THE RELATIONSHIPS BETWEEN TOURISM AND HOTEL INDUSTRY LABOUR MARKET DETERMINANTS AND THE NUMBER OF GRADUATES

Tea Baldigara
Kristina Duvnjak

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Abstract
Purpose – This paper aims to investigate the existence of a relationship between tourism and hotel industry labour market determinants and the number of graduates in the sector in Croatia. Although, the expansion of Croatian tourism and hotel industry in recent years resulted in a growing number of higher education institutions in those sectors, the internationalization of study programmes and their redesigning to better meet the labour market is needed. Furthermore, there is a necessity of labour market features improving to create a motivating working environment for future employees.
Design – The paper presents an explorative analysis designed to analyse Croatian tourism and hotel industry labour market and the number of higher education graduates in those sectors.
Methodology – In investigating whether or not, and in what extend the number of tourism and hospitality graduates is affected by the sectors key development determinants and labour market features, the neural networks and the multiple regression methodology were used.
Findings – The results showed that, although there is a relationship between the selected variables, the research hypothesis cannot be confirmed. In future, more efforts should be addressed in filling the gap, both in theory and practice.
The originality of the research – The paper presents a new approach in modelling tourism-based issues combining alternative methods with traditional ones.
Keywords tourism and hotel industry higher education, labour market features, backpropagation neural networks, multiple regression.

INTRODUCTION

Tourism and hotel industry continues to be, economically, among the most important industries worldwide (Barron et al. 2007, 1). They are among the most rapidly growing global industries worldwide and prerequisites of economic growth, stable income and employment. The growth of tourism and hotel industry to a large expend depends on the employment of well-educated, motivated and committed people (Anandhwanlert and Wattanasan 2016, 340).

However, global financial instability and policy shifts have led to dramatic changes that have affected the higher education system as well (Lugosi and Jameson 2017, 2). Nowadays, the tourism industry is characterised by significant difficulties lacking

qualified labour force. The main reasons of under numbered and under-qualified tourism and hotel industry employees can be searched in an adverse working environment and namely, low salaries, long and not regular working hours, working on holidays and weekends, lack of training and career opportunities (Fominiene et al. 2015, 481). Today's organizational reality, characterized by economic and competitive uncertainties, has led the hotel industry to change its patterns and structures to meet market needs (Meliou and Maroudas 2011, 219).

It is generally known, that tourism and hotel industry business performances and success depend on human resources and the competitive advantages that they can give (Baum 2007, 1396). Researches show that the tourism and hotel industry worldwide growth generate a large number of needed employees. However, a significant gap is perceived between the demand and the supply of employees due to a negative perception conceived by the future employees due to long working hours, low salary packages and low profile jobs (Kumar et al. 2014b). Furthermore, tourism and hotel industry sector does not appear high on the list of the most popular graduate jobs, due to the negative perception of the job quality, seasonality and limited career prospects (European Commission 2016, 1). The tourism labour market remains a relatively minor player in academic research although it is a generator of a major number of jobs (Ladkin 2011, 1135). Despite the rather negative perception, hospitality and tourism programs nowadays attract a large number of students, the student body is becoming more diverse, and finally, attention is being focused on improving efficiency and effectiveness of hospitality and tourism educational programmes (Barron, Watson, and McGuire 2006, 915). Numerous studies and researches on tourism and hotel industry are being produced because of its impact on national economies and primarily on the number of jobs, they create. However, even though tourism and hotel industry create new job opportunities, they are often criticised as generating low-skilled and low-paying jobs (Roney and Oztin 2007, 4).

As in many countries, which economic development is mainly based on tourism and hotel industry, the oversupply of accommodation resulted in a shortage of qualified staff. On the one hand, there is a high motive to work in this industry, but on the other, by the time, graduates reach the final years of study; they lose interest (Kumar et al. 2014, 7). Nevertheless, tourism and hotel industry still offer, if not, even more, job opportunities. Some studies show that career opportunities are claimed to be more accessible in the tourism and hotel industry than other industries of the economy (Fakir and Ahmed 2017, 30).

Assuming the importance of tourism and hotel industry for Croatian economy and its pronounced labour-intensive character, this paper seeks to investigate the existence and the nature of relationships between tourism and hotel industry labour market development and determinants and the number of tourism and hotel industry higher education graduates.

The study is designed based on the presumption that a detailed and systematic analysis of the labour market development, features and environment on one side and the number of graduates on the other can be considered as a starting point for further future harmonisations between theory and practice. Although, the significant expansion of Croatian tourism and hotel industry in recent years resulted in a growing number of

tourism and hotel industry higher education institutions, the internationalization of study plans and programmes and their redesigning to better meet the labour market is needed. Furthermore, in parallel, there is evidence of the necessity of labour market features improving to create an attractive and motivating working environment for future employees.

The study attempt to present a state of the art of the relationships existing between the higher education and the labour market in Croatian tourism and hotel industry. Combining traditional and more innovative quantitative methods, the study explores and analyses whether or not there is a gap in the real labour market needs and the number of graduates in Croatian tourism and hotel industry. Giving the importance of tourism and hotel industry sectors for Croatian economy, the particular value and the novelty of the study can be identified in investigating the existence or not of a misbalance between the human resources supply and the demand in Croatian tourism and hotel industry.

1. THEORETICAL AND METHODOLOGICAL FRAMEWORK

The following gives an outline of the literature review and the description of the modelling process.

1.1. Literature review and theoretical background

A comprehensive desk research and literature review was carried out before approaching the research. The literature review involved researches and studies regarding, tourism and hotel industry higher education, employment in tourism and hotel industry, as well as tourism and hotel industry labour market features and environment. Finally, the implementation of quantitative methods in analysing the topic was investigated.

Tourism and hotel industry education system

In tourism-based countries, such as Greece, tourism and hotel industry education systems have been developed, to meet its labour market needs (Valachis 2003, 2). The tourism and hotel industry and educational system, in any country, need to take responsibility and cooperate to meet the needs of the labour market (Christou 1999, 683).

Because the tourism and hotel industry is a labour-based sector, the satisfaction of tourists' needs depends largely on human resources skills (Gruescu et al. 2008, 172). Moreover, it is a complex industry that accentuates constant knowledge needs, especially in a managerial sense. Education is defined as a multidisciplinary study making training and informal education crucial in the value-added process of an individual. However, unfortunately, connecting the skills acquired in the education system with the needs of the tourism and hotel industry labour market is majorly perceived as slightly unsuccessful in combining the two (Lupu et al. 2014, 800). Considering the importance of tourism and hotel industry for the Croatian economy, as well as its labour-intensive character, higher education assumes a crucial role in generating skilled and competitive human resources. Assuming that employees are at the basis of tourism and hotel industry business performances and development and that they assume a key role in contributing

to the guest's satisfaction level and consequentially, loyalty, more researches are needed in investigating these issues.

Employment in the tourism and hotel industry

Employment in tourism and hotel industry faces numerous challenges, as listed through this study, which could negatively affect career choices and employment. Despite its low status, as Baum (2002, 344) explains, tourism and hotel industry is one of the fastest-growing sectors in the economy worldwide, and it still faces challenges in matching its skills requirements to its labour market needs. Demand for tourism and hotel industry professionals is continuous and the task of finding, forming and keeping them is much of a long-term strategy than anything else and a key for competitiveness in this sector. Gaikwad and Shende (2016, 214) stated that recruiting and retaining talented and skilled employees is one of the biggest concerns in tourism and hotel industry today, namely because of inefficient human resource practices, lack of management initiatives and inappropriate talent retention strategies. Numerous studies go even further in investigating the correlation between education and labour markets such as Kumar et al. (2014, 12) who reviewed the changing perception of 1st year and final year of tourism and hotel industry student's perception. The study resulted in a positive perception of 1st-year students, but a negative one of final year students after exposing them to the labour market. It can be explained as a perception of numerous employment opportunities, but then, when faced with poor employee relations, unorganized work environment, limited or no delegation, long working hours, and overall a hectic working environment (Collins 2002, 95; Lam and Ching 2007, 338), discourages them to pursue a career in tourism and hotel industry. Other researchers with similar studies on the topic of perception of students and their involvement in the labour market, but same results are Leslie and Richardson (2000, 492), Jenkins (2001, 13), Kim and Park (2013, 77), Datta et al. (2013, 51). Some significant issues perceived by students towers the industry as researched by Bao and Fang (2014, 1074) are lack of coordination between schools and employers, opportunities for self-development, pay and welfare, work pressure, the opportunity for work rotation, interesting and challenging work, and autonomy involved in the work. Another main issue was revealed in Kaşlı, and İlban (2013, 83) study, which stated that students in training are viewed as cheap labour what consequentially, does not contribute to their professional development what leads to negative perception towards the industry. Similar conclusions can be drawn from mentioning studies; negative training or internship experience of students' results, develops in a less favourable or negative perception of tourism and hotel industry. These results can be, somehow, explained with Kusluvan and Kusluvan (2000, 262) study that stated that most of the tourism and hotel industry students have no idea about the industry when they join the aimed education and thus when exposed to the actual conditions in the labour market, they develop negative attitude what later leads to the high turnover rate in tourism and hotel industry in general. Hence, if informed properly of actual labour market conditions, they could prepare themselves to the real conditions on the labour market. Unfortunately, some studies such as the one from Casado (1992, 82) showed that even the students with realistic expectations of the industry have a high turnover rate when joined the labour market. As Wong et al. (2019, 290) stated, exploring career options before committing to a career increases future career success and satisfaction. It can be concluded that the majority of students have a negative perception towards the industry what is of great

concern considering that this can be of great affection for the quality of service provided to the guest.

Tourism and hotel industry labour market features

Adequate and proper information, as well as positive attitude for a career in the tourism and hotel industry, is necessary. As Fakir and Ahmed (2017, 31) stated, different opportunities are available in the tourism and hotel industry, but, moreover, success perception leads to a successful career in this industry. As Baum (2013, 2) emphasized, that the collaboration of all stakeholders, directly or indirectly connected to tourism and hotel industry, through dialogue can encourage equality of opportunity and treatment; reduction of wage and salary gaps between men and women and all challenges that tourism and hotel industry is facing today. Despite the inevitable unfavourable aspects of tourism and hotel industry such as anti-social working hours, low status, low pay, unclear career paths, manager have a crucial role in fostering employees' skills, and to display positive and hospitable behaviours (Solnet and Kralj, 2012, 37). To overcome the negative attitude towards the industry, proper information's need to be provided to students choosing a career in the tourism and hotel industry. In this case, educational systems and tourism and hotel industry stakeholders have a crucial role in preparing students to the actual labour market, and consequentially, reduce the gap between education and labour market and reduce the massive turnover that is still a major challenge in tourism and hotel industry.

