions
- Driving behaviour PIs for brake wear
- Driving behaviour PIs for tyre wear
- Ecodriving behaviour
- User feedback
- Emissions (CO₂, NO_x, PMs, PNs)

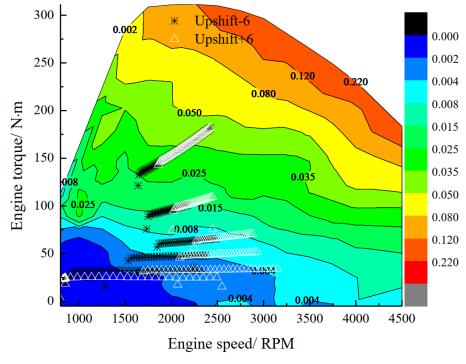


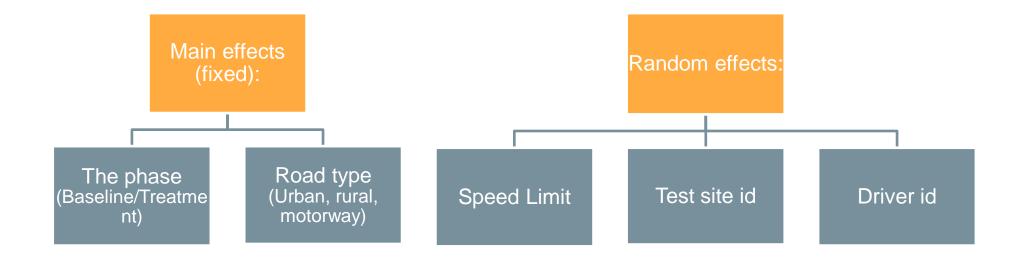
Figure 3.13: Engine operation points in NOx emission map

Statistical analysis methods for naturalistic driving data

- Usual analysis are not well suited
- Subsets are correlated, at least because of the driver itself
- There is the need to "assume" a form of correlation and choose an appropriate model

MODALES approach:

- Generalised linear mixed models (GLMM):
- Allow to choose one, or a combination, of categorical variables to describe the correlation



Conclusion

Analyses

- Data collection still undergoing
- Results not yet available
- Methodology inspired from previous successful projects (ecoDriver, FESTA)

MODALES expectations

- Reduction of emissions from the existing combustion-engined car fleet
- Reduction of unnecessary driver-induced emissions

From previous studies

- App's performances are below embedded systems
- EcoDriver: app (-2.5% fuel) vs OEM systems (-5%)
- OBD dongle + Smartphone app is a robust and efficient solution for large scale field operational tests



Smart and Sustainable Mobility for all.



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