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MANAGEMENT MODEL OF SUPPLY AND DEMAND FOR HIGHER EDUCATION QUALIFICATIONS IN THE REPUBLIC OF CROATIA

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ABSTRACT

This paper analyzes the current problems of the Croatian labor market, focusing on: the imbalance in the supply and demand for higher education qualifications, poor recognition of higher education qualifications after completion of studies under the Bologna study system, and the possibility of implementing technical, technological and scientific development as a response to both the current and future needs of the Croatian economy.

The aim of the paper is to point out the existing problems of the Croatian labor market and education system in the field of higher education and to propose a model in response to these problems.

A labor market survey, conducted from 2008 to 2018, showed two main economic activities that mostly employ the tertiary-educated population. It also showed the ten most-demanded occupations in these two economic activities. A projection of the number of graduates in 2019 has been made according to the recommendations of the Croatian Employment Service in January 2019.

As a possible response to the above-mentioned problems, a unique management model of supply and demand for higher education qualifications in the Republic of Croatia was created. The application of the Croatian Qualification Framework and the largely completed register is implied within the model. The

model can be elaborated, and an information database for all stakeholders in this process can be created.

Key words: *labor market, higher education, Croatian Qualifications Framework, model*

1. INTRODUCTION

New technologies are emerging. Technical, technological and scientific development has its own dynamic. "The great majority of countries now acknowledge the importance of STI (Science, Technology and Innovation) for sustaining growth over the longer term. Low and lower-middle income countries hope to use it to raise income levels, and wealthier countries to hold their own in an increasingly competitive global marketplace."¹ The market is changing, and there is more need to satisfy customers' specific needs and wishes (Mansfield et al. 1996, Leko-Šimić, 2005). All the above-mentioned require competent, autonomous, creative, and innovative employees who skillfully apply their knowledge (Mansfield et al. 1996, Stein 2006, Boyles et al. 2012). This "requires competencies that are acquired through tertiary education, thus placing higher education in the position of being the main driving force for all social change."²

"The digital transformation of the economy is reshaping the way people work and do business. New ways of working are affecting the types of skills needed, including innovation and entrepreneurship. Many sectors are undergoing rapid technological change and digital skills are needed for all jobs, from the simplest to the most complex. High skills enable people to adapt to unforeseen changes."³

Meanwhile, the higher education system is facing real challenges such as negative demographic trends, slowness in introducing the necessary changes in line with development and mismatching of the legislation with the needs of higher education, which altogether leads to inefficiency in the labor market.

Quality planning of needs for qualifications requires a quality base for following the current state. However, by the current parameters and methodology used in the Republic of Croatia, it is impossible to obtain the real state of supply and demand for tertiary education qualifications in the labor market. Statistical reports have been prepared in accordance with the National Classi-

¹ UNESCO (2015): "UNESCO science report: Towards 2030 – Executive summary", UNESCO Publishing, p.11

² Ministry of Science, Education and Sports (2015): "New colors of knowledge: Education, Science and Technology Strategy", Intergrafika TTŽ, Zagreb, p.1

³ European Commission: "A new skills agenda for Europe" COM(2016) 381 final, Brussels, 10/06/2016, p.2

fication of Occupations⁴ from 2010 (NKZ 2010) and the National Classification of Economic Activities⁵ from 2007 (NKD 2007). At the same time, the tertiary education system statistical reports are based on scientific fields and qualifications generated from the Bologna study system. As these are two different measuring units of the supply of and demand for tertiary education qualifications, it is obvious that there are many inconsistencies. The latter is just one of the ongoing problems in this field.

According to the above-mentioned facts, the aim can be elaborated as follows:

- *to highlight the existing problems of the Croatian labor market* – the imbalance in supply and demand for occupations requiring higher education qualifications, the mismatch in the supply and demand unit for the above-mentioned qualifications by the Croatian Employment Service (CES) and Agency for Science and Higher Education (ASHE), and weaknesses of the applied methodology,
- *to point to the existing problems of the higher education system* – graduates complete qualifications according to the Bologna study system that are not recognized in the labor market and are inconsistent with the legal regulation in the application in the employment process and statistical reporting, and the lack of introduction of necessary changes and modernization of study programs in line with the development, and finally,
- *to propose a relational model in response to the above-mentioned problems* – including legally regulated relationships between the stakeholders covered by this paper, by merging key information into a common information base that will be available to all stakeholders, thereby enabling better strategic management.