Quantitative methods

Even though the topic is namely researched throughout questionnaires to estimate perception of tourism and hotel education students towards the labour market, as cited in the paper, through descriptive statistics, the minority of them used quantitative analysis, traditional or alternative and innovative quantitative methods. When dealing with education, an issue of great interests is the way of measuring the success of higher education institutions. They can be regarded from university rankings, school reputation, and financial well-being, and most importantly, student retention. A study by Delen (2011, 19) accentuated the importance of understanding student retention and the cause behind it. The paper predicts freshman student attrition using artificial neural networks, decision trees, and logistic regression. Best performing results were obtained by artificial neural networks with an 81% overall prediction accuracy of the holdout sample and the at most importance of educational and financial variables. A study by Shan et al. (2010) carried out a quantitative analysis of the hotel interns' job satisfaction and job stress of tourism and hotel industry students. Results from a developed regression model show, a negative correlation between job stress and the career choice intention in the tourism and hotel industry. The results suggested a strengthened education between education and labour market what could be, consequentially, helpful in improving job satisfaction and lowering the levels of job stress. Dhanalakshmi et al. (2016, 1) used opinion mining using supervised learning algorithms to find the polarity of the student feedback based on pre-defined features of teaching and learning focusing on a combination of machine learning and natural language processing techniques. The study presented a comparison of algorithms like a Support Vector Machine (SVM), Naïve Bayes, K Nearest Neighbor (KNN) and Neural Network (NN) classifier. All mentioned techniques were used to find

better performance regarding the variety of evaluation criteria for the different algorithms. Jian-qing (2009) raised the question between over-education and under-education more precisely, graduate employment and diploma devaluation. The study was analysed with primary OLS to determine the relationship and later using Co-integration test because OLS obtained a spurious regression.

Tourism and hotel industry higher education and labour market features

Although there is a significant overall interest in analysing and researching, both tourism and hotel industry labour market and higher education, there is less interest in combining those research fields.

Bartoluci and Budimski (2010) emphasized that tourism and hotel industry are both labour-intensive sectors and therefore, require highly qualified employees who will provide quality services that are a *condition sine* qua non of market competitiveness and success of Croatia as a tourist destination. Furthermore, as Sigala and Baum (2003) accentuated, to address the challenges and the needs of tourism and hotel industry students, higher educational institutions should follow a blended mix, using informational technologies, towards education to meet the consequence of the changing environment within both the tourism and hospitality industry and higher educational institutions. Furthermore, Lugosi and Jameson (2017) stated, that higher education in general and tourism and hotel industry education, in particular, are facing significant challenges with the marketization of higher education and the globalisation of competitive educational provision, that made it necessary for higher education institutions to examine the extent and form of tourism and hotel industry education. Nikitina and Lapina (2017) concluded and confirmed previous researches, that higher education institutions should follow the trends in the development of tourism and hotel education and become a proactive and motivating factor of changes by adjusting to the environment by reforming their strategies.

1.2. The modelling approach – data set and methodology

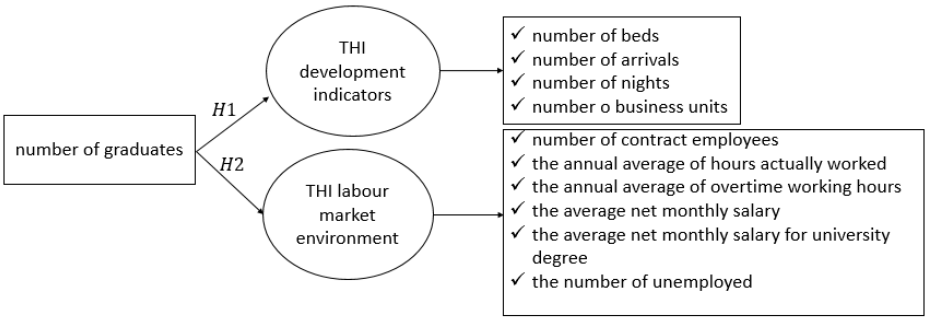
The study aims to investigate the gap between tourism and hotel industry labour market development level and features and the number of tourism and hotel industry higher education graduates. Starting from the aim of the paper, some research questions and purposes were identified, as follows:

- How effective Croatian tourism and hotel industry higher education is?
- Is nowadays Croatian tourism and hotel industry higher education capable to meet and adapt itself to the changing tourism and hotel industry labour market?
- Is there evidence of a gap between Croatian tourism and hotel industry higher education and labour market features and requests?

Following the research objectives and questions, the research aims to explore the features of tourism and hotel higher education and the labour market, as well as the level of their harmonisation.

