FEASIBILITY STUDY

FOR DUBROVNIK AIRPORT PILOT ACTION

Project acronym	ADRIGREEN
Project Title	Green and intermodal solutions for Ports and Airports
Financed through	ERDF
Project duration	01/01/2019. – 31/12/2021.

Related activity:	4.1 –Testing phase
Deliverable name:	Feasibility study for Dubrovnik Airport pilot action
Type of deliverable	Report
Language	English
Work Package Title	Testing and evaluating innovative intermodal and low-carbon solutions
WP number	4
WP Coordinator	Dubrovnik Airport

Status	Final
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Version	1
Due date of deliverable	31h October 2020
First draft:	28h October 2020
Final delivery date	7th December 2020
Project website	https://www.italy-croatia.eu/web/adrigreen

CONTENT

I. EXECUTIVE SUMMARY

According to application form of ADRIGREEN project, Dubrovnik Airport should implement its pilot action covering one of the four main pilot action goals identified:

- Adoption of smart solutions to improve waste and water management and to reduce energy consumption in small-medium regional Airports.

Main deliverables of pilot action implementation should be Feasibility study of implemented action as well as testing report of implemented action, which will be basis for further project steps, especially in conducting Capitalisation manual on identified and tested solutions within ADRIGREEN projects.

Therefore, this document should evaluate pilot action implemented with clear conclusion regarding its feasibility and transferability to other regions or airports, contributing to project transnational approach conclusion which shall be summarised in Capitalisation manual.

Testing results of implemented pilot action in Dubrovnik Airport have demonstrated its advantages from process optimisation point of view as well as from feasibility (cost-effectiveness) and environmental perspective.

In addition, Dubrovnik Airport has presented pilot action implementation plan covering all implementation process phases, from appointing project team, through identifying risks and risk mitigation procedures, conducting public procurement process and, in the end, implementation of equipment and monitoring of its performance.

Conclusion from this study represents recommendations to Dubrovnik Airport management board as well as to other interested parties on how benefits from green field process thinking and optimisation may contribute to the organisation.

Also, to have adequate knowledge on impact and in order to ensure durability of similar pilot actions implemented, it is essential that company implements environmental management system process in place, as an integrated tool for planning, implementation and monitoring of environmentally friendly activities.

II. BACKGROUND OF THE PROJECT

Green and intermodal solutions for Adriatic ports and airports - ADRIGREEN is a project approved under the INTERREG V-A Italy Croatia CBC Programme 2014-2020. The programme is funded by the European Regional Development Fund under the European Territorial Cooperation objective during the programming period 2014-2020.

The managing body of the Cooperation Program is the Veneto Region, Italy. The national body of the Republic of Croatia coordinating the implementation of the joint programme with other participating countries is the Ministry of Regional Development and European Union funds.

The project has started in January 2019 and it is expected to end by January 2022. The total budget approved for the project amounts to 2.104.217,00 EUR, 85% of which is co-financed through the ERDF fund (European Regional Development Fund). The project will be implemented by 10 project partners.

Project description:

One of the main problems that characterize the Adriatic coastal area is the imbalance in the development of infrastructures and modes of transport, caused by low level of investments and insufficient approach to innovation. In Italy and Croatia there are many maritime cities, which have to deal with a very high number of passengers, especially during the peak season. Even though the road transportation is still predominant, the number of people that are reaching Adriatic cities by ferries and airplanes is significantly increasing year by year. However, most of Adriatic ports and airports are suffering from lack of integration with various modes of transportation, causing serious traffic congestion problems during the summer season.

The aim of the project is to improve the integration of Adriatic ports and airports with other modes of transportation by testing several intermodal operational and technological solutions. By identifying and analysing already existing procedures, the project partners will test a number of intermodal practices in order to evaluate their adaptability and transferability into the Programme area.

Also, it is very important to create more environmental-friendly and less polluting transport between ports (cities) and airports by reducing CO2 emissions. This can be achieved by purchasing electric vehicles for transport routes between ports and airports, or for use in port/airport premises.

III. PROJECT OBJECTIVES, PROJECT APPROACH, COOPERATION NEEDED

Project objectives

Low level of integration among different modes of transportation and insufficient investments in sustainable and low-carbon transportation technologies are characterizing several regions in the Adriatic area. The Croatian and Italian Adriatic coasts are rich of touristic destinations, which are reached by millions of tourists every year. Even though the road transportation is still predominant, the number of tourists that are reaching Adriatic towns and cities by ferries and airplanes is significantly increasing. Unfortunately, most of Adriatic ports and airports are suffering from lack of connections with other modes of transportation, causing serious traffic congestions problems, especially during the summer seasons. In addition, the majority of ports and airports facilities are lagging behind the EU average when it comes to sustainable environmental performances.

