Information model sustainable development of nautical tourism in Republic of Croatia 2010-2015

VINKO VIDUČIĆ,
Maritime Faculty Split, University of Split, Zrinsko-Frankopanska 38, 21000 Split
vviducic@pfst.hr

DAMIR BORAS
Faculty of Humanities and Social Sciences, University of Zagreb, Zagreb
dboras@ffzg.hr

LJILJANA VIDUČIĆ
Faculty of Economics, University of Split, 21000 Split
lviducic@efst.hr

CROATIA

Abstract: - This paper presents a new information model for sustainable development of nautical tourism in the Republic of Croatia based on set model variables: modernization, enlargement and building new ports of nautical tourism, construction of nautical fleet, organization of yachting clubs, building shipyards for nautical fleet, building sports, retail, hotel, catering etc. facilities, and building dry berth hangars, motor service stations and vessel maintenance workshops. The information model has given direct growth rates of sustainable development of nautical tourism in the Republic of Croatia with realistic prospects to be achieved. The fundamental scientific hypothesis of this paper is proven by indirect growth rates of above mentioned model variables.

Key-Words: - Sustainable development, information model, nautical tourism

1 Introduction
The position of Croatia on the tourist market will improve if we manage to harmonize the development with the sustainability [1]. The development of nautical tourism should be sustainable so that the environment is preserved for the generations to come [2], [3], [4]. The future generations should have an opportunity to enjoy the benefits of today's relatively authentically preserved nature [5]. Nautical tourism harmfully affects the environment preservation by polluting the sea (seabed, surface and sea mass), the air, and the land (by noise, waste accumulation, fire); furthermore, by overfishing, looting amphorae on the seabed, and by general degradation of the ecosystem [5], [6].

The fundamental scientific hypothesis of this scientific paper is the following: with scientific insights into sustainable development of nautical tourism in the Republic of Croatia, it is possible to suggest a new information model for sustainable development of nautical tourism in the Republic of Croatia.

Before starting drawing up a information model for sustainable development of nautical tourism in the Republic of Croatia, the most significant variables of the model need to be set. By simultaneous accounts of direct and indirect growth rates of the model, it is possible to follow the change of intensity of variable growths as well as their structural relationships. On the basis of hypothetically set values of the model variables, it will be possible to determine the share of the variables in the achievement of sustainable development of nautical tourism in the Republic of Croatia.

The model will comprise the values of set variables in 2010 to be quantified by the authors in view of the expected values in 2013 when the Republic of Croatia is supposed to be in the transitional period of joining the European Union, and the expected values in 2015 by when at the latest, the authors assume, Croatia will obtain full membership of the European Union. Eventually the authors will present a scientifically founded verification or a denial of the fundamental hypothesis of this scientific paper.
2 Proposal of activities for the implementation of the model

Quantification of the information model of the sustainable development of nautical tourism in the Republic of Croatia will stem from qualitative research, when qualitative materials of the set variables of the model are turned into the numeric form.

The evaluation of the variables of the model will take into consideration synergy effects of the following scientific aspects: i) scientific theoretical aspects of individual variables of the model; ii) values and importance of variables of the model in the period analyzed in the research, i.e. from 2000 to 2010; iii) expected values of variables of the model, according to the authors’ expectations, in the years when Croatia is supposed to become an associate member of the European Union – by 2013, and a full member – by 2015.

Drawing of the information model for sustainable development of nautical tourism in the Republic of Croatia will be based on previously set variables of the model:

- modernization, enlargement and building new ports of nautical tourism,
- construction of nautical fleet,
- organization of yachting clubs,
- building shipyards for nautical fleet,
- building sports, retail, hotel, catering etc. facilities,
- building dry berth hangars, motor service stations and vessel maintenance workshops.

We start with the assertion stating that the sustainable development of nautical tourism in the Republic of Croatia consists of "n" inter-relation elements. The value of an individual variable of the model is expressed as $y_{it}$ and $y_{it-1}$ of the $i$ variable in the period $t$ and $t-1$.

An increase of the input value of the $i$ variable of the information model for sustainable development of nautical tourism in the Republic of Croatia [8]:

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

An indirect growth rate of the $i$ variable in relation with $i$, is defined as relation of the input growth of the $j$ variable of the information model for sustainable development of nautical tourism in the Republic of Croatia, $\Delta y_{jt}$, and the input value of the $j$ variable of the model in the period $t$, that is:

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

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

Indirect rates can be expressed in a form of matrix of growth of variables of the model:

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

where $t = 1, \ldots, T$

The variables on the main vertical refer to direct ($i = j$), whereas the others ($i \neq j$) refer to indirect growth rates. The variables in the $i$ row refer to the input growth in the $i$ variable in relation to inputs in other variables. The variables in $i$ column refer to the value growth of the input in all variables of the model in relation to the input of the $i$ variable in the period $t$. Therefore, each variable in the growth matrix is represented by one row and one column, with elements expressing indirect or relative growth relationships. Other rows and columns refer to other elements of the information model for sustainable development of nautical tourism in the Republic of Croatia.

