

# AN INTEGRATED ASSESSMENT OF ROAD TRAFFIC NOISE AND POLLUTANTS CRITICAL HOTSPOTS THROUGH ADVANCED MODELS



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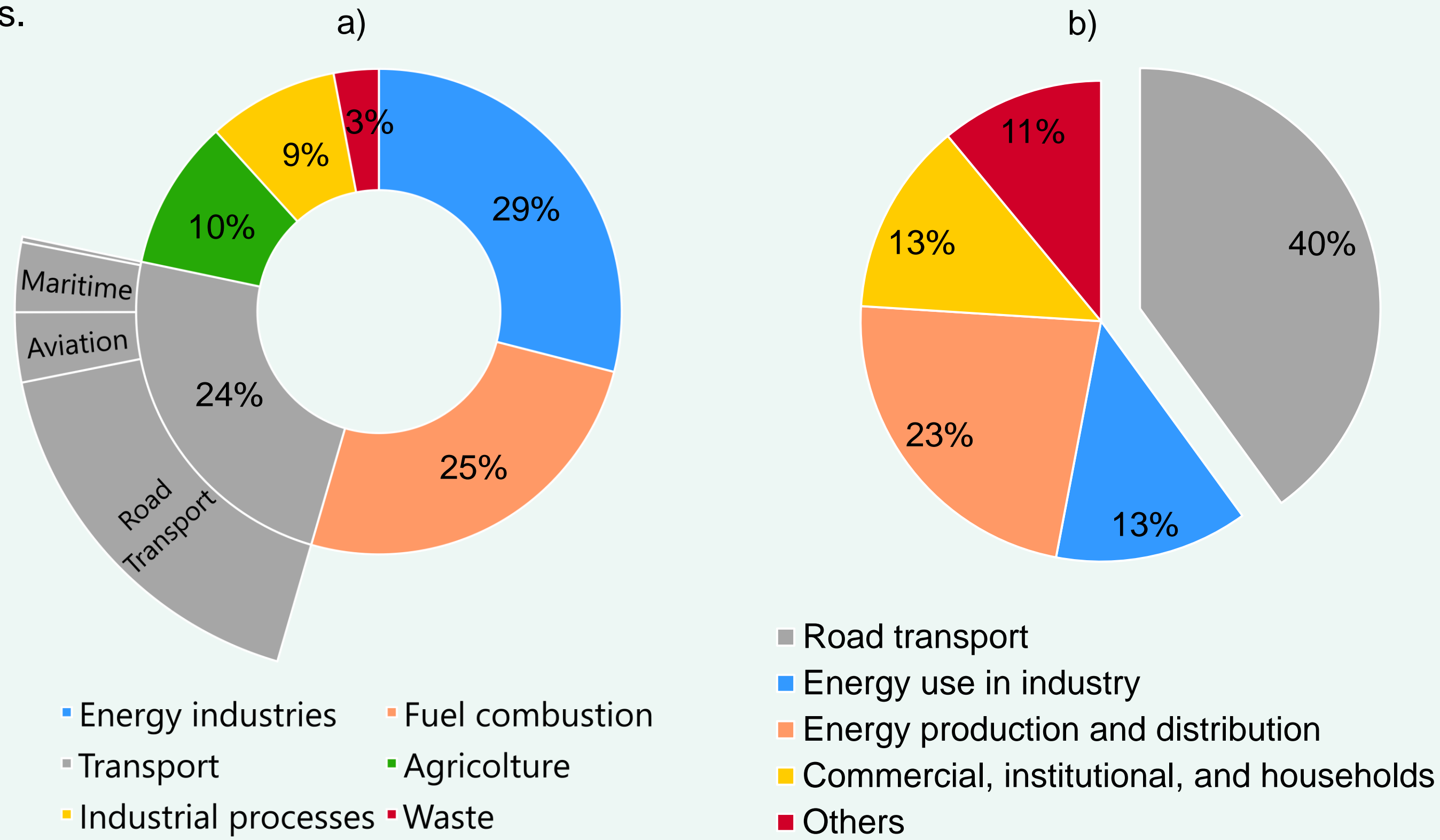
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## 1. INTRODUCTION