The main objective of ADRIGREEN project is to improve the integration of Croatian and Italian ports and airports with other modes of transportation in order to enhance the processing of passengers during the summer seasons and to improve environmental performances of the Adriatic maritime and aviation systems.

In order to do that, the project will implement a set of structured activities based on transnational and cooperative approach. The main idea is to identify and analyse a number of existing operational and technological solutions that can be easily transferred and adapted by involved ports and airports. The partners are not interested in inventing new solutions as there are a plenty successful models and schemes implemented in other parts of the world that can be replicable also in the Programme area. Once the solutions have been identified and analysed, the project partner will test the operational and technological models on their facilities so as to improve intermodal connections and to put in practices new schemes for a sustainable management of ports and airports. The objective of the testing phase will be to demonstrate the feasibility, the effectiveness and the replicability of the identified solutions. The last but not least intention of the project is to disseminate the results of tested solutions so as to explain also to other ports and airports how the operational procedures and technological innovation can be successfully transferred and used.

These objectives will be reached by producing several outputs:

- International investigation on best solutions to be transferred on Adriatic coasts;
- Environmental assessments of involved ports and airports;
- Joint Actions Plans: intermodal measures and green and sustainable actions to be implemented;
- Testing of innovative solutions in involved territories;
- Technical Manual on identified practices;
- Cross-Border Forum of Green and Intermodal Ports and Airports to present solutions, explain benefits and share recommendations for new strategies.

Project approach

Considering that all involved territories are facing similar problems (low integration between different modes of transportation and low environmental performances), the project will implement all activities with a participative and transnational approach.

The first step will be to perform a detailed and in-depth identification and analysis of existing solutions for lowering airports/ports environmental impacts and for intermodal connections of ports/airports with other modes of transportation and to identify a set of possible schemes to be easily adopted in territories involved in the project. It means that existing solutions, identified around the EU/world (mainly North Europe), will be the starting point of ADRIGREEN project. This activity will contribute to solve one of the main issues related to intermodal connections and low environmental performances: lack of knowledge regarding potential, smart and suitable solutions that could significantly improve the processing of passengers and decrease environmental impact of transport activities in Adriatic basin. The research will be followed by a deep environmental assessment and by realisation of specific Action Plans where all identified measures will be described.

The second step will be to test the adaptability and efficiency of identified solutions on ports and airports of ADRIGREEN project. Each partner already identified its major problems and a set of fields to be tackled by the testing phase: smart solutions to connect ports and airports to local public transportation systems; integrated timetabling and information for passengers; new services with public and private transportation services and reducing of energy consumption in airport/port facilities. Each testing phase will strictly pursue a transnational perspective since the final aim is to test solutions, which could be easily adapted in each area involved in the project.

In fact, the project will organize also 4 transnational trainings targeted to staff working on ports and airports (not only those involved as partner) to improve their knowledge on technological solutions and procedures for both lowering the environmental impacts and planning new intermodal connections.

The final step of the project will be to disseminate as much as possible the tested solutions to all ports and airports located in Adriatic area. The dissemination will be based on demonstrations how the situation could be improved once the solutions are adapted.

Cooperation needed

Considering the specific objectives of the project (identification of innovative solutions to be adopted in all Adriatic area, testing of their replicability on ports/airports and spreading out of new tested technological solutions and procedures for improving intermodality and lowering environmental impacts), the cooperation among ports, airports, public authorities and research institutions is indispensable.

The project intends to support partners to test some innovative schemes to speed up the transit of passengers and to make their facilities environmentally friendly with the purpose to adapt and replicate them, not only within the partnership but also in other Adriatic regions not directly involved in the project. This is the main reason why the project goal cannot be efficiently reached at local/regional level. The local single action can be of course meaningful, but the challenge of the project is to contribute in the creation of convincing conditions for making entire Adriatic area better connected and its transport system more environmentally friendly. This challenge can be addressed only if existing practices, operational and technological solutions, and awareness raising campaigns melt together and produce a capitalization effect.

The testing phase (WP4) is a very important part of this project and its implementation will be done with highly transnational approach in order to give the possibility to each partner to benefit from results achieved by other partners. Following pilot actions are identified for the implementation:

- implementation of low-cost and smart solutions to better connect airports and ports with local public transportation system, such as railways and public bus lines;
- implementation of integrated timetabling and information for passengers that shall continue their travel by other means of transportation;
- adoption of smart solutions to improve waste&water management and to reduce energy consumption in small-medium regional Airports (Dubrovnik-Airport pilot action);
- new protocols with public and private transportation providers to experiment new services to speed up the process of passengers from/to touristic destinations which are not well-connected.