Indirect growth rates can be defined in relation to the inputs of the $j$ variable of the model in the period $t=1$, i.e.: $r_{ijt} = \frac{\Delta y_{ijt}}{y_{j,t-1}}$;

where $i, j = 1, \ldots, n$.

The next inter-relation reflects the connection among indirect growth rates:

$$r_{ijt} = \frac{r'_{ijt}}{1 + r'_{i,jt}}$$

and $r'_{ijt} = \frac{r_{ijt}}{1 - r_{i,jt}}$;

where $i, j = 1, \ldots, n$.

The matrix type can be determined through the external vector of the variable of the model. The vector of the growth of variables of the model: $\Delta y_{it} = (\Delta y_{i1}, \ldots, \Delta y_{in})$.

The vector of reciprocal values of variables of the model:

$$\left( \frac{1}{y_{it}} \right) = \left( \frac{1}{y_{i1}}, \ldots, \frac{1}{y_{in}} \right)$$

where $i, j = 1, \ldots, n$, whereas $y_{i0,i} \neq 0$.

The growth matrix of the model defines the external vector of the growth of the coefficients of variables of the model and the vectors of reciprocal values:
If we analyze only direct growth rates, then the growth of a variable is expressed independently regarding the growth of the others. When we analyze indirect growth rates, that is, growth rates of the $i$ variable in relation to $j$ ($i, j = 1, \ldots, n$), it is possible to determine the structure of the growth of variables and express all relationships via the growth matrix in the total system. At the same time, by expressing direct and indirect rates, it is possible to follow both intensity changes of the growth of variables and their structural relationships. On the basis of hypothetically set values of variables of the model, it is possible to determine the share of variables in the implementation of the sustainable development of nautical tourism in the Republic of Croatia.

<table>
<thead>
<tr>
<th>Model variables</th>
<th>Inputs $y_{it}$</th>
<th>Growth $2010$</th>
<th>$2013$</th>
<th>$2015$</th>
<th>$2015/10$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Modernization, enlargement…</td>
<td>40</td>
<td>55</td>
<td>70</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>2. Construction of nautical fleet</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>3. Organization of yachting clubs</td>
<td>40</td>
<td>60</td>
<td>80</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>4. Building shipyards for nautical fleet</td>
<td>40</td>
<td>50</td>
<td>60</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5. Building sports, hotels…</td>
<td>50</td>
<td>65</td>
<td>80</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>6. Building dry berth hangar…</td>
<td>45</td>
<td>60</td>
<td>80</td>
<td>35</td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Value of variables of the information model for sustainable development of nautical tourism in the Republic of Croatia

The research has provided direct growth rates of the information model for sustainable development of nautical tourism in the Republic of Croatia, as well as the following results (see Table 2 and Figure 1).

The direct growth rate of modernization, enlargement and building new ports of nautical tourism indicates that, in the period of 2010 – 2015, it will increase by 42.9%. This can indeed be expected, given all activities undertaken by the Government, counties and municipalities in cooperation with potential investors in existing and new facilities of nautical tourism.

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domestic and foreign, current and potential new businessmen in the sector of nautical fleet construction.

<table>
<thead>
<tr>
<th>Variables</th>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
<th>6.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>42,9</td>
<td>75,0</td>
<td>37,5</td>
<td>50,0</td>
<td>37,5</td>
<td>37,5</td>
</tr>
<tr>
<td>2.</td>
<td>28,6</td>
<td>50,0</td>
<td>25,0</td>
<td>33,3</td>
<td>25,0</td>
<td>25,0</td>
</tr>
<tr>
<td>3.</td>
<td>57,1</td>
<td>100,0</td>
<td>50,0</td>
<td>66,7</td>
<td>50,0</td>
<td>50,0</td>
</tr>
<tr>
<td>4.</td>
<td>28,6</td>
<td>50,0</td>
<td>25,0</td>
<td>33,3</td>
<td>25,0</td>
<td>25,0</td>
</tr>
<tr>
<td>5.</td>
<td>42,9</td>
<td>75,0</td>
<td>37,5</td>
<td>50,0</td>
<td>37,5</td>
<td>37,5</td>
</tr>
<tr>
<td>6.</td>
<td>50,0</td>
<td>87,5</td>
<td>43,8</td>
<td>58,3</td>
<td>43,8</td>
<td>43,8</td>
</tr>
</tbody>
</table>

Table 2. Growth rates of the model for sustainable development of nautical tourism (%)

The organization of yachting clubs will grow by 50,0 % in the period of 2010 – 2015. This growth is realistic, given the fact that there is a lot of room for development in this variable of the information model for sustainable development of nautical tourism in the Republic of Croatia. This growth will be feasible with improved organization of ports of nautical tourism, and with employment of a new generation of highly educated experts in nautical tourism.

