MOBILITAS
ABSTRACT MOBILITY SCENARIOS (D.M.3.3.1)

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Abstract Mobility Scenarios

Introduction

Tourism and mobility are two fields strictly connected, since there is no tourism without a physical displacement. The MED project MOBILITAS - MOBIlity for nearLy-zero CO_2 in medITerranean tourism destinAtionS – involves 7 countries and 9 regions (Rimini and Misano Adriatico in Italy, Nice in France, Coastal-Karst Region in Slovenia, Dubrovnik and Zadar in Croatia, Piraeus in Greece, Malta and Platres Community in Cyprus), affected by intense tourism flows with great pressure on transport infrastructures and mobility. During the summer period, these areas face mass flows of tourists that put great pressure on transport system. Consequently, all project areas have to face congestion, with negative effects in terms of air pollution, CO_2 emission, noise, health, unsafe roads, and loss of attractiveness for the cities.

Coastal areas are the main destinations chosen by tourists who visit European Union. In 2014, the 47.4% of the total nights spent in the EU were in this kind of territory. The high tourist flows can radically affect the local economy, environment and society and coastal cities have to guarantee both the ordinary movements of a standard city and those generated by tourist needs. In this framework, we can observe a triple relation between climate change, tourism and transport.

Tourism transport can be seen as a victim and a vector of climate change. It is a victim, because climate change can influence tourism travel demand, it is a vector due to the highest percentage of GHG emissions produced by the tourism transport. In fact, transport system is the main emitter source and energy consumer of tourism sector, followed by accommodations and other activities. It is also responsible for numerous environmental impacts, such as congestion, air pollution, climate change, accidents and noise pollution. Cruise ships and ferries, new coastal infrastructures, intertidal trampling, leisure activities and daily transport movements of cars and public transports constantly provoke serious damages to the fragile Mediterranean environment. The ecologic impacts in that areas are even more harmful than those provoked on other tourist territories, due to the high level of biodiversity and cultural heritages of these coasts. On the other hand, climate change radically affects tourism flows all over Europe and also influences the modal share of tourists in the destination areas.

MOBILITAS aims at **providing an estimation of the impacts of climate change on future tourism demand** for tourist coastal areas and tries to **assess the tourism-related CO_2 emissions caused by tourism transport, according to the future climate change**. The methodology elaborated by Università Iuav di Venezia within this project develops different mobility scenarios in order to enable policy makers and stakeholders better understanding the effects of different choices on environmental quality of destinations. The final aim of this European project is increasing the capacity to use existing low carbon transport systems and multimodal connections to improve the living environment in high-density coastal destinations.

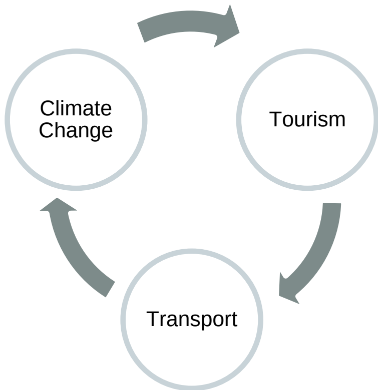

Figure 1 The triple relation between Climate Change, Tourism and Transport sectors.

Three-step approach method

The method developed by Università Iuav di Venezia is based on a questionnaire previously submitted to all PPs in order to obtain some essential information needed for the elaboration of mobility scenarios. It was composed by three primary worksheets:

1. **Destination profile**: snapshot of partner project area and the key starting point for the process. This worksheet is composed by six subsections: *general overview, geomorphological data, weather pattern, land use and built environment, socioeconomic data and demographic data;*
2. **Tourism:** this worksheet represents the current state of tourism in project partner area. It is divided into three sections: *general overview, tourist profile and tourist amenities;*
3. **Transport:** it is the core of the survey and it is composed by six main sections regarding the current state of the transport system and the current relationship between tourism and mobility: *general overview, transport supply, tourism transport, environment, flows and counting station*.

The questionnaire includes all information about tourism and transport and provides a complete description of destination area useful to implement the most suitable transport measures. Once the local/regional data has been collected, Università Iuav di Venezia exploited them to elaborate mobility scenarios, according to the new method developed *ad hoc* for MOBILITAS. It is based on three main steps:

1. Forecast of future tourism demand according to climate change;
2. Definition of transport-related implications;
3. Consequences in terms of CO_2 emissions.

