Co-funded by the
Erasmus+ Programme
of the European Union

Summer school

SUSTAINABLE DEVELOPMENT OF YACHTING AND CRUISE INDUSTRY

CRUISE PORT PERFORMANCE EVALUATION

Lecturer: prof.dr. Elen Twrdy

Kotor, 21/7/2022

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Prof. dr. Elen Twrdy

University of Ljubljana

Faculty of Maritime Studies and Transport

Head of Departmet of transport technology

Fields of interest: maritime transport, ports, terminals, transport policy, methodology

elen.twrdy@fpp.uni-lj.si

Co-funded by the Erasmus+ Programme of the European Union

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the
Erasmus+ Programme
of the European Union

Contents

Introduction

Port

is a place on the coast where ships can dock to load and unload cargo and passengers.

Loading and Unloading Facility: It is the mandatory part of every port to allow loading and unloading of freight as well as people in a ship.

Infrastructure and Equipment's: piers, basins, storage areas, warehouses to store various ferry equipment. Each port is equipped with essential equipment for e.g. hauling equipment's, draggers, cranes, trucks, loaders, etc.

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the Erasmus+ Programme of the European Union

Contents

Introduction

Ports are in the service sector. They provide services to:

1. Ships
2. Inland transport
3. Cargo (& passengers)

Ports are necessary for the development of a country's maritime economy

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the Erasmus+ Programme of the European Union

Contents

Port performance

The concept of port performance is formed by two components:

efficiency "doing things right"

effectiveness "doing the right things."

Port performance is the implementation of port activities to meets targets set by the owners and service providers and fulfills the expectations of the port customers (users).

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Contents

- Introduction
- Port performance

Port performance

PERFORMANCE MEASURE

Quantitative measure of how an activity was performed, in terms of quantity, quality, effectiveness or efficiency; also known as performance indicator

performance = effectiveness + efficiency + participant satisfaction

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the Erasmus+ Programme of the European Union

Contents

Port performance

Performance is a function of:

1. Ability
2. Effort
3. Opportunity

1. Ability is a funcion of:	2. Effort is a funcion of:	3. Opportunity is a funcion of:
human knowledge & skills technological capabilty	Degree of motivation	Management skills

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the Erasmus+ Programme of the European Union

Contents

Port performance

IS A RATIONAL BALANCE BETWEEN

1. Managerial skills
2. Technology
3. Human resources

IS THE RECIPE FOR INCREASE OF PERFORMANCE IN PORT OPERATIONS

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the Erasmus+ Programme of the European Union

Contents

Port performance

WHY MEASURE PORT PERFORMANCE?

You can only improve what you can manage!
You can only manage what you can measure!
You can only measure if you know what to measure & how to measure it & how to expess the measure!

1. To monitor activity
2. To check efficiency
3. To compare present with past performance
4. To compare present with target performance
5. To compare with competitors' performance
6. To adjust targets
7. To promote the business

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the Erasmus+ Programme of the European Union

Contents

Types of performance measures

What to measure?
How?

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the Erasmus+ Programme of the European Union

Contents

Types of performance measures

1. Production measures

measure of effectiveness – Quantity / unit time

2. Productivity measures

measure of efficiency – Quantity / unit resource /unit time

3. Utilization measures

how intensively particular resource is used; ratio between actual use and maximum possible use of resource in given period

4. Service measures

quality of service provided to organization's customers

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the Erasmus+ Programme of the European Union

Contents

Terminology in cruise sector

The cruise market consists of:

- cruise providers that sale cruise routes (destinations),
- people (passengers) who purchase these routes and
- ports which host the cruise ships.

The cruise market is a system where providers, passengers and ports operate. For cruise providers, cruise traffic means the carriage of passengers, but for the ports, the cruise traffic includes the cruise ship's movements and the cruise passenger movements (home in, home out, and transit passengers), i.e., passenger traffic.