Building shipyards for nautical fleet as a variable of the model will grow by 33,3 % in the period of 2010 – 2015. This percentage is realistic given the Croatian tradition of building all types of vessels, as it is explained in more detail in the previous chapters.

According to the applied model, building sports, retail, hotel, catering etc. facilities will grow, in the period of 2010 – 2015, at the rate of 37,5%. The growth is realistic given the fact that the surrounding spaces in Croatian ports of nautical tourism are limited as the majority of Croatia's marinas are built in towns.

Table 2 shows that, in the period of 2010 – 2015, the highest direct growth rates of the model can be expected in the variables construction of nautical fleet and organization of yachting clubs, by 50 %. In the same period, the lowest direct growth rates of the model will be in the variable building shipyards for nautical fleet. Taking into account all that has been said, we can conclude that direct growth rates of all variables of the information model for sustainable development of nautical tourism in the Republic of Croatia have realistic chances to be implemented. This also means that the hypothetical values of all variables of the model have been set realistically.

The growth matrix can determine sustainable development of nautical tourism in the Republic of Croatia for different $t = 1, 2, \ldots, t$, if it is possible to calculate the growth matrix of the information model for sustainable development of nautical tourism in the Republic of Croatia of 2013 in relation to 2010, and the growth matrix of 2015 in relation to 2013. By aligning corresponding growth rates for different periods, it is possible to obtain useful information in the comparative analysis. Variables of the information model for sustainable development of nautical tourism in the Republic of Croatia are in fact the variables affecting the sustainable development of nautical tourism in the Republic of Croatia and these are: modernization, enlargement and building new ports of nautical tourism; construction of nautical fleet; organization of yachting clubs; building shipyards for nautical fleet; building sports, retail, hotel, catering etc. facilities; and building dry berth hangars, motor service stations and vessel maintenance workshops.
The analysis and the evaluation of individual variables of the model and the obtained 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 nautical tourism in the Republic of Croatia.

The fundamental scientific hypothesis of this paper has been the following: with scientific insights into sustainable development of nautical tourism in the Republic of Croatia, it is possible to suggest a new information model for sustainable development of nautical tourism in the Republic of Croatia. The hypothesis has been proven through indirect growth rates of the above stated variables of the model.

3 Conclusion

The basic scientific hypothesis of this paper is: with scientific insights into sustainable development of nautical tourism in the Republic of Croatia, it is possible to suggest a new information model for sustainable development of nautical tourism in the Republic of Croatia. The model has been drawn on the basis of set variables of the model: modernization, enlargement and building new ports of nautical tourism; construction of nautical fleet; organization of yachting clubs; building shipyards for nautical fleet; building sports, retail, hotel, catering etc. facilities; and building dry berth hangars, motor service stations and vessel maintenance workshops. The model comprises quantified values of the above mentioned variables in 2010, on the basis of the expected values in 2013 when the Republic of Croatia is supposed to be in the transitional period of joining the European Union, and the expected values in 2015 by when at the latest, the authors assume, Croatia will obtain full membership of the European Union. By simultaneous accounts of direct and indirect model growth rates, it has been possible to follow the change of intensity of variable growths as well as their structural relationships.

On the basis of hypothetically set values of the information model variables, we have been able to determine the share of the variables in the achievement of sustainable development of nautical tourism in the Republic of Croatia. Direct growth rates of all variables of the model have realistic chances to be implemented. This also means that the hypothetical values of all variables of the model have been set realistically. The growth matrix can determine sustainable development of nautical tourism in the Republic of Croatia for different $t = 1, 2, \ldots, t$, if it is possible to calculate the growth matrix of the information model for sustainable development of nautical tourism in the Republic of Croatia of 2013 in relation to 2010, and the growth matrix of 2015 in relation to 2013. By aligning corresponding growth rates for different periods, it is possible to obtain useful information in the comparative analysis. Variables of the information model for sustainable development of nautical tourism in the Republic of Croatia are in fact the variables affecting the sustainable development of nautical tourism in the Republic of Croatia.

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References: