MODEL FOR THE TRAFFIC AT THE SERVICE OF SUSTAINABLE DEVELOPMENT OF MARITIME TOURISM IN CROATIA

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Abstract: The research presented in this paper has been focused on the synergistic impact of the model for the traffic on the sustainable development of maritime tourism in the Republic of Croatia for the period 2012.-2018. The presentation of the mutual influence of the obtained growth rates of the model's variables has been aimed at a scientific formulation of the research findings and determining the most important theoretical principles of the influence of traffic on the sustainable development of maritime tourism in the Republic of Croatia. The paper provides explanation of the obtained indirect growth rates of the chosen variables by the year 2018. The highest indirect growth rates of the information model for the traffic at the service of the sustainable development of maritime tourism in the Republic of Croatia from 2012 to 2018 may be expected in the variable railway traffic (14.3 %), whereas the lowest values are forecasted for: air traffic, sea traffic, nautical tourism and cruise travels (4.8 %).

Keywords: indirect growth rates, transport, environment, hospitality, private sector, nautical tourism, cruise season service.

1. Introduction

The basic hypothesis of this scientific paper is the following: "Owing to the synergetic action of the indirect growth rates in the variables of the information model for the traffic at the service of the sustainable development of maritime tourism in theRepublic of Croatia from 2012 to 2018, their values will be increased in the year 2018." The synergetic interrelation of the following variables has been studied: road traffic, railway traffic, air traffic, sea traffic, environment protection, hotel industry, private sector, nautical tourism, cruise travels and extra-accommodation service. In addition to the graphs displaying the values of the indirect growth rates, on the index scale from zero to 100, the comment on themutual synergetic action among the variables has been provided in a mental-verbal way.Combinations of a number of scientific methods have been used, among which the most relevant are descriptive, comparative, statistical and mathematical methods, method of model drawing (growth matrix), analysis and synthesis, induction and deduction, proving and refuting.

2. Traffic at the Service of the Sustainable Development of Tourism in the Republic of Croatia

As a tourism development factor, the transport has an essential role and is a fundamental requirement for tourist traffic; mass tourism is most directly affected by traffic system conditions.The major problem that Croatia as well as other European countries experience is an overload of traffic and tourist infrastructure and superstructure throughout the tourist