The **first step** has the aim to quantify the variation in tourism arrivals and overnight stays according to climate change. The model developed by EU project TopDAd allows to analyse the fluctuations of tourism demand according to different climate change effects, such as altering of mean temperatures or precipitation patterns. Climate change can radically impact the attractiveness and competitiveness of traditional tourist destinations, pushing mass tourism flows towards new uncharted areas. For example, as mean temperature will rise, the southern European coasts – up to now favourite tourist destinations – will probably be less attractive and the northern ones – with warmer temperatures – can probably attract some demand. TopDAd model works with different climatic scenarios (RCP) and different adaptation strategies scenario (SSP). According to the variation rates provided by TopDAd model, it was possible to obtain the future tourist arrivals and overnight stays necessary for the final calculation of CO_2 emissions produced to reach/leave and move within the destination.

The **second step** aims at defining the total amount of kilometers run by tourists to get, to move within and to depart from the destination area. The input data of this step derives from the output of the first step (*future tourist arrivals and overnight stays*) and information collected by the questionnaire (*current modal share* and *distance run by a tourist).* The last two sources allow us to convert tourists flows into traffic flows. The process phase of the second step consists in the definition of *future modal share to reach/leave and to move within the destination area*. This figure has been calculated according to different scenarios and mobility plans and it is expressed as percentages of users that adopt different transport means in the future, with a 5-linear variation. The future modal share is derived from three alternative scenarios: Status quo (a prosecution of the current modal share), Intermediate scenario (a lower modal shift toward more sustainable transport means), Optimistic scenario (a significant modal shift toward more sustainable transport means). It is used to calculate the final output of the second step – *the total distance run by tourists to reach/leave and to move within the destination area* – that can be obtained multiplying the four components – average distance to reach/leave the destination, average distance to move within the destination, future modal share to reach/leave the destination, future modal share to move within the destination – by the shares of future tourist arrivals and future overnight stays.

The **third step** exploits the number of kilometers run by tourist in the two different cases – to reach/leave the destination and to move within it – to calculate the total amount of CO_2 emissions produced by tourist within the project area and to reach it. Thanks to the adoption of another model developed by the Handbook Emission Factors for Road Transport, it has been possible to calculate the emission factors of different transport means (motorcycle, private car, bus, etc.). Then the total emissions produced by tourists to reach/leave and to move within the destination area have been calculated multiplying the number of kilometers in the two cases by the emission factors. Finally, the sum of these two components determines the yearly overall emissions produced by tourism transport in the project area.

The analysis about expected changes in transport emissions due to the tourism is largely affected by the quantity and the quality of data collected. Project Partners are the best experts of features and characteristics of their territory. Accordingly, the development of future scenarios in the pilot areas can be realized only with their active support, under the common framework depicted in this section. The quantity and the quality of information is rather heterogenic: some partners provided a quite comprehensive vision of their region, while in other cases the framework is more fragmented.

Results

The cities involved in MOBILITAS project are all different and show also diverse results in future tourism demand, future transport flows and total amount of CO_2 produced by tourist transport. Results reveal that there are similarities among the localities object of analysis. Due to the rise of the mean temperature, the beach season will be prolonged to spring and autumn in every region. However, the development in the different localities could be different, according to the geographical context. In Nice, for example, the variation in tourist arrivals is positive (up to +2.34%). Also in Zadar, the growth rates of tourism are positive (up to +1.02% by 2050). However, in the majority of areas analysed losses of overnight stays and arrivals are expected. This is due to their geographical position in the Southern part of the Mediterranean Sea, where tourists will perceive temperatures during summer as too hot. The cases of Platres Community (up to -2.20% under the worst climatic condition) and Malta (-1.56%) are emblematic. Anyway, there are also Mediterranean destinations where losses are expected to be rather moderate, due to their attractiveness and popularity as beach destinations. It is the case of Misano Adriatico and Rimini (-1.00%), or Dubrovnik (-0.37%). Other localities present different trends according to the future climatic scenario and the time period considered. For example, Slovenian Coastal Karst Region shows an increase in new arrivals by 0.31% in 2050, and a decrease by 0.63% in 2035.

