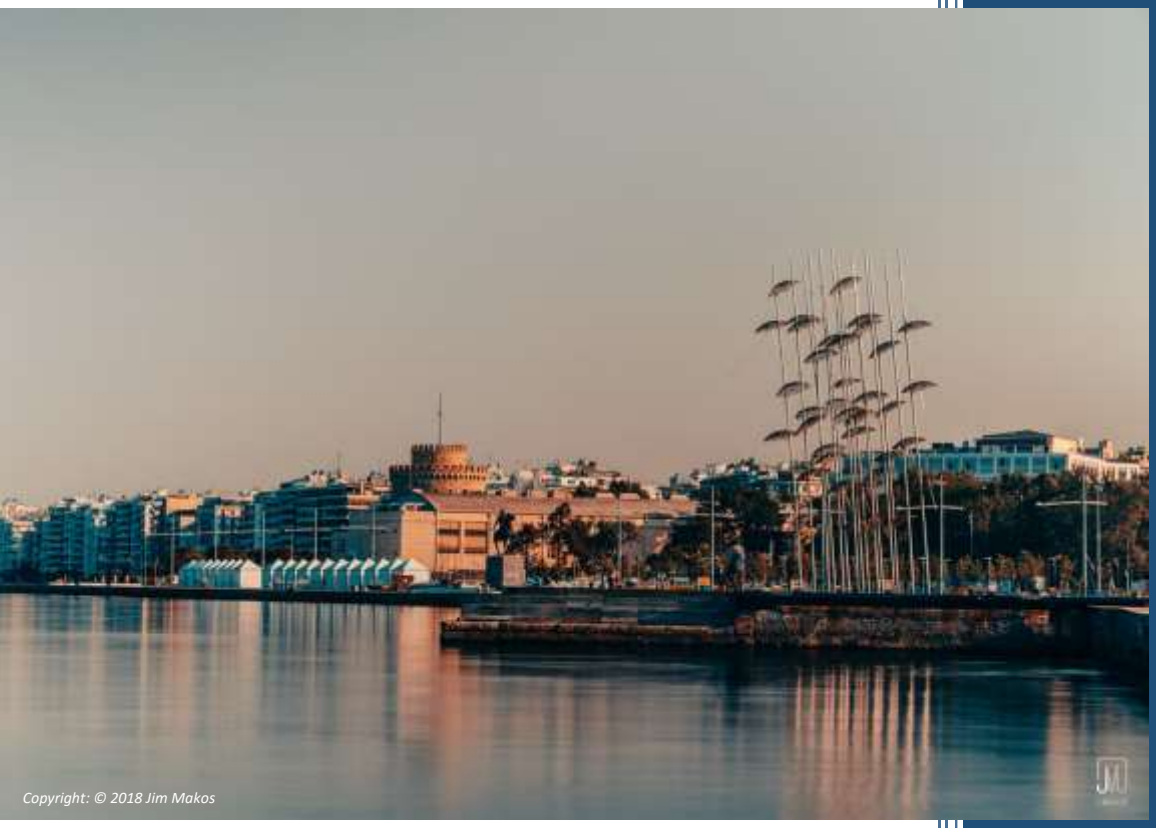
FEASIBILITY STUDY FOR THE DEVELOPMENT OF THE URBAN SEA TRANSPORTATION IN THESSALONIKI, GREECE



Dr. Alexandros Sikalidis

K. Karamanli Av. 4, p.c.. 54638

Thessaloniki, Greece

tel: +30 6944 523936,

email: alexsikalidis@gmail.com

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This study was carried out based on activity 8, requiring 'feasibility studies for low-carbon mobility options and transport systems, accessibility, improvements to inter-modality and cycling/walking options to partner destinations'.

The study was carried out by Dr Alexandros Sikalidis, on behalf of the Major Development Agency of Thessaloniki. All content of this document is based exclusively on the goals and activities of the DESTI-SMART project. Any other use or citing of all or part of this content by third parties must expressly state the source and indemnify the author from all possible consequences.

Executive Summary

This report describes the work undertaken to access the costs and benefits related to the development of Urban Sea Transportation which would link the municipalities of the metropolitan area of Thessaloniki around its waterfront.

At first, the report focuses on the generation of options related to the different types of boats which could be employed in order to provide the necessary services. Secondly, the assessment of the two different options and the strengths as well as weaknesses of the case for each option in a common Strategic Assessment Business Framework is presented. The work presented does not aim to constitute a fully presented business case for any option, but instead it utilizes the Guide to Cost-Benefit Analysis of Investment Projects (an Economic appraisal tool for Cohesion Policy 2014-2020) prepared by European Commission as a framework to assess the suitability of alternative options.

The cost-benefit analysis presented aims to demonstrate that the transport intervention:

- develops a strong case which improves the transportation network and is in line with wider objectives – '**multi-criteria analysis**';
- is financially viable – the '**financial analysis**';
- represents significant economic benefits – the '**economic analysis**';
- involves a set of risks which can be mitigated – the '**risk analysis**';
- it is investable since there are potential sources of funding – the '**investment resources analysis**'; and
- is achievable – the '**institutional framework analysis**'.

The feasibility study has been commissioned by MDAT (Major Development Agency of Thessaloniki) which received funding from the European Union Interreg Europe programme, as part of the DESTI-SMART project. DESTI-SMART aims to bring together partners in coastal towns and cities within the European Union area, where tourism suggests an important section of the regional development, to form proposals for sustainable, accessible transport aiming to upgrade connectivity in these regions and encourage the growth of the regional as well as the visitor economy.

The concept of MDAT behind the public sector intervention is that, there is an urgent need to improve the Public Transport System which effectively leads to the construction of new transportation modes. Currently, the Metro is under construction, however a new Urban Sea Transportation system is expected to both complement the Public Transport System while it could constitute a tourist attraction. Presently, the only option of public transport along the Thessaloniki Metropolitan area seafront is through the bus system. Nevertheless, the degree of

provision is characterized by low frequency of service and interchange. Therefore, the planning, design and construction of Urban Sea Transportation could potentially improve significantly the connection with the Airport and the east suburban districts and effectively enhance an efficient connection with the Thessaloniki city center.

A straight and more frequent service would: encourage new developments and investments in the seafront municipalities, including the Peraia, Neoi Epivates etc towns; **ensure and enhance Thessaloniki Metropolitan area touristic profile** by providing a new and more enjoyable mean of transport **but also by moderating the current traffic congestion**; and **assist the development of new companies in the east suburban districts of Thessaloniki Metropolitan area**. A new mean of public transport like Urban Sea Transportation would also support policies and efforts to develop **the seafront and relevant economy of the Thessaloniki Metropolitan area and promote its conversion into a famous all-year destination**.

The options which have been assessed and considered for our analyses (Multi-criteria, Financial, Economic and Risk analysis) are shown in the following table:

Table A: Options assessed

Option	Boat capacity	Engine Type	Size of fleet	Route	Alignment	Frequency
Traditional boats which use marine-diesel oil	300	Diesel	6	Eleftherias square – Dimarxeio – Posidonio – Marina Kalamarias- Airport – Neoi Epivates	Seafront	15 min to 30 min
Electric boats	300	Electric	6	Eleftherias square – Dimarxeio – Posidonio – Marina Kalamarias- Airport – Neoi Epivates	Seafront	15 min to 30 min

Specifically, the options related to the two different types of boats have been examined against their suitability regarding both the main as well as the wider strategic objectives of the project of the Urban Sea Transportation. Moreover, the differences related to the costs and benefits of the two options have been analyzed and explained in depth. That analysis came as a result of the options' assessment which utilized the European Commission framework for Cost-Benefit analysis of Investment Projects.