In WP4 the partners will have the possibility to identify some possible win-win solutions and to test concretely their efficiency. Each partner will consequently benefit from testing solutions carried out in other partners' areas. During the testing phase, the partners will have the opportunity to evaluate together the feasibility and effectiveness of identified solutions in order to know how to act in case of further investments to be done in this sector.

Through the transnational approach, the definition of both Joint Action Plans and of the Manual on identified solutions and practices will ensure the comparability of data and also the complementarity of the work.

IV. NEEDS ANALYSIS DUBROVNIK AIRPORT

The Dubrovnik Airport experienced continuous growth in last 18 years. In the last four years (2015 – 2019) Dubrovnik Airport recorded a constant increase of yearly passenger turnover with average growth of 13% per year. During the war in early 90ts the airport infrastructure was completely devastated, since then airport was renovated several times. The most significant renovation project was the last on, the Dubrovnik Airport Development project.

Dubrovnik Airport is located in the Dubrovnik-Neretva County. The Dubrovnik-Neretva County is the southernmost Croatian county. The main characteristic of this region is its transport isolation from the rest of Croatian territory and following that, from the rest of Europe, mostly as a result of physical separation from the rest of the state territory by the Bosnia and Herzegovina access corridor to the Adriatic. The region is also heavily lacking railway and highway infrastructures as the railway and highway links end at Ploče, a town located about 100 km North from the City of Dubrovnik and about 120 km from the Dubrovnik Airport. Air transport is the most important transport mode, considering the number of transported passengers, connecting the county with the rest of Croatia's territory and the world through the Dubrovnik Airport.

The region's economy is mostly based on agriculture and tourism. Therefore, the traffic in Dubrovnik airport is mostly international traffic, including various destinations worldwide, especially during the summer season. This is why the area gravitating towards the Dubrovnik airport is much wider, including the Montenegrin territory and the territory of Bosnia and Herzegovina.

In the last decade Dubrovnik has become a significant cruise ship destination in Adriatic Sea, namely the second one after Venice. The connectivity between Airport and Port is of major interest from environmental and industrial point of view. Also, it is important to highlight that there is only one route (a national road) between the Airport and the Port. This represents a significant infrastructural challenge to overcome, especially during tourist season. Dubrovnik Airport is in close relation with Dubrovnik Port, to monitor and organize transfers between the airport and andport, and the are also collaborating on a number of projects. Such projects range from dedicated business projects such as Home Port for cruise ships, to more public ones such as projects supported by EU founding.

As pointed out, the Dubrovnik Airport had rapid traffic growth in last years that has introduced airport to new environmental challenges, such as increase of air pollutions and integration of environmental protective measures. Such challenges are mostly elaborated and mitigated through airport major infrastructure projects such as DAD. Also, Airport highly invest in partnership with the port and other stakeholders in order to coordinate and collaborate on environmental issues, which result from the increase of traffic and tourist demand, and to mitigate negative effects of increasing airport traffic.

There are other emerging environmental challenges that were identified in recent years. Such new challenges are mostly due to the increase of traffic and the introduction of new airport infrastructure. The additional manoeuvring areas, buildings and facilities need to be integrated in existing systems and exploited in efficient way with lesser possible negative environmental effects.

In order to cope with new environmental challenges, Dubrovnik Airport has planned to increase the level of multimodality/intermodality and environmental performance at the airport through number of dedicated projects. With the completion of DAD project in spring 2020, the airport is facing significant challenge how to effectively integrate new infrastructure in existing systems. The introduction of new facilities has dislocated number of airport organizational units due to safety and performance needs. Now the internal communication and transport between those units is representing organizational and environmental challenges. Such needs should be met with environmental-friendly solutions taking into the account specifics of airport technology and operations.

The ADRIGREEN Project represents a unique opportunity for Dubrovnik Airport to continue its development toward an environmentally friendly airport. In addition, thanks to the project, the Airport will analyse and evaluate existing and future strategies, concepts and technology to improve intermodal solutions. Dubrovnik Airport is especially interested in improving and integrating communication and transport between units, and in opportunities to implement new innovative technologies according to the latest environmental and sustainable development principles.

Consequently, Dubrovnik Airport pilot action includes purchasing of electric vehicles to be used in airside and landside, covering the following pilot action field:

- adoption of smart solutions to improve wastewater management and to reduce energy consumption in small-medium regional Airports

The new solutions tested at the Airport will reduce airport air pollution and will better integrate airport systems. Gained experience and benchmark information will provide inputs for future sustainable development of the whole region.

V. SAFETY AND INDUSTRY REGULATIONS

The airports are highly regulated and standardised environments due to specifics of global international air transportation system. There are a number of international organizations, standards, regulations and agreements that regulate airport performance in any fields. Beside the international regulations, all countries have their own national legislations dedicated to regulate air transportation in general and airports in specific. In addition, there are different industry standards form non-governmental organizations that are widely accepted as norms by government bodies.

In general, airport regulations can be divided in two major groups: airside and landside. The landside area is open to the public, while access to the airside area is tightly controlled. The airside area includes all parts of the airport around the aircraft, and the parts of the buildings that are accessible only to passengers and staff.

The most significant regulatory body is the International Civil Aviation Organization (ICAO), an UN specialized agency, which manages the administration and the governance of the Convention on International Civil Aviation (Chicago Convention). ICAO works within the Convention's UN Member States and industry groups to reach consensus on international civil aviation Standards and Recommended Practices (SARPs) and policies for civil aviation sector. These SARPs and policies are used by UN Member States to ensure that their local civil aviation operations and regulations conform to global norms.

For the EU Member States there is the European Union Aviation Safety Agency (EASA). The EASA is an agency of the EU with responsibility for civil aviation safety. Each State has its own Civil Aviation Agency (CAA) that is responsible to enforce international aviation regulations (ICAO SARPs and EU Directives) at national level. The CAA are regulated and appointed by national legislation and respective governments. CAA is responsible for safety performance of all national air transportation subjects, including airports of the particular state. From industry standards most significant are those issued by the International Air Transport Association (IATA). The IATA is the trade association for the world's airlines which significantly influence airport performance as standards of this organization are widely recognized and enforced by national civil aviation agencies.

Both technology systems and vehicles at the airport landside or airside need to follow the basic national regulations for the specific filed, such as work safety bylaw commercial vehicle bylaws. Beside those there are same general airport standards that need to be followed at the airports, such as ICAO Annex 14 (airport infrastructure) and ICAO Annex 17 (airport security). For the airport airside there are additional safety regulations and standards that need to be follow. Those specific standards are based on ICAO Annex 14, and additionally defined by the CAA in form of national legislation such as Ordinance on airports, Ordinance on ground handling, and Ordinance on airport rescue and firefighting.

Equipment purchased within ADRIGREEN project is implemented in airport processes and put in use obeying all mentioned standards. Additionally, Dubrovnik Airport safety manager is continuously controlling processes from safety point of view with regular reporting process implemented.

VI. DESCRIPTION OF PILOT ACTION IMPLEMENTED

Dubrovnik Airport pilot action implemented is in compliance to third main pilot action field identified within the project: *"adoption of smart solutions to improve waste&water management and to reduce energy consumption in small-medium regional Airports"*; and is divided into three main areas / types of vehicles purchased:

- electric vehicle for waste management process,
- electric vehicle for ICT department, for field work within Dubrovnik Airport premises,
- electric scooters and bicycles to be used by airport staff for airside and landside processes optimisation.

According to the need's analysis performed, Dubrovnik Airport has identified following fields for improvement in landside and airside area:

- energy efficiency improvements within airport processes,
- cost effective optimisation of business processes.

Purchase and implementation of the electric vehicle for waste management process and electric vehicle for ICT department will significantly lower CO2 emission and it will reduce energy consumption in performing daily processes within Dubrovnik Airport premises since old fuel vehicles are fully replaced and put out of the function. Also, since these vehicles are used on the landside area, it will be visible to the stakeholders and general public contributing to the airport green field policy and zero emission strategy adopted within Dubrovnik Airport and presented to the public.

Additionally, daily operative activities performed by Dubrovnik Airport staff in landside and airside area were supported mainly by several vehicles on diesel fuel and some bicycles, where bottlenecks occurred due to the limited space in the landside and airside area for vehicle usage. These bottlenecks have influenced optimisation of Dubrovnik Airport landside and airside processes, resulting in non-cost-effective processes.

Prior to ADRIGREEN project these processes were performed by several vehicles on diesel fuel. In 2017, Dubrovnik Airport replaced some of the vehicles with non-electric bicycles. During 2017-2018, Dubrovnik Airport monitored performance of airport staff and business processes flow comparing usage of non-electric bicycles and vehicles and came to the conclusion that airport processes are more cost-effective and environmentally friendly at the same time by usage of bicycles. Therefore, within ADRIGREEN project Dubrovnik Airport has purchased 10 electric bicycles and 10 electric scooters for day to day airport staff activities, replacing remaining two diesel vehicles and with usage of these electric scooters and bicycles energy consumption and airborne pollutant emissions will be significantly reduced.

VII. FINANCIAL AND ENVIROMENTAL ANALYSIS

Financial analysis

Dubrovnik Airport has performed financial analysis of equipment purchased and used. In conducting financial analysis following assumptions were taken into the consideration:

- purchase price of new vehicle and old (replaced vehicle),
- additional yearly maintenance expenses,
- electric battery change each five years,
- discount interest rate of 3% (source: Croatia National Bank decision from September, 2017),
- economic life usage period of vehicles (8 years).

Other information:

- electric vehicle Goupil for waste management process was purchased and put in use in June 2019.
- electric vehicle Melex for ICT department was purchased and put in use in December 2019,
- electric scooters and bicycles were purchased and put in use in January 2020.

1. WASTE MANAGEMENT VEHICLE ANALYSIS

FINANCIAL ANALYSIS OF 1ST VEHICLE - WASTE MANAGEMENT DIESEL VEHICLE

fuel consumption	16.740
service	4.300
tyres	2.500

VALUE IN CONSTANT PRICES

	Year	Purchased price	Operating expenditures (service, fuel….)	Residual value	Net cash flow
0	2019	293.121			293.121
1	2020		21.040		21.040
2	2021		23.540		23.540
3	2022		21.040		21.040
4	2023		23.540		23.540
5	2024		21.040		21.040
6	2025		23.540		23.540
7	2026		21.040		21.040
8	2027		23.540		23.540
	SUM	**293.121**	**178.320**	**0**	**471.441**

DISCOUNT VALUES (3%)

Year	Purchased price	Operating expenditures (service, fuel….)	Residual value	Net cash flow
2019	293.121	0	0	293.121
2020	0	20.427	0	20.427
2021	0	22.189	0	22.189
2022	0	19.255	0	19.255
2023	0	20.915	0	20.915
2024	0	18.149	0	18.149
2025	0	19.714	0	19.714
2026	0	17.107	0	17.107
2027	0	18.583	0	18.583
SUM	**293.121**	**156.339**	**0**	**449.460**

FINANCIAL ANALYSIS OF 1ST VEHICLE - WASET MANAGEMENT El. VEHICLE	
batery change	36.750
energy consumption	1.543
service	3.000
tyres	1.600

VALUE IN CONSTANT PRICES					
	Year	Purchased price	Operating expenditures (service, fuel….)	Residual value	Net cash flow
0	2019	332.309			332.309
1	2020		4.543		4.543
2	2021		6.143		6.143
3	2022		4.543		4.543
4	2023		6.143		6.143
5	2024		41.293		41.293
6	2025		6.143		6.143
7	2026		4.543		4.543
8	2027		6.143		6.143
	SUM	**332.309**	**79.493**	**0**	**411.802**

DISCOUNT VALUES (3%)				
Year	Purchased price	Operating expenditures (service, fuel….)	Residual value	Net cash flow
2019	332.309	0	0	332.309
2020	0	4.411	0	4.411
2021	0	5.790	0	5.790
2022	0	4.157	0	4.157
2023	0	5.458	0	5.458
2024	0	35.620	0	35.620
2025	0	5.145	0	5.145
2026	0	3.694	0	3.694
2027	0	4.849	0	4.849
SUM	**332.309**	**69.123**	**0**	**401.432**

According to financial analysis performed, waste management electric vehicle costs for period of 8 years are 401 thousand HR compared to 450 thousand HRK for diesel vehicle, which makes it more feasible and cost effective for the company.

2. ELECTRIC VEHICLE FOR ICT DEPARTMENT ANALYSIS

FINANCIAL ANALYSIS OF 2nd VEHICLE - ICT DEPARTMENT DIESEL

fuel consumption	8.370
service	4.300
tyres	2.500

VALUE IN CONSTANT PRICES

	Year	Purchased price	Operating expenditures (service, fuel….)	Residual value	Net cash flow
0	2019	177.853			177.853
1	2020		12.670		12.670
2	2021		15.170		15.170
3	2022		12.670		12.670
4	2023		15.170		15.170
5	2024		12.670		12.670
6	2025		15.170		15.170
7	2026		12.670		12.670
8	2027		15.170		15.170
	SUM	**177.853**	**111.360**	**0**	**289.213**

DISCOUNT VALUES (3%)

Year	Purchased price	Operating expenditures (service, fuel….)	Residual value	Net cash flow
2019	177.853	0	0	177.853
2020	0	12.301	0	12.301
2021	0	14.299	0	14.299
2022	0	11.595	0	11.595
2023	0	13.478	0	13.478
2024	0	10.929	0	10.929
2025	0	12.705	0	12.705
2026	0	10.302	0	10.302
2027	0	11.975	0	11.975
SUM	**177.853**	**97.584**	**0**	**275.437**

FINANCIAL ANALYSIS OF 2nd VEHICLE - ICT DEPARTMENT ELECTRIC

batery change	22.500
energy consumption	1.300
service	3.000
tyres	1.600

VALUE IN CONSTANT PRICES

	Year	Purchased price	Operating expenditures (service, fuel….)	Residual value	Net cash flow
0	2019	97.800			97.800
1	2020		4.300		4.300
2	2021		5.900		5.900
3	2022		4.300		4.300
4	2023		5.900		5.900
5	2024		26.800		26.800
6	2025		5.900		5.900
7	2026		4.300		4.300
8	2027		5.900		5.900
	SUM	**97.800**	**63.300**	**0**	**161.100**

DISCOUNT VALUES (3%)

Year	Purchased price	Operating expenditures (service, fuel….)	Residual value	Net cash flow
2019	97.800	0	0	97.800
2020	0	4.175	0	4.175
2021	0	5.561	0	5.561
2022	0	3.935	0	3.935
2023	0	5.242	0	5.242
2024	0	23.118	0	23.118
2025	0	4.941	0	4.941
2026	0	3.496	0	3.496
2027	0	4.658	0	4.658
SUM	**97.800**	**55.126**	**0**	**152.926**

According to financial analysis performed, electric vehicle for ICT department costs for period of 8 years are 152 thousand HR compared to 275 thousand HRK for diesel vehicle, which makes it more feasible and cost effective for the company.

3. ELECTRIC SCOOTERS AND BICYCLES

Some of the old diesel vehicle fleet for landside and airside day-to-day operative activities were replaced with non-electric bicycles in 2017. Dubrovnik Airport has performed analysis of the usage of non-electric bicycles to diesel vehicles and concluded that day to day processes are more effective in bicycle usage

- one diesel car purchase cost is approximately higher than that of about 20 bicycles,
- day-to-day processes are more effective since bicycles can be used by larger group of employees,
- usage of bicycles is more feasible and environmentally friendly.

The remaining two diesel vehicles were replaced in 2019 In the framework of ADRIGREEN project. Electric bicycles and scooters are considered to be more process-effective than non-electric ones, therefore Dubrovnik Airport decided to buy them within the project.

Financial analysis for purchase of electric scooters and bicycles is not applicable due to the fact that total of 20 electrical items have replaced two existing diesel vehicles. Total costs of diesel vehicles is more than 350 thousand HRK while total costs of electric scooters and bicycles was less than 200 thousand HRK.

Also, processes in Dubrovnik Airport are more optimised when employing 20 electrical items than two Diesel items for day-to-day activities performed by Dubrovnik Airport staff.

Environmental analysis

At this stage, environmental analysis performed relates to basic calculation of CO2 emissions according to technical specifications of equipment purchased compared to the one replaced. In further steps of the pilot action testing, evaluation grid will be developed in order to asses action performance and to show how the environment and transit of passengers benefited from pilot actions. Also, it is important to specify that it is not yet fully investigated the impact of changing electric battery each five years on environment in respect of battery production and battery disposal.

Accordingly, listed below are technical specifications of pilot actions:

- Waste management vehicle – old diesel vehicle CO2 emission is 162 g / km, on a yearly basis, 30.000 km, it is 4.860.00 g. Electric vehicles emission factor was 234,81 g CO2 eq/kWh in Croatia in 2017;
- Vehicle for ICT department – old diesel vehicle CO2 emission is 162 g / km, on a yearly basis, 15.000 km, it is 2.430.00 g. Electric vehicles emission factor was 234,81 g CO2 eq/kWh in Croatia in 2017,
- Two old vehicles –CO2 emission is 162 g / km, on a yearly basis, 12.000 km, it is 2.430.00 g per vehicle. Electric vehicles emission factor was 234,81 g CO2 eq/kWh in Croatia in 2017;

VIII. RISK ANALYSIS

Risk identification

Dubrovnik Airport has participated on several project meetings in order to discuss project implementation and to coordinate project activities.