This has direct consequences also on the CO_2 emissions from mobility of the different areas: a general decrease from 2015 to 2035 is registered, mainly due to the general improvement of means efficiency. Looking at the total emissions in 2035 from tourism in the different areas, the results largely vary according to the three mobility scenarios considered (Status quo, Intermediate and Optimistic). In each area, the overall quantity of emissions decreases in the optimistic scenario, thanks to the shift from more pollutant vehicles towards more sustainable ones.

In Nice, for example, the total emissions can vary from 7.05 $ktCO_2$ (status quo) to 3.63 $ktCO_2$ (optimistic scenario). In Malta, the variation in total emissions is higher than the French partner and it starts from 21.91 $ktCO_2$ calculated in the status quo scenario to reach and to leave the 13.69 $ktCO_2$ if virtuous transport strategies are applied (optimistic scenario). Misano Adriatico presents more moderate quantity of total emissions (also according to the different number of arrivals and overnight stays, which is significantly lower than any other Region that has provided data), but in relative terms their reduction can be as high as other partners. In the status quo scenario, Misano Adriatico registers by 2035, 0.55 $ktCO_2$, but it can reach and to leave 0.21 $ktCO_2$, by using less pollutant vehicles (optimistic scenario). Similarly, the CO_2 emissions from tourism in Rimini vary from 10.11 $ktCO_2$ (status quo) to 6.36 $ktCO_2$ (optimistic scenario). The total emissions produced by tourists in Coastal-Karst Region if nothing changes, will be 3.34 $ktCO_2$. Anyway, a decrement of about 50% is possible in the optimistic scenario (1.53 $ktCO_2$). Zadar can save less emissions than other partners, due to the great increase of its tourist flows (1.19 $ktCO_2$ in the status quo scenario; 0.91 $ktCO_2$ in the optimistic scenario), but only the external component of tourist mobility has been calculated. The total emissions produced by the internal component of mobility Dubrovnik tourism can vary from 2.12 $ktCO_2$ (status quo) to 1.09 $ktCO_2$ (optimistic scenario). Unfortunately, due to the absence of data about Platres Community and Piraeus, it has been not possible to calculate the overall emissions to reach and to leave the destination areas and to move inside. If data is available in the future, it will be possible to calculate the expected variation in tourism and the related CO_2 emissions and have a more coherent comprehensive picture.

In interpreting the results presented in the report, at least three caveats are necessary. First, climate change is only one of the elements that can determine the success or the failure of a tourist destination. Other aspects play a main role, such as the international and local economic conjuncture, the accessibility, or the development of local tourist attractions. The values that we have presented in this report and that are referred to the future travel demand have to be considered as “virtual” indicators about the **impacts of climate change on tourism and mobility coastal areas**, and not as the future trend of tourism in such areas. Second, the variation in the total amount of CO_2 emissions from tourism transport can be the result of **different conditions**. For instance, a decrease of emissions can be caused by a reduction of the tourists that visit a place. Even though environmentally favourable, this determines negative effects to the local development of a region. However, a reduction can be obtained also by a broader use of sustainable transport modes to reach and to leave the area as well as to move inside the area, with a contextual increase of the travel demand. This condition is ideal, because it merges the positive environmental effects produced by the shift towards less polluting transport modes with the economic ones. Hence, in interpreting the results of the different scenarios in terms of CO_2 emissions, as provided in section 4 of the Report, the implications in terms of travel demand should be always considered. Third, the **local scale** of our analysis is another important aspect. According to the aim of the MOBILITAS project, only the implications of mobility in terms of emissions produced in a specific area are assessed. This makes it possible the connection of the findings with the guidelines of the SUMPs or other forms of mobility plans under realization. However, tourist emissions do not include only this scale: if a comprehensive analysis is to be performed, the entire trip to reach and to leave a destination should be considered.

Despite these points, the method described provides useful information about the current and the future status of tourist mobility and CO_2 emissions in the pilot areas of the project. Outputs of this activity can be a scientific basis for the definition of the primary measures to reduce the future levels of CO_2 emissions from tourism transport, without curbing its demand.