2. ANNUAL LABOR MARKET ANALYSIS FROM 2008 TO 2018

Labor market analysis⁶, which is the subject of this research, refers to professions requiring higher education qualifications. According to NKZ 2010, professions that include higher education qualifications are organized into the major groups 1 and 2. This research includes only occupations in major group 2, assuming that people performing the duties listed within the professions

⁴ Official Gazette 147/2010 link: https://narodne-novine.nn.hr/clanci/sluzbeni/2010_12_147_3736.html access 15/03/2019

⁵ Official Gazette 58/2007 link: https://narodne-novine.nn.hr/clanci/sluzbeni/2007_06_58_1870.html access 15/03/2019

⁶ The analysis was made based on data available from the Croatian Employment Service (CES) database considering the number of vacancies by economic activity from 2008 to 2018.

in major group 1 are those who, by profession, actually fall into major group 2, and that exclusion of major group 1 will not significantly affect the findings and conclusions of the research. In the data analysis and conclusions, a statistical method was applied to a sample of the population that completed tertiary education and was reported to the CES. Table 1 shows the total demand for all occupations annually from 2008 to 2018, the demand for occupations in major group 2, and the share of the demand for occupations in major group 2 in the total demand. From Table 1, it can be seen that the greatest share of the occupations in major group 2 in the total demand was in 2013, 2014 and 2015, and the least in 2008. In the observed period, the average share of occupations in major group 2 in the demand for occupations was 22.3 %. Based on the above, it can be concluded that occupations from major group 2 comprise approximately one-fifth of the total demand for occupations in the labor market with deviations in the above-mentioned years.

Table 1: Demand for occupations annually from 2008 to 2018

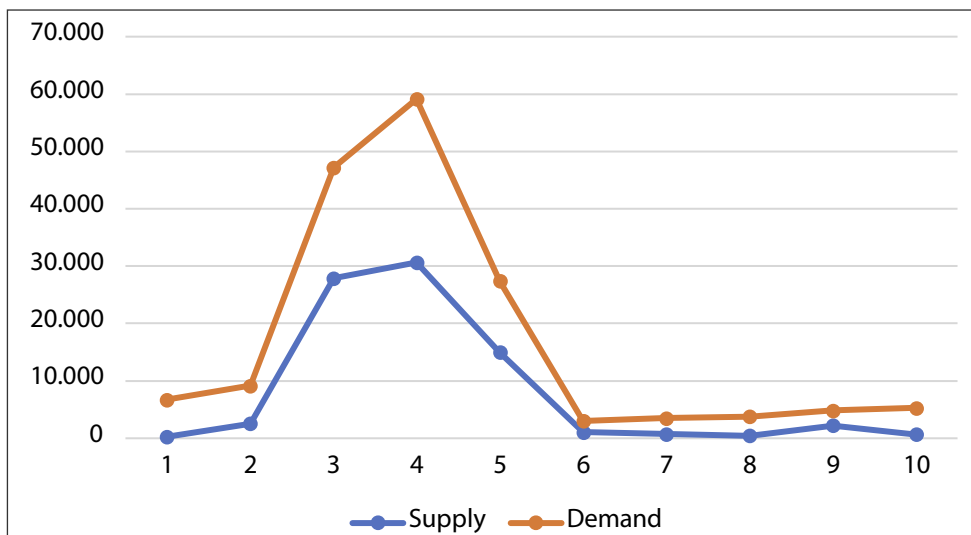
Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Demand major group 2	21.770	20.544	20.990	27.000	30.503	40.576	43.931	55.048	50.562	48.572	49.391
Total demand for occupations	141.794	102.427	104.739	125.578	131.927	143.340	152.869	202.468	232.254	250.216	253.116
Share of major group 2 in all (%)	15,35	20,06	20,04	21,50	23,12	28,31	28,74	27,19	21,77	19,41	19,51