### Background

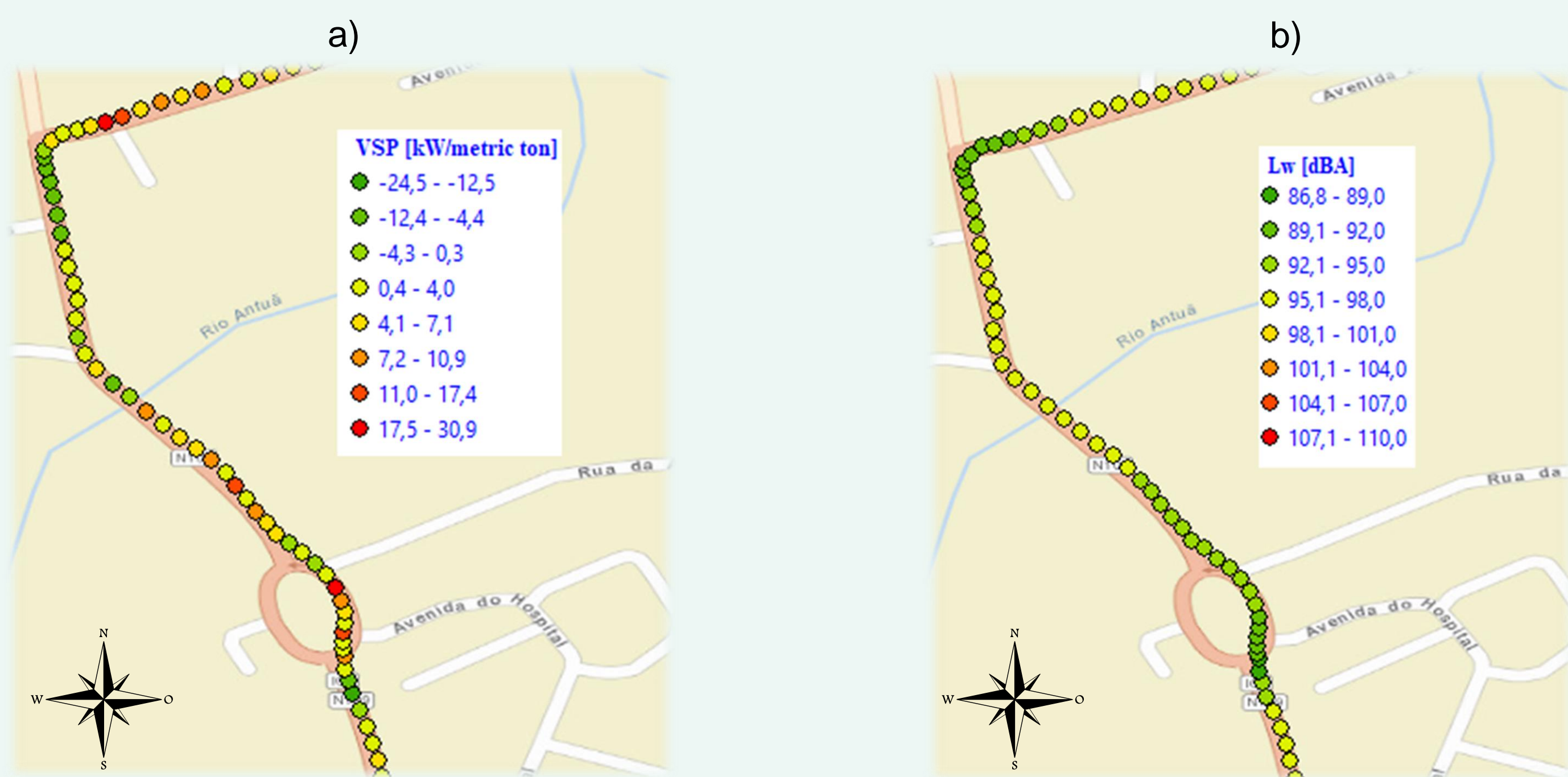
Road Traffic Noise and Exhaust Emissions represent a sustainability problem since they have impacts on human health, environmental depletion, and the economy by causing external costs.