To explore and quantify the existing relationships two main constructs, one dependent and a set of independent variables were chosen (Figure 1).

Figure 1: **The research problem – constructs and hypothesis**



Source: own elaboration

As depicted in figure 1 the defined constructs were approximated using some quantitative variables. In the study is assumed that the number of graduates approximates the supply of human resources generated from the higher education institutions. On the other hand, the development and the labour market environment variables approximate the tourism and hotel industry demand for highly trained employees.

The research is, therefore, based on the assumption that the number of graduates is indirectly affected by tourism and hotel industry development presuming, therefore, that the more developed it is, the greater the employment opportunities are, which influences consequently the decision to approach tourism and hotel industry higher education. On the other hand, it is assumed that tourism and hotel industry labour market features and characteristics directly influence the number of graduates in the sector. Those assumptions were the starting point in designing the modelling approach. Two research hypotheses are therefore defined:

(i) H1: The number of graduates is positively correlated with tourism and hotel industry development indicators;
(ii) H2: The number of graduates is positively correlated with tourism and hotel industry labour market features and environment.

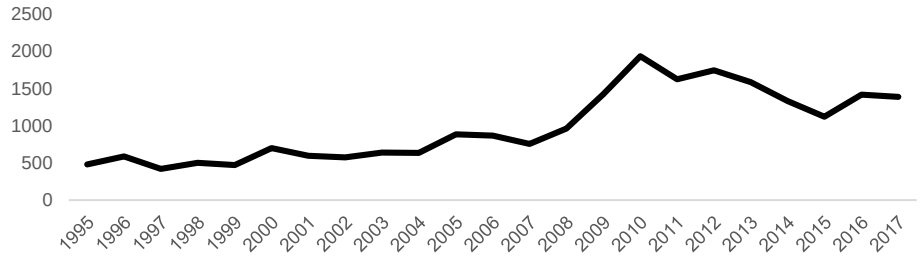
The following summarizes the data set and the theoretical models, as the foundation to describe the modelling process used in this study.

The data set

Following the described modelling approach, the data set consists of one dependent and ten independent variables. All data were collected from the Croatian Bureau of Statistics Yearbooks. Data are annual and cover the period from 1995 to 2017. The number of tourism and hotel industry graduates (*UTHCro*) was chosen as the dependent variable. With the development of tourism over the past few decades, the number of enrolled

students, and consequentially graduates, is increasing. Figure 2 depicts a positive trend since 1995.

Figure 2: **Tourism and Hospitality Graduates trend – period: 1995-2017**



Source: Croatian Bureau of Statistics Yearbooks, 1995 to 2017

The number of graduates reached its maximum level in 2010 with 1936 graduates from tourism and hospitality higher education. In the analysed 23 years period there were registered on average 994,78 graduates per year, with a standard deviation of 481,02 graduates. The lowest number of graduates (421) was registered in 1997.

For the modelling process, a set of ten independent variables was chosen. Considering the research issue and the hypothesis, the set of independent variables was grouped into two subsets. The independent variable grouping process is represented in table 1.

Table 1: **The independent variable**

Variable name	Shorten name
Subset #1: Hotel industry development determinants	
- the number of beds in tourist accommodation facilities	*AccCroB*
- the number of total tourist arrivals	*ACro*
- the number of total tourist nights	*NCro*
- the number of business units in the tourism and hotel sector	*BuTH*
Subset #2: Tourism and hotel industry labour market features	
- the total number of contract employees in the tourism and hotel industry	*CCro*
- the annual average of hours actually worked in the tourism and hotel industry	*HTH*
- the annual average of overtime working hours in the tourism and hotel industry	*OtHTH*
- the average net monthly salary in the tourism and hotel industry	*STH*
- the average net monthly salary for a university degree in the tourism and hotel industry	*SUd*
- the number of unemployed in the tourism and hotel industry	*UnETH*

Source: own elaboration

The first variables subset were chosen to approximate the level of development of the sector and starting with the assumption that those development indicators may indirectly affect the decision to approach tourism and hotel industry higher education. These variables can be considered as indicators of future employment possibilities and act as

motivators in choosing a study program. It is assumed, therefore, that the hotel industry development level positively affects the number of graduates. Such an assumption was also confirmed by high correlation coefficients between the dependent variable and the independent variables approximating tourism and hotel industry development level (Table 2).

The second variables subset approximates the working conditions and environment. It is assumed a positive relationship between those indicators and the number of graduates.

To analyse the existence and nature of a relationship between the chosen independent variables and their potential influence on the dependent variable, the linear correlation analysis was performed (Table 2).

Table 2: **Linear correlation matrix**

	UTHCro	*BUTH*	*Ccro*	*UnETH*	*STH*	*SUd*	*OtHTH*	*HTH*	*AccCroB*	*ACro*	*NCro*
UTHCro	1										
BUTH	0,81	1									
Ccro	0,25	0,36	1								
UnETH	0,29	0,22	-0,47	1							
STH	0,85	0,91	0,12	0,28	1						
SUd	0,81	0,88	0,10	0,31	0,99	1					
OtHTH	-0,64	-0,61	-0,33	0,01	-0,47	-0,39	1				
HTH	-0,69	-0,75	-0,06	-0,40	-0,80	-0,77	0,36	1			
AccCroB	0,70	0,91	0,39	0,10	0,89	0,90	-0,45	-0,61	1		
ACro	0,74	0,94	0,28	0,25	0,94	0,95	-0,43	-0,69	0,98	1	
NCro	0,76	0,89	0,30	0,20	0,89	0,88	-0,57	-0,62	0,9	0,91	1

Source: own elaboration

As shown, quite all selected independent variables are correlated to the number of graduates (UTHCro). The correlation coefficients are significant showing the expected sign.

The following gives an outline of some theoretical foundations of the methodologies used in this study.

Theoretical models

As mentioned, the research is developed using an artificial neural network model and two multiple linear regression models. In the attempt to investigate the existence of a relationship between tourism and hotel development determinants and labour market features and the number of tourism and hotel higher education graduates in Croatia the methodology of the neural networks was implemented to isolate the most influencing variables. Furthermore, two multiple regression models were designed to quantify the potential relationships between variables. Based on the assumption that the most influencing input variables, selected by the artificial neural network model, are those that affect the most the number of graduates, the multiple regression models aim to group those variables and quantify the relationship between single independent and dependent variable.

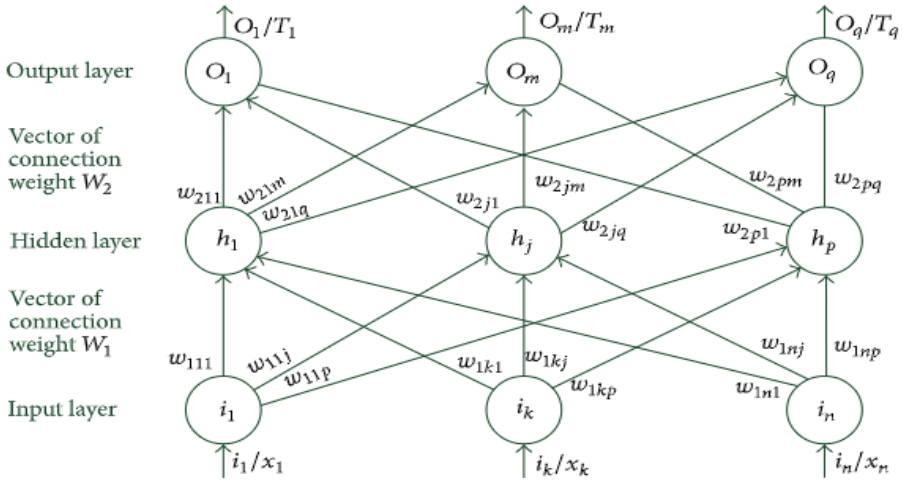
The Neural Networks model

Artificial neural networks models, as Machine Learning methods, are based on mathematical models with an architecture analogous to the human nervous system. A neural network is characterised by the architecture (the pattern of connections between the neurons), the training algorithm (the method of determining the weights on the connections) and the activation function. Neural networks usually consist of a set of interconnected neurons (perceptrons) organised in layers: an input layer, one or more hidden layers and an output layer. The hidden layers are capable to capture nonlinear relationships between variables. In the input layer, each neuron accepts a single value/variable (distributed input) and generates an output value that will be used as an input for the neurons of the following layer. The net input for the neuron *j* of the receiving layer is given by the following equation:

$$\text{netj}=\sum_i w_{ij} I_i \qquad (1)$$

where I_i is the signal sent by the neuron *i*, w_{ij} is the weight associated to the neuron and, consequently, net_j is given by the sum of the weights of each neuron multiplied to the related signal received by the input neuron. The receiving neuron creates the activation based on the signal net_j. The activation becomes the input of the following layer and the process reiterates until the final signals reach the output layer. During the training process, the weights, initially set to very small random values, are determined through the training Backpropagation (BP) algorithm, that stops when the value of the error function achieve the aimed threshold. The weights are updated following the comparison between the obtained output and the expected result, evaluated through the selected error function. Among the different types of neural networks architecture, the feedforward neural networks are the most widely used. In most considered studies, they are usually designed with the backpropagation learning algorithm, and they are simply called backpropagation neural networks (*BPNNs*) and sometimes referring to multilayer perceptrons (*MLPs*). The structure of a BP neural network is depicted in Figure 3.

Figure 3: **The structure of a BP neural network**



Source: https://www.hindawi.com/journals/mpe/2015/362150/ (31.3.2020.)

BP neural networks are used in a variety of analysis and forecasting researches and are considered particularly effective in approximating various nonlinearities in data sets with a high degree of accuracy. The backpropagation (BP) neural network prediction method is used widely because of its high plasticity and simple structure, weights can be optimized by adaptive adjustment Ye and Kim (2018, 176). The modelling approach used in the BP neural network developing process consisted of the following steps: data pre-processing, BP neural network architecture selecting, BP neural network training process, and model performance testing.