In addition, Dubrovnik Airport has performed qualitative risk analysis for different stages of feasibility study (FS) and Action plan implementation as follows:

- Preparation phase – includes steps that are to be fulfilled prior to developing of FS and Action plan
- Implementation phase – includes steps that are to be taken for purchase of equipment or software necessary for testing pilot action
- Testing phase – includes steps that are to be undertaken during the testing phase of the Action plan and producing FS.

Per each phase of the Action plan lifecycle, engaged partners will perform following activities:

- Risk identification – all types of risks that can occur needs to be identified and addressed,
- Risk assessment – based on prescribed methodology, each risk shall be measured and assessed based on the probability of occurrence and impact on the project objectives achievement,
- Corrective measures and mitigation measures – measures prescribed by engaged parties in order to mitigate risk to acceptable level. Acceptable levels of risks are moderate or below, other risk levels should be addressed by appropriate measures.

Methodology for risk assessment

The qualitative risk analysis is based upon a combination of impact and probability and is evaluated according to the below risk matrix.

Impact/ Probability	I	II	III	IV	V
1	Low	Low	Low	Low	Moderate
2	Low	Low	Low	Moderate	High
3	Low	Moderate	Moderate	High	High
4	Low	Moderate	High	Very High	Very High
5	Moderate	High	High	Very High	Very High

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Table: Qualitative risk analysis per FS and Action plan phases

PREPARATION PHASE						
Type of risk	**Risk description / Effect on the project**	**Prob.**	**Impact**	**Risk**	**Measures implemented / mitigation measures**	**Status after measures on 28.10.2020. / new deadlines**
Delay in start-up of project activities	Possible delays in signing of Subsidy contracts, Partnership agreement or delays in establishing internal project team could result in not achieving prescribed timeframe for deliverables nor spending forecast and consequently in project budget decommitment.	IV	V	**Very high**	According to internal rules and procedures of DBV internal project teams can be established from the official date of the project (1.1.2019) and prior to signing the SC and PA in order to start implementing activities on time.	Project has started in delay (AP in delay also), DBV team is established, procurements are done for the action plan implementation, risk is still on very high level. **Corrective measures:** FS needs to be adopted by end of October 2020.
Delay in adopting of Programme guidelines	Delay in adopting Implementation manual could severely influence partner's capability for preparing procurement procedures which can result in mistakes during procurement process and financial corrections.	IV	IV	**Very high**	Eventhough there was a delay in prescribing Implementation manual, DBV needs to follow National guidelines for procurement and establish adequate procurement plan in order to avoid possible financial corrections.	DBV has adopted procurement plan and performed all procurements. FLC has performed control of all procurements related to AP for DBV, no corrections were issued. **Risk is mitigated to low level.**
Not adequate input / conclusion form International research performed and	If best possible solutions from international research on number of low-impact intermodal solutions are not properly identified, then quality of Action plans as well as purchased equipment may not be in	III	III	Moderate	International research for low-impact solutions, useful data on intermodality, best practices and operational and technical schemes to reduce environmental impact of ports and airports has to provide	There is a significant delay in finalising IIS. Risk has escalated to high level. **Corrective measures:** IIS together with Capitalisation

Environmental impact assessment	line with project objectives, which can result in project decommitment.				sufficient data for AP implementation.	report needs to be adopted by the end of the April 2020. **However, due to the more delays in the project implementation, this risk has increased to very high level, new deadline April 2021.**
Replacement of key personnel	Due to the envisioned timeframe of the project, key personnel may change positions within the Company or leave Company which can result in delays in closing the project. Information level of the person taking over the position will inevitably be lower than for the one leaving the position.	III	III	Moderate	Project procedures needs to include clear directions on what measures are to be taken to secure information hand-over when a key person is replaced. This includes e.g. a hand-over meeting and a hand-over memorandum. The hand-over process will be supervised to ensure that it is thoroughly executed.	Internal project procedures identifying hand over procedures are adopted. Internal project team has been named. **Risk is mitigated to low level**
Lack of sufficient communication between WP coordinator and partners	Not adequate communication between WP coordinator and partners in producing FS and AP may result in unadequate FA and AP design especially regarding identifying testing phases and evaluation criteria.	III	IV	High	According to the result of Capitalisation report, FS for each territory should be created describing AP implementation and testing results achieved.	There is significant delay in producing Capitalisation report, therefore input for FS at the moment is not adequate. **Risk has escalated to the very high level.** **Corrective measures:** IIS together with Capitalisation