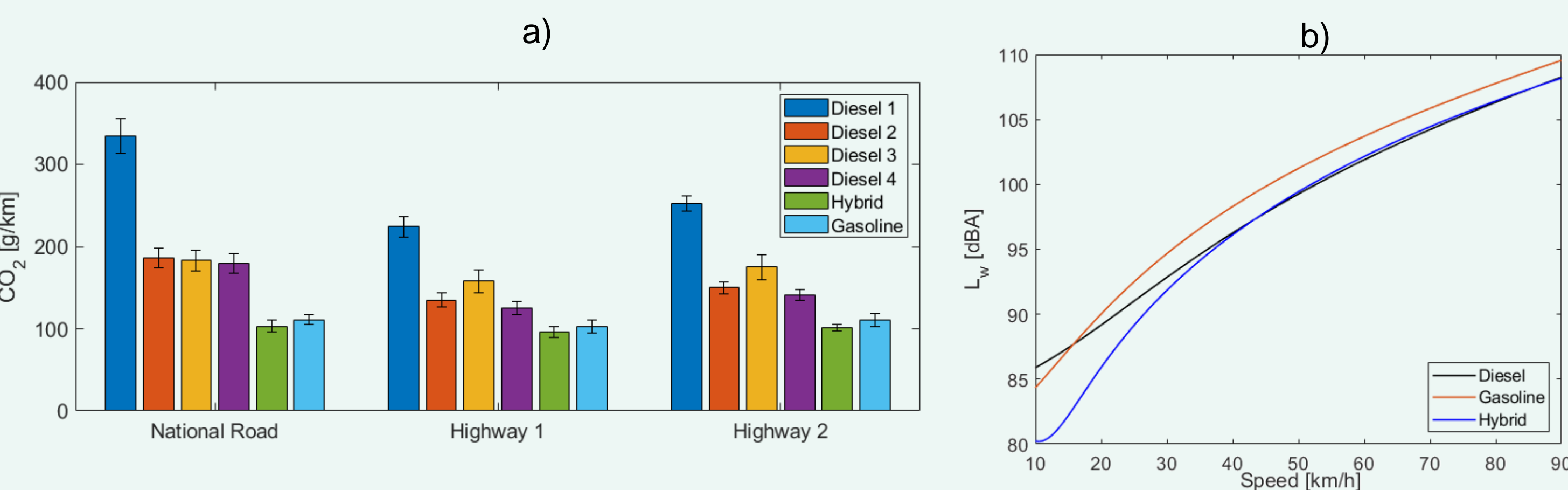
- 48% of the European population is exposed to day-evening-night noise levels ( $L_{den}$ ) higher than 55 dBA.
- 12% of the European population is exposed to night noise levels ( $L_{night}$ ) above 50 dBA.
- Disability-Adjusted Life Years (DALYs) lost in Europe for noise:
  - 21,000 for tinnitus;
  - 45,000 for cognitive impairment of children;
  - 60,000 for ischemic heart diseases;
  - 654,000 for annoyance;
  - 903,000 for sleep disorders.

### Research Gaps

- In contrast with on-road exhaust emission models, no noise model includes acceleration (and other kinematic parameters) as independent input variable, although some of them present correction terms. This can lead to underestimating noise emissions in critical hotspots (roundabouts, traffic intersections, and other traffic singularities) [1].



- Although on-road exhaust emission models consider vehicle motorization (diesel, gasoline, hybrid, and electric) as a variable, the same does not happen for the noise models [2].



- Few studies regarding driving volatility with noise and exhaust emissions were conducted, and this remains an actual topic [3].

## References

[1] Pascale, A., Fernandes, P., Guarnaccia, C., Coelho, M.C., 2021. A study on vehicle Noise Emission Modelling: Correlation with air pollutant emissions, impact of kinematic variables and critical hotspots. Sci. Total Environ. 787.

[2] Pascale, A., Fernandes, P., Bahmankhah, B., Macedo, E., Guarnaccia, C., Coelho, M.C., 2020. A Vehicle Noise Specific Power Concept. Forum Integr. Sustain. Transp. Syst. IEEE ISTS 2020 170–175.