Multiple regression models

In designing the neural network model, the whole input variable data set is considered. Considering the research hypotheses, the splitting the set of independent variables into two distinct subsets, and in the attempt to isolate the variable that influences the most the number of graduates, two multiple double log autoregressive regression models were specified. The first model was set up to investigate the existence between the number of graduates and tourism development determinants. The model is expressed as follows:

$$UTHCro_t = \beta_0 + \beta_1 AccCroB_{t-1} + \beta_2 ACro_{t-1} + \beta_3 NCro_{t-1} + \beta_4 BuTH_{t-1} \qquad (2)$$

The second model was specified to investigate if the number of graduates is dictated by the features of tourism and hotel labour market conditions and features. The model is:

$$UTHCro_t = \beta_0 + +\beta_1 CCro_{t-1} + \beta_2 HTH_{t-1} + \beta_3 OtHTH_{t-1} + \beta_4 STH_{t-1} + \beta_5 SuD_{t-1} + \beta_6 UnETH_{t-1} \qquad (3)$$

The independent variables chosen in both models are as explained in table 1 while the dependent variable (*UTHCro*) is represented by the number of graduates.

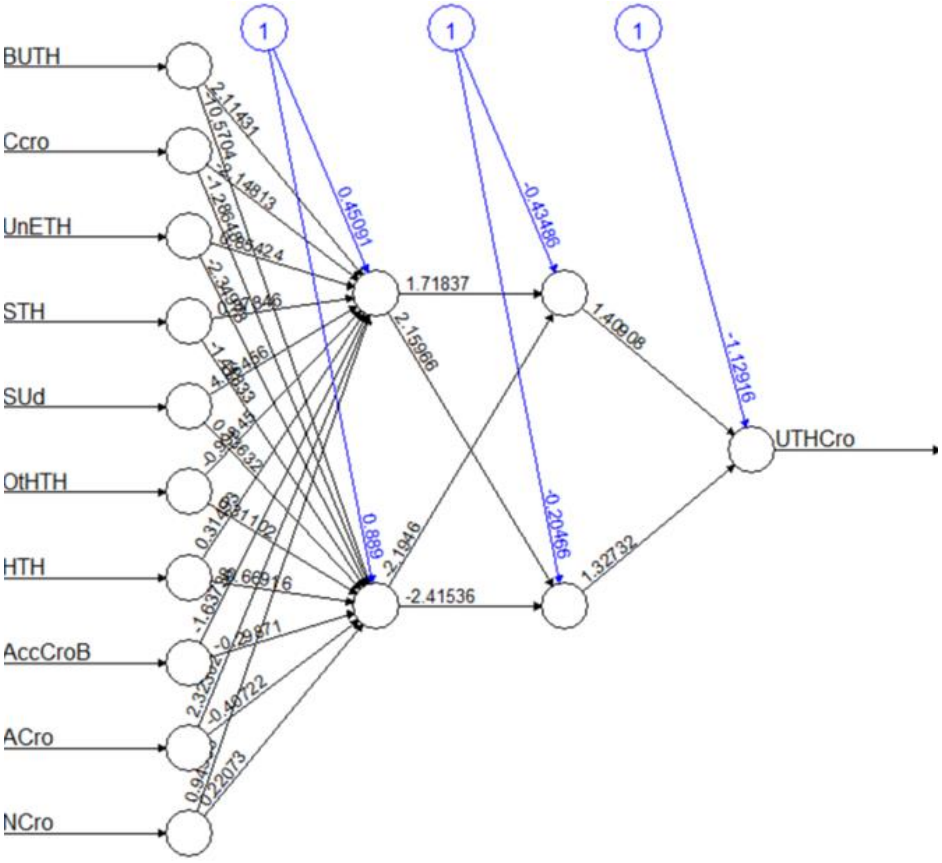
2. EMPIRICAL FINDINGS

In designing the multilayer architecture, the input data set consisted of ten variables. Input and output data have been normalized using the z-score normalization method and the minimum-maximum normalisation method, respectively. After input data scaling, the whole data set has been split into the training (70% of the initial data set) and the testing (30% of the remaining) set. The training set was implemented in the training process of the neural network, while the testing set, was used to test the model in the evaluation stage. The selected BP neural network presents the following features:

(i) 10 input nodes, corresponding to the input variables;
(ii) 2 hidden layers with 2 nodes respectively and
(iii) 1 output node, corresponding to the target variable.

The architecture of the neural network is depicted in Figure 4.