season, i.e. the seasonal nature and uneven exploitation of capacities throughout the year.Foreign tourists arrive to Croatia mostly by their own cars or other forms of road transport (92.6%), whereas other means of transport are significantly less used (trains 0.4%, airplanes 5.5%, vessels 1.5%) [1].From January to December 2011 there were 830 cruise travels of foreign vessels in the Republic of Croatia. These vessels accommodated 1,141,454 passengers, staying in Croatia for 1,659 days, i.e. on average two days per person [3].In 2011 Croatian airports handled 5,554,026 passengers, 7.2 per cent more than in 2010. Last year there was an increase in passenger traffic in all Croatian airports [2]. The connection of motorways with tourist destinations is relatively weak in Croatia. Therefore motorways should stretch towards the extreme south of the country and it is necessary to continue building or reconstructing access roads from the motorway nodes to the coastal cities and towns. The quality of certain roads on the islands and in the hinterland is also insufficient, particularly in tourist season when roads are overcrowded by tourists' vehicles.The road infrastructure in suburban and urban areas is inadequate. Present bus stations in many coastal cities and towns do not meet the requirements of the tourist season and hardly cope with local and international road traffic, hence it is necessary to reconstruct the existing bus stations or construct new ones at other locations.Croatia has to encourage investments in railway infrastructure and modernisation of major traffic routes. Quite often the capacities and the functionality of railway stations do not comply with the present-day standards for the accommodation and movement of passengers, so it is necessary to build new and adequate railway terminals.Airports cope with insufficient secondary facilities and services (such as aircraft parking, warehouses, cargo service, etc.) and it is necessary to increase the capacity of aircraft parking lots and passenger terminals, e.g. at Split airport.All places along the coast deal with a chronic lack of still traffic infrastructure (parking facilities and access road links to port facilities), in particular over summer months, and it is necessary to start solving this problem [9]. Most of the Croatian sea ports have developed in city cores. As the maritime transport is closely connected with road transport, and given the fact that Croatia is an outstanding tourist receptive country, the streets of the major sea ports are often crowded and jammed in summer, in particular at seasonal traffic peaks. These are the moments when ports cannot fully fulfil their basic function of handling passengers and vehicles. Over the past two decades many competitive ports have been modernised [4] and modern seaport terminals with adequate access roads have been constructed in France, Italy, Spain, Greece, Turkey and other giants in tourism industry. One billion euros have been invested in Barcelona passenger terminal alone. Therefore, it is necessary to carry out major restructuring of almost all Croatia's sea ports and their access roads, and to shift the traffic, partially at least, to new locations. Ferry terminals that are connected to major roads are unable to handle the traffic of passengers and vehicles and it is necessary to build new facilities or increase the capacity of the existing terminals through reconstruction and restructuring [5]. Croatia lacks sea and dry berths for yachts and mega-yachts as well as for the accommodation of cruise liners of all types and sizes. Also, the increasing population of boaters requires more anchorages fitted with mooring buoys. The capacity of ports of nautical tourism is limited and should be enlarged; in this sense, an integral study of designing year-round berths, seasonal berths and anchorages for the accommodation of nautical tourism vessels should be carried out. Maritime tourism is a cluster of relationships and phenomena arising from the sojourn of guests at tourist destinations which gravitate towards or are located at the sea coast, and from sailing by sea for non-commercial reasons.The sustainable development comprises the economic growth and social development that are harmonized with the eco-systems in which they take place, and are therefore sustainable in the long run. The sustainable development is the impulse which will launch new social activities. The major problems experienced in Croatia's

maritime tourism industry include the insufficiently organised private accommodation which comprises more than 60% of the overall capacities, the incomplete privatisation of hotel facilities, and the local way of doing business which lacks vision and is not market-driven. As the share of hotels in the overall accommodation facilities is rather low, it is necessary to design a program for improvement, restructuring and the increase of competitiveness of private accommodation, to foster the process of privatisation of the state-owned hotels, and to encourage investments in new accommodation facilities, in particular the four-star and five-star hotels.Selective forms of tourism (cultural, rural, congress tourism etc.) have not been sufficiently developed and it is necessary to expand these services and the associated infrastructure in order to prolong the tourism season and increase competitiveness.In the Republic of Croatia there is a lack of awareness of the need for joint tourist destination marketing. Destination management programs have to be designed, in particular with the aid of life-long learning as it is well known that life-long learning directly affects the development of the Croatian coastal area. The process of adjustment to new trends is rather slow and the awareness of the importance of continuous human resources education is still relatively low. Qualification and competence structure of the staff employed in tourism is not satisfactory and their pays are low. A particularly low level of know-how and educated personnel can be noticed in the fields of market research and the application of marketing principles in business. Instead of creating competitive advantages, the executives in charge of tourism development keep on rely on comparative (natural) advantages. The process of application of modern technologies is slow, especially in small accommodation facilities. Also, in Splitsko-Dalmatinska County for instance, there are not enough specialised facilities or services targeting special market niches. Finally, there are not enough high-quality nautical berths and the nautical logistics sector has not been sufficiently developed, given the ever-increasing demand. It is necessary to encourage investments into the development of nautical ports and facilities in order to stimulate the high-quality tourism growth.

3. Quantification of the Information Model Variables

Prior to quantifying the variables of the information model for traffic at the service of the sustainable development of maritime tourism in the Republic of Croatia, the most relevant model variables should be determined: road traffic, railway traffic, air traffic, sea traffic, hotel industry, private sector, nautical tourism and cruise travels.By evaluation of model variables, the synergistic effect of the following scientific aspects is taken into account: scientific theoretical aspects of individual model variables, values and meaning of model variables in the period that was analysed in sections 2, 3 and 4, etc. till 2012, the expected variables in 2015 and those in 2018 by which time Croatia can develop all elements of the proposed model on the level of 70-80%- standard transport for sustainable development of maritime tourism in highly developed countries in the European Union. The quantification of the above mentioned variables will be performed on the basis of their values for the year of 2012 in the Republic of Croatia. The current value of each variable is determined on the index scale from zero to 100. It is assumed that the value of the variables is zero in the non-developed countries, whereas their value amounts to 100 in the most developed countries in the world [4].Here is the quantification of the variables of the information model for traffic at the service of the sustainable development of maritime tourism in the Republic of Croatia for the period 2012-2018: 1. road traffic: 80, 2. railway traffic: 45, 3. air traffic: 75, 4. sea traffic: 70, 5. environment protection: 80, 6. hotel industry: 65, 7. private sector: 70, 8. nautical tourism: 75, 9. cruise travels: 75, and 10. extra-accommodation service 70.

4. Designing the Information Model for Traffic at the Service of Sustainable Development of Maritime Tourism in the Republic of Croatia from 2012 to 2018

Based on the previously elaborated basic research and the anticipated evaluation of the growth of the variables of the model for traffic at the service of sustainable development of maritime tourism in Croatia 2012 – 2018 (on the scale from 1 to 100), the variable values have been quantified (Table 1).

Values of the variables of the information model for traffic at the service of sustainable development of maritime tourism in Croatia 2012 – 2018		Inputs y_{it}			Growth
		2012	**2015**	**2018**	**2018/12**
1.	Road traffic	80	82	84	4
2.	Railway traffic	45	48	55	10
3.	Air traffic	75	77	79	4
4.	Sea traffic	70	72	74	4
5.	Environment protection	80	82	85	5
6.	Hotel industry	65	67	70	5
7.	Private sector	70	72	75	5
8.	Nautical tourism	75	76	79	4
9.	Cruise travels	75	77	79	4
10.	Extra-accommodation service	70	73	75	5

Source: by the authors

Table 1 Values of the variables of the information model for traffic at the service of sustainable development of maritime tourism in Croatia 2012 – 2018

The design of the model for traffic at the service of sustainable development of maritime tourism in the Republic of Croatia 2012 – 2018 is based on previously set variables of the model. We start with the assertion that the traffic at the service of sustainable development of maritime tourism consists of "n" inter-reliant elements [8].

The value of an individual model variable is expressed as y_{if} and $y_{it\text{-}1}$ of the *i* variable in the period *t* and *t*-1. An increase of the input value of the *i* variable of the model for the sustainable development of maritime tourism in the Republic of Croatia form 2012 – 2018 is expressed by the relation:

$$\Delta y_{it} = y_{it} - y_{it-1}$$

An indirect growth rate of the *i* variable in relation with *i*, is defined as the relation among the input growth of the *i* variable of the information model for traffic at the service of the sustainable development of maritime tourism in the Republic of Croatia 2012 – 2018, Δy_{it}, and the input value of the *j* variable of the model in the period *t*, that is, the indirect growth rate is expressed by the equation:

$$r_{ijt} = \frac{\Delta y_{it}}{y_{it}}$$

where: i, j=1, …, n, whereas $y_{it-1} \neq 0$.

The indirect rates can be expressed in a form of the growth matrix of the model variables.

$$r_t = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1nt} \\ r_{21} & r_{22} & \cdots & r_{2nt} \\ \cdots & \cdots & \cdots & \cdots \\ r_{n1t} & r_{n2t} & \cdots & r_{nnt} \end{bmatrix}$$

where$t$=1, …t

Here is the growth matrix of the information model for traffic at the service of sustainable development of maritime tourism in the Republic of Croatia 2012 – 2018 by variables, in relation to the current and future values for the period of 2012 – 2018:The vector of the model growth is [7].:

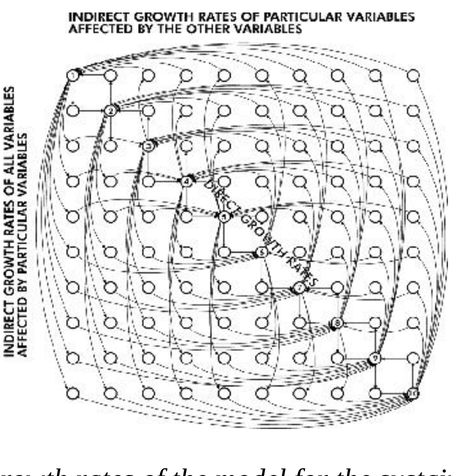
$$\Delta y_{2018} \begin{bmatrix} 4 \\ 10 \\ 4 \\ 4 \\ 5 \\ 5 \\ 5 \\ 4 \\ 4 \\ 5 \end{bmatrix}$$

The vector of the reciprocal values of the model is:

$$\frac{1}{y_{2018}} = \left(\frac{1}{84}, \frac{1}{55}, \frac{1}{79}, \frac{1}{74}, \frac{1}{85}, \frac{1}{70}, \frac{1}{75}, \frac{1}{79}, \frac{1}{79}, \frac{1}{75} \right)$$

$$R_{2018}\begin{bmatrix}
\frac{4}{84} & \frac{4}{55} & \frac{4}{79} & \frac{4}{74} & \frac{4}{85} & \frac{4}{70} & \frac{4}{75} & \frac{4}{79} & \frac{4}{79} & \frac{4}{75} \\
\frac{10}{84} & \frac{10}{55} & \frac{10}{79} & \frac{10}{74} & \frac{10}{85} & \frac{10}{70} & \frac{10}{75} & \frac{10}{79} & \frac{10}{79} & \frac{10}{75} \\
\frac{4}{84} & \frac{4}{55} & \frac{4}{79} & \frac{4}{74} & \frac{4}{85} & \frac{4}{70} & \frac{4}{75} & \frac{4}{79} & \frac{4}{79} & \frac{4}{75} \\
\frac{4}{84} & \frac{4}{55} & \frac{4}{79} & \frac{4}{74} & \frac{4}{85} & \frac{4}{70} & \frac{4}{75} & \frac{4}{79} & \frac{4}{79} & \frac{4}{75} \\
\frac{5}{84} & \frac{5}{55} & \frac{5}{79} & \frac{5}{74} & \frac{5}{85} & \frac{5}{70} & \frac{5}{75} & \frac{5}{79} & \frac{5}{79} & \frac{5}{75} \\
\frac{5}{84} & \frac{5}{55} & \frac{5}{79} & \frac{5}{74} & \frac{5}{85} & \frac{5}{70} & \frac{5}{75} & \frac{5}{79} & \frac{5}{79} & \frac{5}{75} \\
\frac{5}{84} & \frac{5}{55} & \frac{5}{79} & \frac{5}{74} & \frac{5}{85} & \frac{5}{70} & \frac{5}{75} & \frac{5}{79} & \frac{5}{79} & \frac{5}{75} \\
\frac{4}{84} & \frac{4}{55} & \frac{4}{79} & \frac{4}{74} & \frac{4}{85} & \frac{4}{70} & \frac{4}{75} & \frac{4}{79} & \frac{4}{79} & \frac{4}{75} \\
\frac{4}{84} & \frac{4}{55} & \frac{4}{79} & \frac{4}{74} & \frac{4}{85} & \frac{4}{70} & \frac{4}{75} & \frac{4}{79} & \frac{4}{79} & \frac{4}{75} \\
\frac{5}{84} & \frac{5}{55} & \frac{5}{79} & \frac{5}{74} & \frac{5}{85} & \frac{5}{70} & \frac{5}{75} & \frac{5}{79} & \frac{5}{79} & \frac{5}{75}
\end{bmatrix}$$

The research has produced the direct growth rates (the diagonal values in Table 2) as well as the indirect growth rates of the information model for traffic at the service of sustainable development of maritime tourism in the Republic of Croatia 2012 – 2018 (Table 2 and Graph 1). Due to limited space, the indirect growth rates will not be elaborated in this paper [6]. Note: direct growth rates are shown as diagonal in the table; they are not in the focus of this research.The following graph 1, shows a graphical representation of the correlation between the variables of the model.



Source: by the authors

Graph 1 Direct and indirect growth rates of the model for the sustainable development of maritime tourism in the Republic of Croatia

The following Table 2, is one with the calculation derived of growth rates of variables of the model.

The model variables (in %)	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1.	4,8	**7,3**	**5,1**	**5,1**	**4,7**	**5,7**	**5,3**	**5,1**	**5,1**	**5,3**
2.	**11,9**	18,2	**12,7**	**13,5**	**11,8**	**14,3**	**13,3**	**12,7**	**12,7**	**13,3**
3.	**4,8**	**7,3**	5,1	**5,1**	**4,7**	**5,7**	**5,3**	**5,1**	**5,1**	**5,3**
4.	**4,8**	**7,3**	**5,1**	5,1	**4,7**	**5,7**	**5,3**	**5,1**	**5,1**	**5,3**
5.	**6**	**9,1**	**6,3**	**6,8**	5,9	**7,1**	**6,7**	**6,3**	**6,3**	**6,7**
6.	**6**	**9,1**	**6,3**	**6,8**	**5,9**	7,1	**6,7**	**6,3**	**6,3**	**6,7**
7.	**6**	**9,1**	**6,3**	**6,8**	**5,9**	**7,1**	6,7	**6,3**	**6,3**	**6,7**
8.	**4,8**	**7,3**	**5,1**	**5,1**	**4,7**	**5,7**	**5,3**	5,1	**5,1**	**5,3**
9.	**4,8**	**7,3**	**5,1**	**5,1**	**4,7**	**5,7**	**5,3**	**5,1**	5,1	**5,3**
10.	**6**	**9,1**	**6,3**	**6,8**	**5,9**	**7,1**	**6,7**	**6,3**	**6,3**	6,7

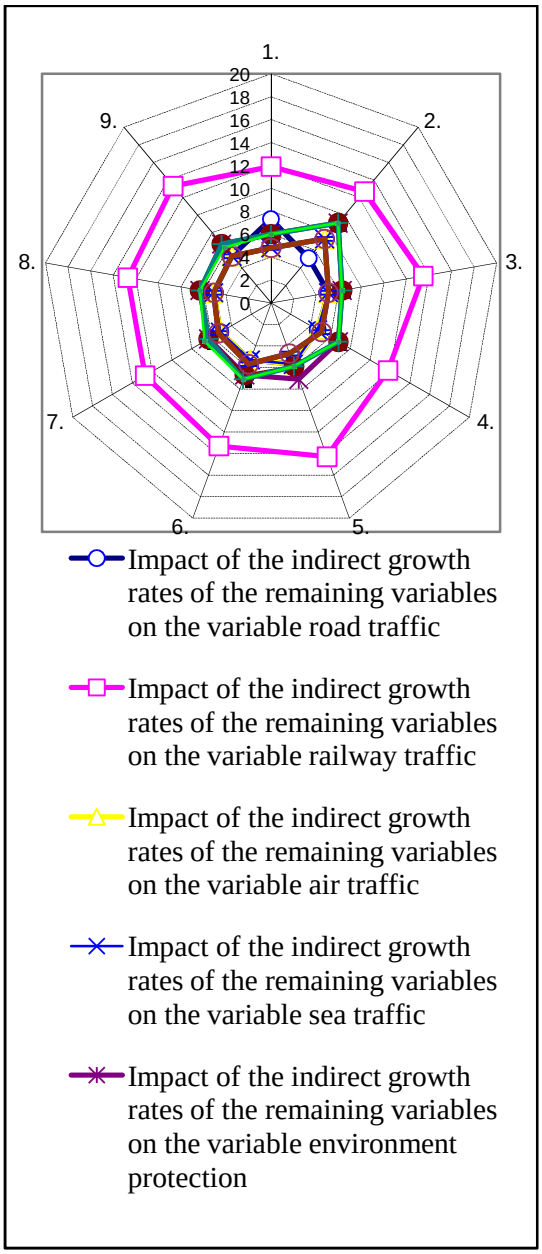
Source: by the authors

Table 2 Growth rates of the information model for traffic at the service of sustainable development of maritime tourism in the Republic of Croatia 2012 – 2018

5. Indirect growth rates of the information model

Here is the analysis of the synergetic interrelation of the variables of the information mode for the traffic at the service of the sustainable development of maritime tourism in the Republic of Croatia from 2012 to 2018.Graph 2 shows that the variable *road traffic* will be mostly affected by the variables *railway traffic* having an indirect growth rate of 7.3 % and *hotel industry* having an indirect growth rate of 5.7 %, whereas the variable *environment protection*, having the indirect growth rate of 4.7 % will affect the variable *road traffic* the least.The great influence of the variable *railway traffic* results from the assumption that this variable will see the greatest growth in 2018 when compared to its value in 2012 (10) due to considerable investments that are required in the railway transportation.The impact of the variable *hotel industry* results from the assumption that substantial funds will be invested in this industry leading to its significant growth in the observation period (5). Also, indirect growth rates of these two variables will strongly affect the variable *road traffic* due to the fact that in 2012 they had the lowest values (on the index scale from zero to 100), compared to the remaining variables of the information model (45 and 65).The variable *environment protection* has the least influence on the variable *road traffic* because the variable *environment protection* had a high value in 2012 (80), whereas its growth by the year 2018 is relatively low (5 %). A scientific analysis of the Graph 2 proves that the variable *railway traffic* will be least affected by the variable *environment protection* having the indirect growth rate of 11.8 %, while the greatest influence will have the variable *hotel industry* reaching the indirect growth rate of 14.3 %.The reason for the greatest influence of the indirect growth rate of the variable *hotel industry* on the variable *railway traffic* lies in the fact that the former variable had the lowest value in 2012 (on the index scale from zero to 100) compared to the remaining variables of the information model (45), so that it is foreseen that this variable will obtain the highest growth by 2018 (10).The variable *environment protection* has the least

influence on the variable *railway traffic* because the variable *environment protection* had a high value in 2012 (80).



Source: by the authors

Graph 2 Impact of the indirect growth rates of the remaining variables on the variable road traffic

A scientific analysis of the Graph 2 proves that the variable *air traffic* will be least affected by the variable *environment protection* having the indirect growth rate of 4.7 %, while the greatest influence will have the variable *railway traffic* reaching the indirect growth rate of 7.3 %.

The reason for the greatest influence of the indirect growth rate of the variable *railway traffic* on the variable *air traffic* lies in the fact that the former variable had the lowest value in 2012 (on the index scale from zero to 100) compared to the remaining variables of the information model (45), and it is assumed that this variable will obtain the highest growth by 2018 (10).