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the Erasmus+ Programme of the European Union

Contents

Terminology in cruise sector

1. Home ports

are the ports where passengers begin or end their cruises, usually are lines set up as loops – they end up in their port of origin

2. Ports of call (transit ports)

Are just one stop in the route to another destination

3. Hybrid ports

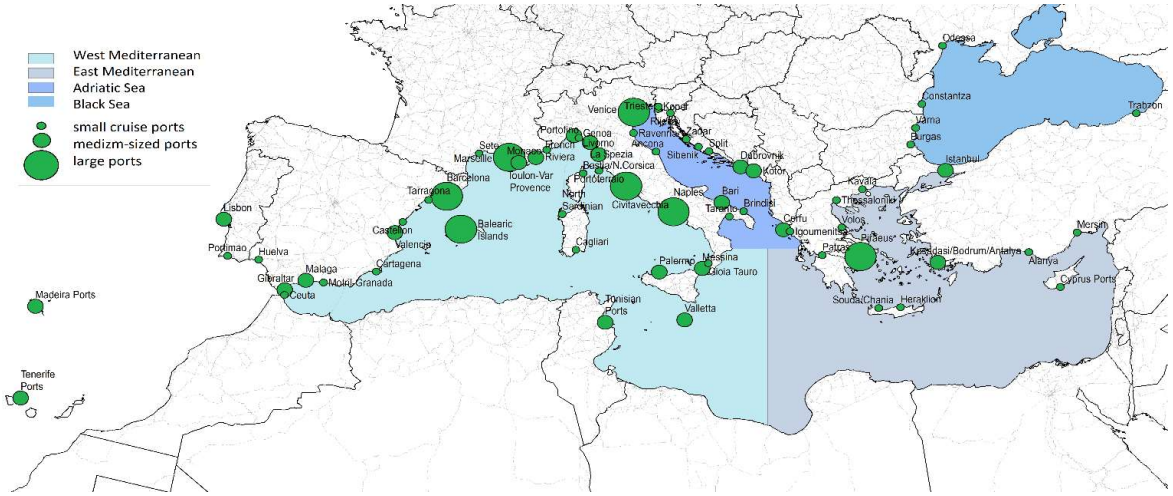
they are the starting and ending point for some cruise , but also present port of call for other cruise itineraries.

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the
Erasmus+ Programme
of the European Union

Contents

The Mediterranean ports can be divided down into four regions, the Western Med, the Eastern Med, the Adriatic Sae and the fourth region, the Black Sea or the Southern Mediterranean (Rodrigue and Notteboom, 2013)



Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the Erasmus+ Programme of the European Union

Contents

Cruise port performance

- Measuring cruise port performance is a complex task for port operators. There are not generally accepted or known tools for measuring the performance of cruise terminals.

- The performance of cruise ports can be based on the efficiency and effectiveness dimensions of a cruise port. Efficiency is defined as the performance in the perspective of the port authority, while effectiveness involves the prospect of customers and all actors involved in the port environment.

efficiency "doing things right"
effectiveness "doing the right things."

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Contents

Cruise port performance

- The performance of the cruise port can be improved - the port becomes more efficient and productive.
- The more efficient ports have a greater advantage to become a chosen port for cruise itinerary. Therefore, ports are improving and investing in themselves in seeking to gain more cruise traffic.
- Port development affects port efficiency and consequently on port productivity
- The biggest gaps regarding efficient cruise port management are port infrastructure, port facilities, political instability, cruise tourism policy (promoting cruise tourism and protecting the destination), comfort and safety of the cruise passengers. These gabs were crucial in identifying how port management issues should be prioritized for improvement and development of the cruise port.

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the Erasmus+ Programme of the European Union

Contents

Multi-criteria decision-making model for cruise port performance evaluation

- The performance of port should be evaluated from several points of view: the traffic impact (passenger movements, cruise ship calls, etc.) is certainly fundamental, but the three pillars of the paradigm of sustainable mobility (social, economic, safety-environmental) must certainly be taken into consideration. Each of these four aspects can be assessed according to different criteria, often not homogeneous: hence the need for a multi-criteria approach (Lorenčič, Giuffrida, Twrdy, Inturri, & Ignaccolo, 2020).
- Multi-Criteria Decision Making (MCDA) is a branch of general-class operations research that deals with decision-making problems in the presence of several decision-making criteria.

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the Erasmus+ Programme of the European Union

Contents

Multi-criteria decision-making model for cruise port performance evaluation

Aspect	Criteria	Indicator	Parameter
Traffic – technical	1. Traffic flow	1.1 Number of cruise ship calls	A total number of cruise ship calls (Homeport, port of call).
		1.2 Number of cruise passengers	A total number of cruise passengers (Embarked, disembarked and transit passengers).
	2. Accessibility	2.1 Accessibility by Public Transport	The number of transit stops/stations in a 2 km radius from the cruise terminal.
		2.2 Accessibility by bike and walking	Length of pedestrian paths in 2 km radius from the cruise terminal.
		2.3 Accessibility by car	No. of parking lots in a 2 km radius from the cruise terminal.
	3. Infrastructure	3.1 Port passenger terminal	No. of the present passenger terminal, else 0.
		3.2 Number of berths	Total No. of berths, else 0
		3.3 Cruise ship draft	Maximum allowed draft of a cruise ship in port (meters).

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the Erasmus+ Programme of the European Union

Multi-criteria decision-making model for cruise port performance evaluation

Contents

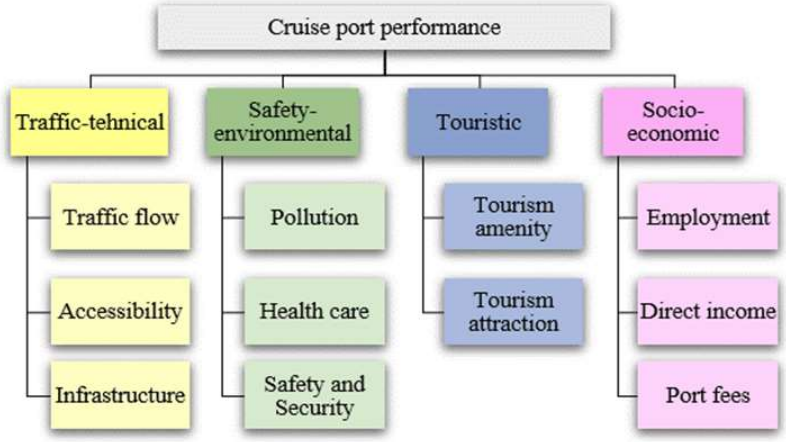
Safety - environmental	4. Pollution	4.1 Pollution index	Survey results.
		4.2 Waste	The amount of solid waste that the cruise port receives from cruise ships (tons).
	5. Health care	5.1 Health care	Survey results.
	6. Safety and Security	6.1 Crime index	Survey results.
Touristic	7. Tourism amenity	7.1 Tourism amenity	The number of tourism amenities in a 2 km radius from the cruise terminal.
	8. Tourism attraction	8.1 Tourism attraction	The number of tourism attractions in a 2 km radius from the cruise terminal.
Socio-economic	9. Employment	9.1 Employment	No. of jobs in the region generated indirectly due to the cruise passengers.
	10. Direct income	10.1 Direct income	Calculated expenditures of cruise passengers in the port city.
	11. Port fees	11. Port fees	Port income from fees paid by cruise ship for each passenger embarking, disembarking and transiting the port.

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the Erasmus+ Programme of the European Union

Multi-criteria decision-making model for cruise port performance evaluation

Contents



The formula of the multi-criteria model for assessing the performance of cruise port:

$$U = PT + VO + T + SE$$

The formula of the multi-criteria model for assessing the performance of cruise port consists of individual criteria, so it can be also written as:

$$U = (pt \cdot U_{pt} + do \cdot U_{do} + in \cdot U_{in}) + (on \cdot U_{on} + zd \cdot U_{zd} + va \cdot U_{va}) +$$
$$+ (tz \cdot U_{tz} + ta \cdot U_{ta}) + (za \cdot U_{za} + dp \cdot U_{dp} + pp \cdot U_{pp})$$

U -performance assessment of the port passenger terminal
PT - traffic-technical criteria,
VO - safety-environmental criteria,
T - touristic criteria
SE - socio-economic criteria

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the Erasmus+ Programme of the European Union