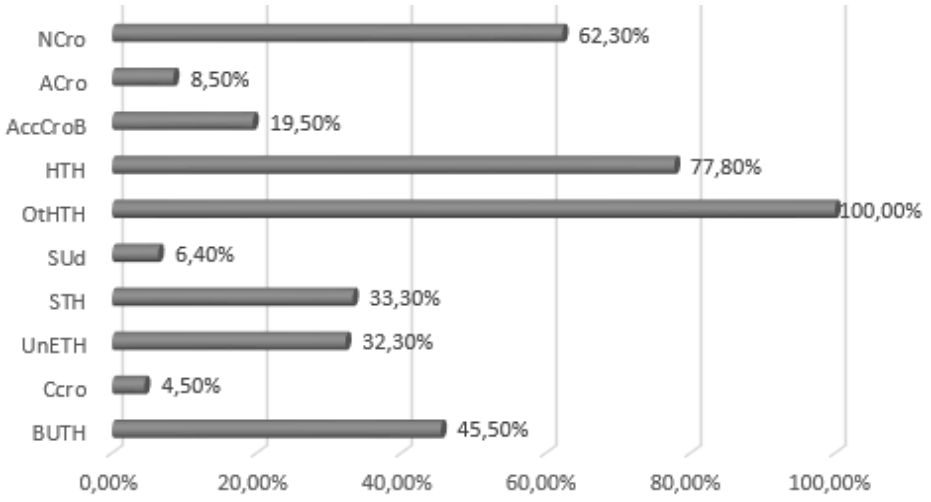
Figure 4: Neural Network Architecture



Source: R output

The selected neural network model is a multilayer type with a feedforward structure that can be written as 10:2:2:1. The logistic function was used in the hidden, and the linear activation function in the output layer. The selected neural network architecture evidenced the inputs that most affect the target variable (figure 5).

Figure 5: **Neural Network Architecture**



Source: own elaboration

Considering the neural network results and the input importance analysis, the multiple regression analysis aims to isolate and quantify the single potential relationships between the dependent variable and the two subsets of chosen independent variables. The multiple regression models in (1) and (2) were estimated using the OLS method. The results are summarised below.

The estimated model in (1) can be written as:

$$logUTHCro_t = -0{,}23logAccCroB_{t-1} - 0{,}10logACro_{t-1} + 0{,}02logNCro_{t-1} + 1{,}18logBuTH_{t-1}$$

$$\begin{array}{lllll} se = & (0{,}10) & (0{,}25) & (0{,}20) & (0{,}27) \\ t = & (-2{,}19) & (-0{,}42) & (0{,}21) & (4{,}33) \\ p = & (0{,}04) & (0{,}67) & (0{,}83) & (0{,}00) \end{array} \quad (4)$$

$$Prob(F-stat) = 0{,}000001)$$

S.E. of regression= 0,10

$R^2 = 0{,}76$ $\quad \chi^2_{Auto}(2) = 7{,}03$ $\quad \chi^2_{Norm}(2) = 0{,}47$ $\quad$ RSS=0,18 $\quad \chi^2_{White}(10) = 14{,}6$

$MAE = 0{,}07$ $\quad MAPE = 2{,}4$ $\quad MSE = 0{,}008$ $\quad RMSE = 0{,}09$ $\quad r = 0{,}86$

The estimated model in (2) can be written as:

$$logUTHCro_t = 1{,}32logCCro_{t-1} - 1{,}81logHTH_{t-1} - 0{,}056logOTHTH_{t-1} + 1{,}83logSTH_{t-1} - 0{,}81logSUD_{t-1} - 0{,}11logUNETH_{t-1}$$

$$se = (0{,}60) \quad (1{,}15) \quad (0{,}24) \quad (1{,}58) \quad (1{,}97) \quad (0{,}38)$$

$$t = (2{,}18) \quad (-1{,}56) \quad (-0{,}23) \quad (1{,}15) \quad (-0{,}41) \quad (-0{,}29) \tag{5}$$

$$p = (0{,}04) \quad (0{,}13) \quad (0{,}81) \quad (0{,}26) \quad (0{,}68) \quad (0{,}77)$$

$$Prob(F-stat) = 0{,}000001)$$

S.E. of regression= 0,19

$R^2 = 0{,}81$ $\chi^2_{Auto}(2) = 1{,}6$ $\chi^2_{Norm}(2) = 0{,}92$ RSS=0,09 $\chi^2_{White}(18) = 19{,}6$

$MAE = 0{,}06$ $MAPE = 2{,}19$ $MSE = 0{,}005$ $RMSE = 0{,}07$ $r = 0{,}95$

The diagnostic checking yield to the conclusions that both models are correctly specified. Both models passed all the diagnostic checking. The residuals are homoscedastic and stable, and the level of fitness is acceptable. The forecasting errors indicate a good forecasting accuracy. Nevertheless, the regression results indicate that the number of graduates in tourism and hotel higher education is affected just by the number of business units in time *t-1* (in the first model) and by the number of contract employees in time *t-1* (in the second model). However, the regression results showed that there is no demonstrated relationship between other selected variables, confirming that they are not statistically significant. It can be, therefore, concluded that the number of graduates is not, directly or indirectly, affected by all selected independent variables. When comparing the neural network input importance analysis (figure 5) and the regression results, it can be observed that the most significant input (45,5%), namely the number of business units is also the only independent variable resulting to be significant in the first regression model.

As far as the second estimated regression model results are concerned, they are not following the neural network input importance analysis.

Finally, the research hypotheses have to be rejected, although the research results pointed out that there are some demonstrated relationships between variables in both estimated regression models. The results of the Engle-Granger co-integration test yield to the conclusions that the null-hypothesis of no co-integrating equation is rejected at the 5% level. Hence, it is concluded that a long-run relationship exists among the variables in both models.

CONCLUSIONS

The study aimed to explore the relationship between the demand and the supply of human resources in Croatian tourism and hotel industry. In the study is assumed that the number of graduates approximates the supply of human resources generated from the higher education institutions. On the other hand, the development and the labour market environment variables approximate the tourism and hotel industry demand for highly trained employees.