[3] Can, A., L'Hostis, A., Aumond, P., Botteldooren, D., Coelho, M.C., Guarnaccia, C., Kang, J., 2020. The future of urban sound environments: Impacting mobility trends and insights for noise assessment and mitigation. Appl. Acoust.

## 2. PH.D. RESEARCH OBJECTIVES

### Main objective

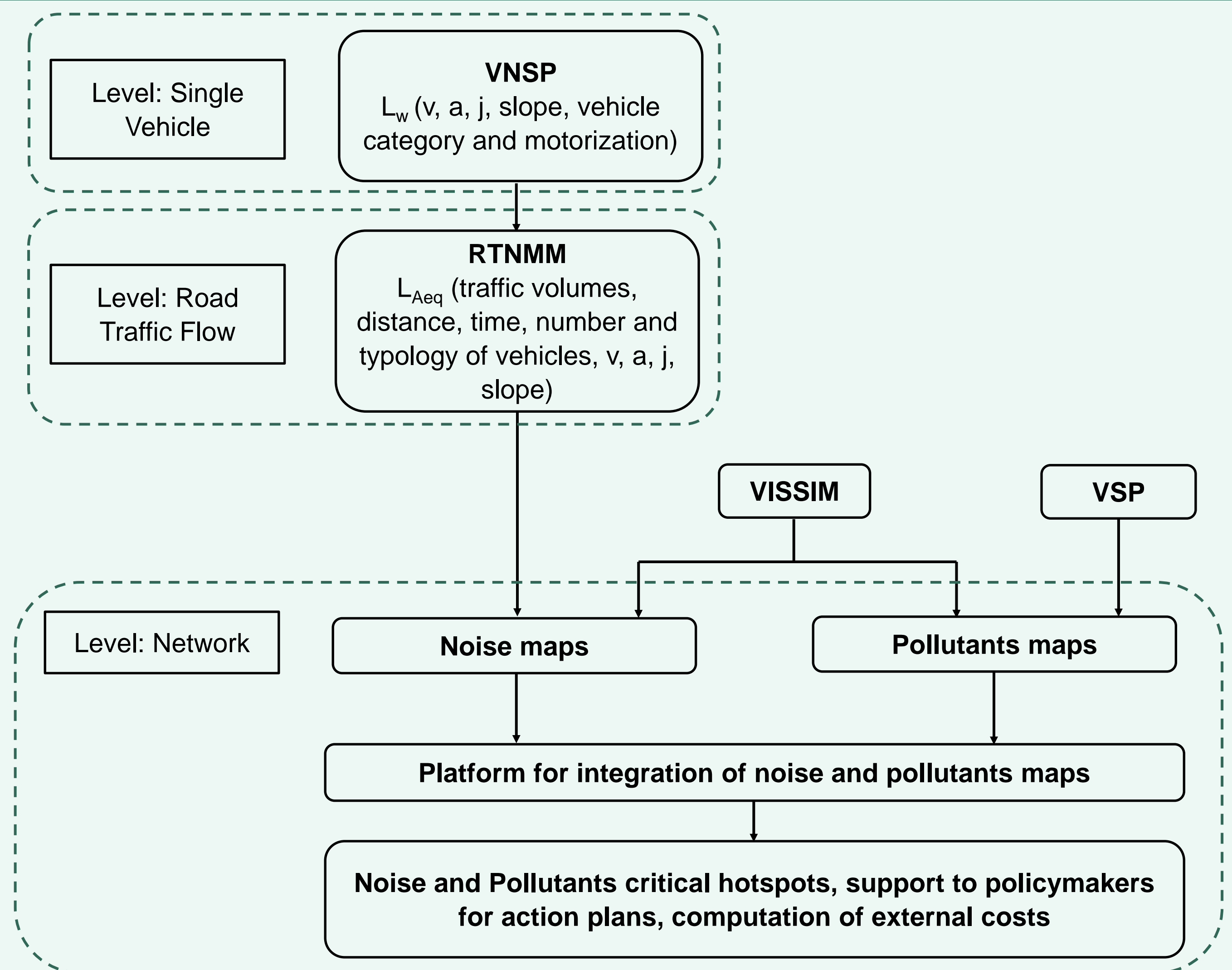
To develop a Noise Emission Model (NEM) denominated Vehicle Noise Specific Power (VNSP) able to estimate the sound power level ( $L_w$ ) for different categories of vehicles by considering speed, acceleration, vehicular jerk (i.e., the time derivative of the acceleration, and road slope.

### Specific objectives

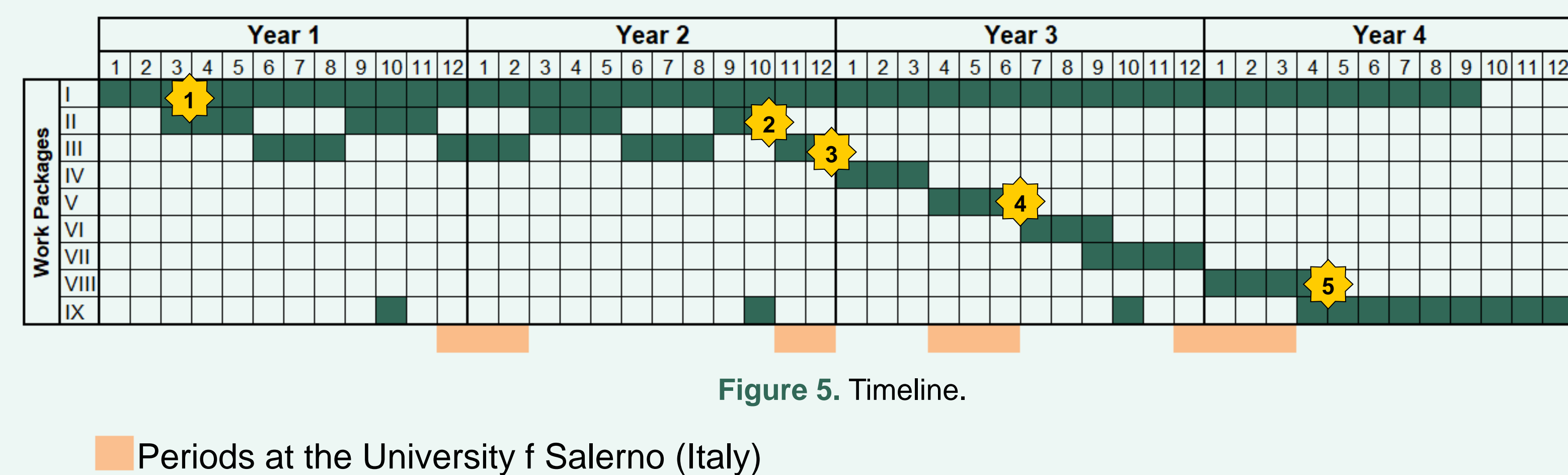
- To introduce a classification of vehicles based on motorization in the VNSP.
- To develop a Road Traffic Noise Microscopic Model (RTNMM) based on VNSP.
- To develop noise and pollutants maps and incorporate them into a numerical platform.



## 3. METHODOLOGY



## 4. TIMELINE



### Work Packages:

- Literature Review.
- Data Collection for VNSP Development.
- Development of VNSP.
- Development of RTNMM.
- Validation of RTNMM.
- Updating of VSP Emission Factors.
- Development of Noise and Pollutant Maps.
- Development of Numerical Platform.
- Dissemination, Reporting, and Thesis Writing.

### Milestones:

- Functional Specification Report.
- Database creation.
- VNSP development completed.
- RTNMM development and validation completed.
- Numerical platform development completed.

## 5. SWOT ANALYSIS

### STRENGTHS

- Supervisors' background and expertise.
- Well-established collaboration network (between the Universities of Aveiro and Salerno).
- Collaboration with a car dealership.

### WEAKNESSES

- Data collection issues due to vehicles availability.

### OPPORTUNITIES

- Development of a numerical platform relevant in the context of the transport monitoring systems.
- Policy links in terms of guidance and/or recommendations based on the obtained results.

### THREATS

- Delays in data collection due to weather conditions.
- Delays in data collection due to the Covid-19 situation.

### ACKNOWLEDGEMENTS:

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