						report needs to be adopted by the end of the April 2020. **However, due to the more delays in the project implementation, this risk has increased to very high level, new deadline April 2021.**
IMPLEMENTATION PHASE						
Type of risk	**Risk description / Effect on the project**	**Prob.**	**Impact**	**Risk**	**Measures implemented / mitigation measures**	**Status after measures on 28.10.2020. / new deadlines**
Procurement plan not adopted	If all necessary procurements related to the project are not adopted and approved on time within the partners organization, equipment and related service may not be contracted and project objectives will not be met.	II	V	Moderate	Procurements related to the ADRIGREEN project should be adopted within the annual procurement plan of the Company in order to secure procurement funds.	Procurement plans have been adopted and all procurements have been finished and contracts signed. Also, all equipment is delivered and put in function in Dubrovnik Airport. **Risk is mitigated to low level.**
Delays in public procurement publication	If public procurements are not published on time or delayed due to appeals, equipment will not be purchased on time to recover depreciation costs which may than be bared by the beneficiaries. Also, contracting of services related to performing testing	III	IV	**High**	DBV has appointed public procurement expert and publish all procurements related to testing of pilot actions not later than 30.4.2019.	Procurement plans have been adopted and all procurements have been finished and contracts signed. Also, all equipment is delivered and put in function in Dubrovnik Airport.

	actions may be delayed resulting in delay in achieving project objectives and outputs					. **Risk is mitigated to low level.**
TESTING PHASES						
Type of risk	**Risk description / Effect on the project**	**Prob.**	**Impact**	**Risk**	**Measures implemented / mitigation measures**	**Status after measures on 12.2.2020. /new deadlines**
Not adequate testing plan	If testing plan does not include all necessary details and testing timeline, testing results may not be in accordance to project needs and project outputs underlined. Also, if Methodology for evaluating environmental impact is not described, results may be misinterpreted.	III	IV	**High**	DBV shall develop adequate testing plan and methodology for environmental impact solutions implemented on time.	Adopting of IIS as well as AP is in delay and consequently adopting of testing plans and testing procedures. **Risk has remained at high level.** **Corrective measures:** IIS together with Capitalisation report needs to be adopted by the end of the April 2020. **Since neither is finished, risk has escalated to very high level, new deadline April 2021.** Testing procedures and FS for Dubrovnik Airport (as an template for the project) should be finished by the end of the March and discussed on next project meeting in

						Ancona. **Template was sent to the partners in June 2020, FS is finished in October 2020, however, WP 3 is still not yet finished, risk Very high level.**
Testing procedures not performed according to plan	If testing procedures are not performed according to prescribed plan, testing results will not be in line with project objectives and project outputs which can result in project funds decommitment.	III	III	Moderate	Testing procedures should be performed according to methods agreed and on representative sample to ensure adequate testing results.	N/A
Not adequate actions implemented	If Dubrovnik Airport has not implemented adequate actions as prescribed by the AF, or actions are implemented in wrong manner, objectives and outputs of the project will not be reached.	III	III	Moderate	Dubrovnik airport has purchased equipment according to specification in AF and has put them in use. Testing results should confirm improvement in environmental impact solutions	N/A

Identified risks shall be monitored and evaluated through entire Action plan and FS lifecycle.

IX. CONCLUSION

Dubrovnik Airport has implemented process for monitoring and implementation of pilot action. Process consisted of following:

- identifying project team with clear responsibilities of each project team member,
- preparation of project implementation plan including pilot action implementation steps,
- identifying risks that can occur during pilot action implementation process with continuously monitoring and evaluation process,
- conducting timely public procurement processes for purchase of needed equipment,
- implementing purchased equipment in practice and measuring their performance,
- establishing monitoring system for environment analysis and process optimisation analysis for future benefits.

Furthermore, pilot action implemented is in compliance to third main pilot action field identified within the project: *adoption of smart solutions to improve waste&water management and to reduce energy consumption in small-medium regional Airports*; and is divided into three main areas / types of vehicles purchased:

- electric vehicle for waste management process,
- electric vehicle for ICT department, for field work within Dubrovnik Airport premises,
- electric scooters and bicycles to be used by airport staff for airside and landside processes optimisation.

Finally, according to testing results of implemented actions, feasibility of each implemented action is demonstrated as well as their positive impact on environment, which clearly demonstrates transferability and applicability of implemented pilot action to other airports and regions. Also, implemented pilot action is in compliance to aviation safety and security standards.

In further steps of the pilot action testing, evaluation grid will be developed in order to asses action performance and to show how the environment and transit of passengers benefited from pilot actions.