The study was an attempt to investigate whether or not, and in what extent the number of graduates in tourism and hotel higher education is affected by the tourism and hotel industry development, as well as by the labour market features. The independent variables were grouped into two subsets, namely the development level and the labour market features. It was assumed that tourism and hotel industry development level variables indirectly affect the number of graduates, as they reflect the future employment possibilities. The second variables subset consisted of some independent variables resuming the labour market conditions and environment. The empirical analysis was based on the presumption that combining innovative and traditional quantitative models would produce more significant results. Therefore, a backpropagation neural network was designed and two multiple regression models were specified and tested. The backpropagation neural network model was designed to emphasize the most influencing input variables, while regression analysis aimed to detect and quantify the relationships between the independent and the dependent variables. The neural network input importance analysis emphasised that the variables that influence the most the number of graduates is the annual average of overtime working hours, the annual average of hours actually worked, the number of tourists nights, and the number of business units in tourism and hotel industry. Moreover, the regression analysis results showed that only the number of business units and the number of contract employees were significant in the two specified and tested model.

The empirical findings evidenced that, although there are some demonstrated relationships among the selected variables, the research hypothesis could not be confirmed. Although, the significant expansion of Croatian tourism and hotel industry in recent years resulted in a growing number of tourism and hotel industry higher education institutions, the internationalization of study plans and programmes and their redesigning to better meet the labour market is needed. On the other side, significant efforts in redesigning the labour market features to improve its attractiveness are needed. The research results evidenced, therefore, a gap in communication and interrelationships between the tourism and hotel industry sector and the education system in terms of collaboration in creating study programmes and curricula, on one side, and deliberation of market needs and prerequisite on the other.

The number of graduates should be a consequence of a study programme and labour market environment harmonisation and improvement.

DISCUSSION AND IMPLICATIONS

Regardless of the research results, the authors suggest that the existence of balanced relationships between higher education, as the supply and the labour market as the demand for highly motivated, trained, and capable tourism employees are at the basis of competitiveness and success. Higher education institutions should be flexible and attentive to the market needs. Their capability to adjust their study programmes and curricula to fast-changing market conditions is a prerequisite of producing highly educated and trained employees. Study programmes should provide knowledge and competences that enable future employees to be successful and effective. The flexibility and the capability of adaptation of higher education institution is a core prerequisite of producing highly educated potential employees. Educational institutions must probe the needs and of the labour market and develop their educational programmes following the development tendencies. The tourism and hotel industry growth and competitiveness depend on well trained and skilled human resources. Motivated employees are the key success factor of the tourism and hotel industry as service-based activities.

Giving the importance of tourism and hotel industry sector for Croatian economic development, the shifting towards harmonisation between education and market is necessary. The tourism and hotel industry growth and competitiveness depend on well trained and skilled human resources.

Nowadays, not only the global economy but also educational institutions are facing the $Covid_{19}$ worldwide crisis. Never before, harmonisation and adjustment to new crisis conditions have been more significant and necessary. With the new Coronavirus pandemic there is a necessity of fast adaptation and shifting the attention to implementing innovative information technologies in tourism and hotel industry and education. Certainly, many issues and concerns are not covered in this study. However, the issues addressed can be expanded in future researches that could provide a valuable basis for both, higher education and labour market features. The study identified just some of the major areas of concerns. Therefore, future researches should provide recommendations and guidelines for better harmonisation of tourism labour market demand and supply.

LIMITATIONS AND FURTHER RESEARCH

The study aimed to explore the existence of harmonization between education and market in Croatian tourism and hotel industry. The particular value and the novelty of the research can be identified in approaching the exploration of the issue conjointly and in emphasising the importance of adapting higher education to the demand of human resources in Croatian tourism and hotel industry. Giving its exploratory nature, it should be considered as a starting point for future more systematic and detailed analysis.

Regardless of the research results, the paper has limitations and weaknesses. A limited sample is certainly one of the limitations. Regression analysis and especially the Artificial Neural Networks methodology are sensitive to the sample size. Besides, the sample size, more weaknesses can be identified in the incorrect or insufficient set of variables.

More significant results would be certainly achieved, by including in the study systematic qualitative market research, as well as students and other stakeholders' opinions and needs.

The authors have reviewed several studies to provide the background for this study. However, given that many countries have well-developed hospitality and tourism educations systems, future researches should be conceived on the analysis of examples from a variety of countries and regions worldwide to provide further research context. Moreover, further researches should address more deeply the gap in the literature in conjointly researches of both, higher education and labour market features in tourism and hotel industry. Furthermore, in future, more efforts should be addressed to fill the gap in communication and harmonizing theory and practice.

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Tea Baldigara, PhD,Full Professor
University of Rijeka, Faculty of Tourism and Hospitality Management
Department of Quantitative Economics
Naselje Ika, Primorska 42, p.o. 97, 51410 Opatija, Croatia
Phone: +385 51 294684
E-mail: tea.baldigara@fthm.hr

Kristina Duvnjak, MA, Ph.D Student (Corresponding Author)
Vojnovićeva 29, Zagreb, Croatia
Phone: +385 1 4571 123
E-mail: kri.duvnjak@gmail.com

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