Multi-criteria analysis

Traditional small ferry boats that use marine diesel oil engines can improve significantly the connectivity of the coastal municipalities of Metropolitan Area of Thessaloniki (main objective).

More specifically, it is expected that the travel time will be significantly reduced for trips between the seafront towns of the Metropolitan area of Thessaloniki. As for the broader objectives, it is expected that the boats used will offer accessibility to all users (visitors and residents) and an easy connection to the airport.

However, the option of electric boats is expected to be more viable (use of electricity) but also to attract tourists since electric boats can be an environmentally friendly proposal, which is going to improve the tourist product of the area. Regarding the acceptance by the public, a positive reaction is expected. More specifically, the Urban Sea Transportation will enhance the accessibility of the seafront for both the visitors and the citizens of the prefecture of Thessaloniki while it will reduce the need for parking spaces due to the reduced use of private means of transport. The cost of the ticket is expected to be significantly lower than the total cost of travelling by car (fuels & vehicle operating costs) or other means of transport. Nevertheless, both public acceptance and the consequent financial viability of the project are a matter of concern since it is the main factor that cannot be accurately predicted a priori.

The alternative option, that of electric boats provides significant improvement in terms of project sustainability. It is an environmentally friendly option that significantly reduces the environmental footprint of the Urban Sea Transportation project while improving the tourist product of the city of Thessaloniki. More specifically, the use of electric ships will reduce air pollution while the climate change considerations will be mitigated. This is expected to be the case due to the reduced use of private means of transportation as well as the zero pollution caused by electric boats. The cost of operating and maintaining the electric ships is expected to be significantly lower, which may contribute to the reduced price of the ticket. On the other hand, the initial investment in both the land facilities where the boat batteries will be charged and the cost of the boats themselves are expected to be much higher. These facts will increase the recovery time of the initial investment and potentially the price of the ticket. In addition, the technology for electric boats is relatively new, rendering the in depth investigation of potential reliability issues particularly important.

Overall, the choice of electric boats is expected to have the greatest positive impact as a transport intervention in terms of strategic objectives, with a possible negative impact on service frequency due to the time it will take for ships to charge their batteries. Moreover, the reliability of the service has also to be taken into consideration due to the fact that the relevant technology is new. Using traditional ships is expected to offer fewer improvements, but there are fewer risks. More specifically, the initial investment is expected to be much lower, nevertheless operating and maintenance costs seem to be significantly higher when compared to electric boats. Finally, the

choice of traditional ships seems to lag far behind in environmental matters as electric boats are far superior when compared to marine diesel-powered ships.

The use of low emission means of transport is an objective for DESTI-SMART while this is also the case at the national, regional and local level. It seems that electric boats option can meet this objective, hence they strengthen their strategic case against the marine diesel powered boats.

Financial analysis

There are important challenges when it comes to financial analysis for both types of boats (electric and marine-diesel powered boats) options. Based on the breakeven analysis of the traditional boat option, 2.47% of the people who currently use alternative measures of transport should use the Urban Sea Transportation so that the project is financially viable. For a price ticket of 2€, total revenues of the first year of operation are expected to be 6,721,213€. The total investment cost is calculated at the level of 18,691,904€ while the cost of salaries, administrative and the boat operating/maintenance costs are expected to be 5,348,855€ for the first year of the Urban Sea Transport operation. For the alternative option, electric boats are expected to be 40% more expensive than the traditional while the operating costs are expected to be 25% of the operating costs of the first option. Moreover, an extra 5,000,000€ are expected to be invested for land battery -charging facilities. Thus, the total initial investment is significantly higher than the first option and is expected to be at the level of 27,649,904€. Nevertheless, the operating costs of the electric boats are significantly lower for the 30 years of the project rendering the second option as a project with a significantly higher NPV for the same level of revenues. Specifically, the NPV of the electric boats option is expected to be 36,505,965€ when the option for traditional boats would be almost 0€. From the financial analysis it is evident that due to the significant levels of investment, the operator has to assume revenue risk and potentially third-party funding since any negative deviation from the 2,47% estimation might render the project as financially unsustainable. The capital and investment plan of each of the options are analyzed in a separate section.