The variable *environment protection* has the least influence on the variable *air traffic* because the variable *environment protection* had a high value in 2012 (80).A scientific analysis of the Graph 2 proves that the variable *environment protection*will be least affected by the variable*road traffic* having the indirect growth rate of 6%, while the greatest influence will have the variable *railway traffic* reaching the indirect growth rate of 9.1 %.A scientific analysis of the Graph 2 proves that the variable *hotel industry* will be least affected by the variable *environment protection* having the indirect growth rate of 5.9 %, while the greatest influence will have the variable *railway traffic* reaching the indirect growth rate of 9.1 %.The reason for the greatest influence of the indirect growth rate of the variable *railway traffic* on the variable *hotel industry* lies in the fact that the former variable had the lowest value in 2012 (on the index scale from zero to 100) compared to the remaining variables of the information model (45), and it is assumed that this variable will obtain the highest growth by 2018 (10).The variable *environment protection* has the least influence on the variable *hotel industry* because the variable *environment protection* had a high value in 2012 (80).A scientific analysis of the Graph 2 proves that the variable *private sector* will be least affected by the variable *environment protection* having the indirect growth rate of 5.9 %, while the greatest influence will have the variable *railway traffic* reaching the indirect growth rate of 9.1 %.The reason for the greatest influence of the indirect growth rate of the variable *railway traffic* on the variable *private sector* lies in the fact that the former variable had the lowest value in 2012 (on the index scale from zero to 100) compared to the remaining variables of the information model (45), and it is assumed that this variable will obtain the highest growth by 2018 (10).A scientific analysis of the Graph 2 proves that the variable *nautical tourism* will be least affected by the variable *environment protection* having the indirect growth rate of 4.7 %, while the greatest influence will have the variable *railway traffic* reaching the indirect growth rate of 7.3 %.The reason for the greatest influence of the indirect growth rate of the variable *railway traffic* on the variable *nautical tourism* lies in the fact that the former variable had the lowest value in 2012 (on the index scale from zero to 100) compared to the remaining variables of the information model (45), and it is assumed that this variable will obtain the highest growth by 2018 (10).The variable *environment protection* has the least influence on the variable *nautical tourism*because the variable *environment protection* had a high value in 2012 (80). A scientific analysis of the Graph 2 proves that the variable *cruise travels* will be least affected by the variable *environment protection* having the indirect growth rate of 4.7 %, while the greatest influence will have the variable *railway traffic* reaching the indirect growth rate of 7.3 %.The reason for the greatest influence of the indirect growth rate of the variable *railway traffic* on the variable *cruise travels* lies in the fact that the former variable had the lowest value in 2012 (on the index scale from zero to 100) compared to the remaining variables of the information model (45), and it is assumed that this variable will obtain the highest growth by 2018 (10).The variable *environment protection* has the least influence on the variable *cruise travels* because the variable *environment protection* had a high value in 2012 (80).

A scientific analysis of the Graph 2 proves that the variable *extra-accommodation service* will be least affected by the variable *road traffic* having the indirect growth rate of 5.9 %, while the greatest influence will have the variable *railway traffic* reaching the indirect growth rate of 9.1 %.The reason for the greatest influence of the indirect growth rate of the variable *railway traffic* on the variable *extra-accommodation service* lies in the fact that the former variable had the lowest value in 2012 (on the index scale from zero to 100) compared to the remaining variables of the information model (45), and it is assumed that this variable will obtain the highest growth by 2018 (10). The variable *road traffic* has the least influence on

the variable *extra-accommodation service*because the variable *environment protection* had a high value in 2012 (80).

6. Conclusion

The basic hypothesis of this scientific paper is that, owing to the synergetic action of the indirect growth rates in the variables of the information model for the traffic at the service of the sustainable development of maritime tourism in the Republic of Croatia from 2012 to 2018, their values will be increased in the year 2018.The hypothesis has been confirmed by the research findings indicating that the given model's variables, whose value ranged from 4 to 10 %, have produced indirect growth rates from 4.8 to 14.3 % for the year 2018.The research has produced the following indirect growth rates of the information model for the traffic at the service of sustainable development of nautical tourism in the Republic of Croatia from 2012 to 2018: road traffic: 4.7 to 7.3 %, railway traffic: 11.8 to 14.3 %, air traffic: 4.7 do 7.3 %, sea traffic: 4.7 to 7.3 %, environment protection: 6 to 9.1 %, hotel industry: 5.9 do 9.1 %, private sector: 5.9 to 9.1 %, nautical tourism: 4.7 to 7.3 %, cruise travels: 4.7 to 7.3 % and extra-accommodation service: 5.9 to 9.1 %.The analysis and evaluation of the individual model's variables and the obtained indirect growth rates have been aimed to formulate, in a scientifically founded way, the results of the research by the most significant theoretical laws of sustainable development of maritime tourism in the Republic of Croatia.

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