Multi-criteria decision-making model for cruise port performance evaluation

Contents

Criteria\Weight	Port authorities	Rank
A. Traffic – technical aspect	23,91	
1. Traffic flow	6,38	9
2. Accessibility	7,19	8
3. Infrastructure	10,34	4
B. Safety – environmental aspect	28,32	
4. Pollution	6,27	10
5. Health care	10,38	3
6. Safety and Security	11,67	2
C. Touristic aspect	26,35	
7. Tourism amenity	7,30	6
8. Tourism attraction	19,05	1
D. Socio – economic aspect	21,42	
9. Employment	9,18	5
10. Direct income	7,30	6
11. Port fees	4,94	11

Criteria weights by a group of stakeholders expressed as a percentage

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the Erasmus+ Programme of the European Union

Contents

Multi-criteria decision-making model for cruise port performance evaluation

TOPSIS The technique of Order Preference Similarity to the Ideal Solution is one of the multi-criteria decision analysis.

It is bases on the concept that the best alternative would be the one that simultaneously has the shortest distance from the positive ideal solution (PIS) and the farther distance from the negative-ideal solution (NIS) or anti-ideal solution.

By using the TOPSIS method, from the decision matrix we can find out the best alternative - the best cruise port with the higher performance value. The problem occurs when computing the weightage of the criteria. From the TOPSIS method, we cannot gain weights directly. This problem we tackled with the Analytic Hierarchy Process (AHP) by performing a comparison matrix for the criteria and following the steps of the AHP.

We used AHP to determine criteria and weights, and then by using those weights in the TOPSIS method to select the cruise port with the highest performance indicators (Lorenčič, Twrdy, Lep, 2022).

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the Erasmus+ Programme of the European Union

Contents

Multi-criteria decision-making model for cruise port performance evaluation

We used the application of TOPSIS methodology to evaluate the performance of two small Mediterranean cruise ports:

- the port of Catania (Sicily Italy) and
- the port of Koper (Slovenia).

The performance of those ports is evaluated in comparison with best practices from successful European Cruise ports (port of Barcelona, Piraeus, Civitavecchia, Marseille, and Livorno), in terms of all previously described criteria

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

UCG
University of Montenegro

Co-funded by the
Erasmus+ Programme
of the European Union

Contents

- Introduction
- Port performance
- Types of performance measures
- Terminology in cruise sector
- Cruise port performance
- Multi-criteria decision-making model

Multi-criteria decision-making model for cruise port performance evaluation

Criteria	Parameter	Best practices	Parameter value
1.1 Number of cruise ship calls	A total number of cruise ship calls (Homeport, port of call).	Barcelona	830
1.2 Number of cruise passengers	A total number of cruise passengers (Embarked, disembarked and transit passengers).	Barcelona	3.041.963
2.1 Accessibility by Public Transport	The number of transit stops/stations in a 2 km radius from the cruise terminal.	Barcelona	292
2.2 Accessibility by bike and walking	Length of pedestrian paths in 2 km radius from the cruise terminal.	Barcelona	408,93
2.3 Accessibility by car	No. of parking lots in a 2 km radius from the cruise terminal.	Marseille	14.546
3.1 Port passenger terminal	No. of the present passenger terminal, else 0.	Barcelona	7
3.2 Number of berths	Total No. of berths, else 0	Civitavecchia	33
3.3 Cruise ship draft	Maximum allowed draft of a cruise ship in port (meters).	Civitavecchia	18
4.1 Pollution index	Survey results.	Koper	23,88
4.2 Waste	The amount of solid waste that the cruise port receives from cruise ships (tons).	Piraeus	64.381
5.1 Health care	Survey results.	Marseille	83,69
6.1 Crime index	Survey results.	Koper	21,24
7.1 Tourism amenity	The number of tourism amenities in a 2 km radius from the cruise terminal.	Barcelona	3.982
8.1 Tourism attraction	The number of tourism attractions in a 2 km radius from the cruise terminal.	Barcelona	549
9.1 Employment	No. of jobs in the region generated indirectly due to the cruise passengers.	Barcelona	5.476
10.1 Direct income	Calculated expenditures of cruise passengers in the port city.	Barcelona	125,78
11.1 Port fees	Port income from fees paid by cruise ship for each passenger embarking, disembarking and transiting the port.	Barcelona	10,04

Values of best practice criteria used in the TOPSIS methodology for calculating the performance assessment of cruise port.

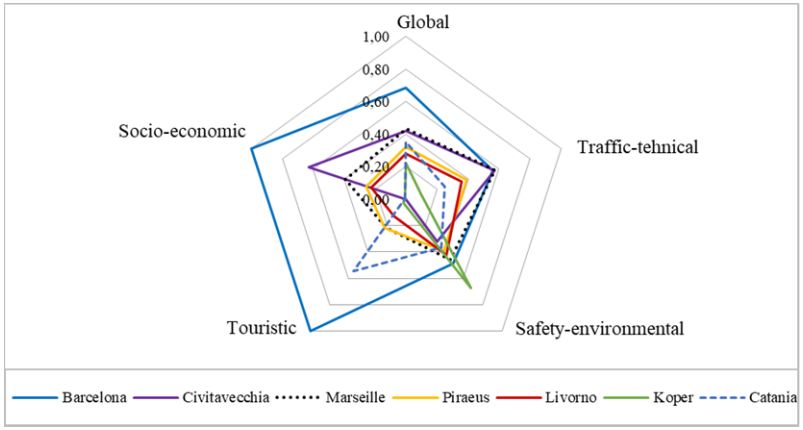
Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the Erasmus+ Programme of the European Union

Multi-criteria decision-making model for cruise port performance evaluation

Contents

	Global	Traffic-technical	Safety-environmental	Touristic	Socio-economic
Barcelona	1	3	2	1	1
Civitavecchia	3	1	6	7	2
Marseille	2	2	3	3	3
Piraeus	5	4	7	4	4
Livorno	6	5	4	5	5
Koper	7	7	1	6	7
Catania	4	6	5	2	6



TOPSIS step six – ranking ports in order from best (1) to worst (7).

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

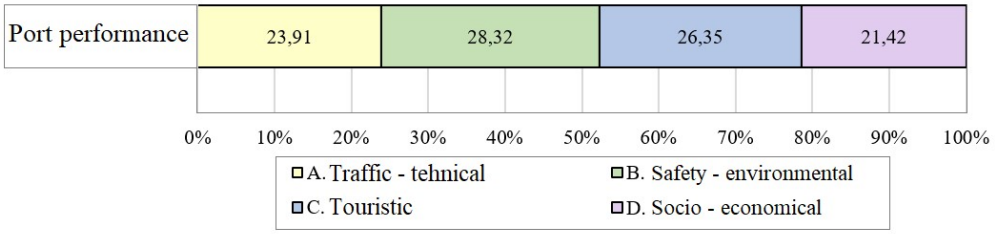
Co-funded by the Erasmus+ Programme of the European Union

Contents

Multi-criteria decision-making model for cruise port performance evaluation

Results of the model

- What is the optimal balance of all aspects for a cruise port to be successful and have the highest performance? To answer all those questions, we need to find the optimal balance between all four aspects. In this context, we used weights of the criteria and aspects conducted from the AHP survey



The measurement scale for assessing the performance of a cruise port

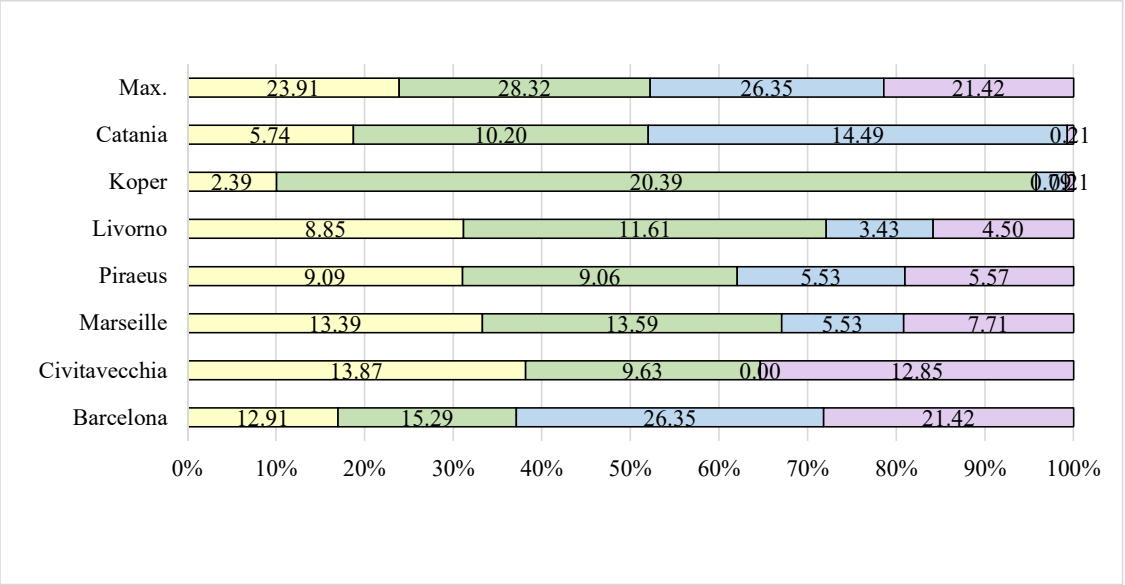
Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the Erasmus+ Programme of the European Union

Multi-criteria decision-making model for cruise port performance evaluation

Contents

Cruise port performance comparison by four aspects



Small ports such as Koper and Catania remain less efficient and less attractive for cruises until they invest in traffic-technical aspect (infrastructure, etc.).

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the Erasmus+ Programme of the European Union

Multi-criteria decision-making model for cruise port performance evaluation

Contents

Now we can use the formula of the multi-criteria model for assessing the performance of cruise port U = PT+ VO+ T+ SE, to calculate the actual port performance on the tendency of a cruise port for an optimal ratio of ratings be tween aspects, as directed by port authorities

Port\Aspect	PT	VO	T	SE	Score (%)	Rank
Barcelona	12,91	15,29	26,35	21,42	75,97	1
Civitavecchia	13,87	9,63	0,00	12,85	36,35	3
Marseille	13,39	13,59	5,53	7,71	40,23	2
Piraeus	9,09	9,06	5,53	5,57	29,25	5
Livorno	8,85	11,61	3,43	4,50	28,38	6
Koper	2,39	20,39	0,79	0,21	23,79	7
Catania	5,74	10,20	14,49	0,21	30,64	4

The most successful port in terms of the tendency to achieve an optimal ratio of rations is Barcelona.

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the Erasmus+ Programme of the European Union

Contents

Conclusions

Cruise port operators (port authority) are constantly under pressure to improve the efficiency and capacity of the terminal to become more successful and competitive. Therefore, they are looking for ways to measure and improve the operation of the cruise terminal, and ways to maintain quality services for ships and passengers. In this context, we have developed a multi-criteria model that evaluates the performance of port passenger terminals with an unconventional approach. Using the multi-criteria model of evaluating the performance of port passenger terminals developed in this paper, helps passenger terminal operators to assess the performance of the terminal from multidisciplinary aspects, and to extract their competitive advantages/disadvantages and what actions are needed to make the cruise port more competitive and successful.

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the Erasmus+ Programme of the European Union

Contents

Key sources

- Lorenčič, V., Giuffrida, N., Twrdy, E., Inturri, G., & Ignaccolo, M. (2020). *Measuring and evaluating the performance of cruise ports with a multicriteria approach*. https://icts.sdzp.org/wp/wp-content/uploads/2020/09/Proceedings-ICTS-2020.pdf
- LORENČIČ, V., TWRDY, E., LEP, M. (2022). Cruise port performance evaluation in the context of port authority : an MCDA approach. *Sustainability*, ISSN 2071-1050, 2022, issue 7, 4181, str. 1-23, ilustr. https://www.mdpi.com/2071-1050/14/7/4181
- Rodrigue J.-P., Notteboom T. (2013). The geography of cruises: Itineraries, not destinations. Applied Geography 38 (2013) 31-42

Project no. 609675-EPP-1-2019-1-ME-EPPKA2-CBHE-SP

Co-funded by the
Erasmus+ Programme
of the European Union

Thank you for your attention!