Economic analysis

The economic analysis for both options suggests that there should be significant benefits to the economy due to reduced journey times (users time savings) for the people who use the Urban Sea Transportation. The analysis of the benefits assumes that each option can ensure a sufficient number of fare-paying passengers to cover each option's operating costs – it can breakeven.

Table B describes the total economic benefit from the first option (traditional boats) while Table C focuses on the economic benefits from the second option (electric boats) for the 30 years of the project.

It is clear that the benefits for the economy from electric boats is significantly higher. The main sources of that difference are:

- the total financial benefits (36.505.965€ vs. 3.687,389€)
- the air pollution reduction (9.922.125 € vs. -9.431€)
- the green house gas reduction (5.530.000€ vs. 1.740.404 €)

Table B: Economic benefits of Urban Sea Transportation – Main Option	
Calculation of the Economic Benefit	**NPV in €**
NPV – Financial Analysis (VAT excluded)	3.687.389€
Benefit from travel time reduction	58.714.878€
Benefit from Vehicle Operating Costs savings	48.983.601€
Accidents reduction	44.302.112€
Noise reduction	3.154.184€
Air pollution reduction	-9.431€
Green House Gas reduction	1.740.404 €
Total	**160.573.138€**

Table C: Economic benefits of Urban Sea Transportation – Electric boats	
Calculation of the Economic Benefit	**NPV in €**
NPV – Financial Analysis (VAT excluded)	36.505.965€
Benefit from travel time reduction	58.714.878€
Benefit from Vehicle Operating Costs savings	48.983.601€
Accidents reduction	44.302.112€
Noise reduction	3.154.184€
Air pollution reduction	9.922.125 €
Green House Gas reduction	5.530.000 €
Total	**207.112.865 €**

In conclusion, the total economic benefits for the second (first) option for the 30 years of the project have an economic NPV equal to 207.112.865€ (160.573.138€).

Risk analysis

There are important risks related to the project which are being taken into consideration. Thus, a sensitivity analysis is performed where the impact on NPV and ENPV of the variability of certain factors is demonstrated. Specifically:

- A variation of demand and revenues is considered.
- A variation of investment and operating costs is considered.
- A variation of the discount rate.
- A further establishment of new stops integrated in the system.

There was also a qualitative risk analysis considered where certain factors which may affect significantly the success of the project were identified. At the same time proposed mitigating actions were also presented. As part of the sensitivity analysis a further assessment of the impact of electric boats was considered and in particular there was an analysis on the break-even level of demand required for the project to have an NPV equal to 0 (so that the project is financially sustainable). The minimum demand required for the project to be financially sustainable is when electric boats are considered is 1,65%. All assumptions in this case are the same as with the basic scenario.

Urban Sea Transportation stops

Conclusions

There are significant financial and commercial risks as well as uncertainties related to both options (electric vs. traditional boats). Hence, currently, it might be quite demanding to realize each of the two alternative options if no clear funding means are secured for the preferred alternative or a specific regulatory and institutional framework which would enhance the operations of the Urban Sea Transportation system is created. Another challenge, especially related to electric boats would be related to the relevant technology advancements. However, strategically and according to the the multi-criteria analysis, the Urban Sea Transportation as a new public transport mean satisfies both main and wider objectives while it fits well into the national, regional and local policy frameworks. Thus, a successful implementation of the Urban Sea Transportation project, could deliver greater benefits and integrate sea traveling to the general transport system by linking seafront towns with the airport and Thessaloniki city centre. This project would enhance tourism and relevant economic benefits while it will improve the accessibility of the appealing seafront and travel along its attractive coastal towns.