Source: Croatian Employment Service

The research also sought to find out which economic activities have the greatest demand for higher education qualifications and which are the most sought-after occupations. The labor market analysis shows that, in the observed period, the most sought-after occupations in major group 2 according to the National Classification of Economic Activities (NKD 2007) were in two groups: Education (192.357 vacancies) and Human Health and Social Work activities (100.026 vacancies). In each of these, a list of the ten most sought-after occupations was made. It should also be noted that it is not possible to make a comparison of the demand for occupations between the two above-mentioned economic activities. This is because numerous vacancies in the Educational sector are not for permanent jobs, but for short-term replacement (e.g., due to sick leave) or for maternity leave. If a replacement was not found on the first registration of vacancy, the vacancy was again registered, and this was recorded in the CES database as a new (not repeated) vacancy. No record was kept of repeated vacancies. In the Human Health and Social Work sector, this was not the case except for maternity leave.

The detailed labor market analysis showed the ten most sought occupations in each of the two sectors in the observed period. In the Educational sector, these were: (1⁷) University and Higher Education Teachers – 2310⁸, (2) Vocational Education Teachers – 2320, (3) Secondary Education Teachers – 2330, (4) Primary school teachers – 2341, (5) Early Childhood Educators – 2342, (6) Education Methods Specialists – 2351, (7) Special Needs Teachers – 2352, (8) Teaching Professionals Not Elsewhere Classified – 2359, (9) Economists – 2631, and (10) Musicians, Singers and Composers – 2652. Figure 1 shows the relation between supply and demand for occupations from major group 2 in the Educational sector. The recorded supply of all teaching occupations should be viewed through the above-mentioned nature of vacancies, which are numerous, but many are also repeated, or only short-term replacements are sought.

Figure 1: The annual relation between supply and demand for occupations in major group 2 in the Educational sector annually from 2008 to 2018 (total value)



Source: Croatian Employment Service

Figure 1 shows that the smallest deviation between supply and demand exists for Education Methods Specialists, Economists and Special Needs Teachers. The largest deviation exists for Primary school teachers and Secondary Ed-

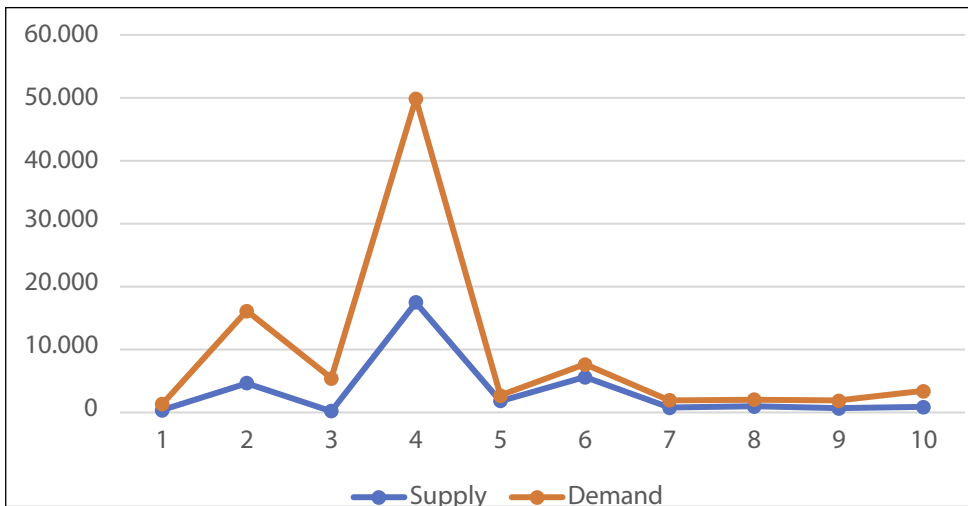
⁷ Numbers refer to the abscissa values in Figure 1.

⁸ The occupation code defined by the National Classification of Occupations NKZ 2010 according to the European Skills, Competences, Qualifications and Occupations (ESCO), which is derived from the International Standard Classification of Occupations (ISCO). All three documents represent equal classifications of occupations on a national, European and international level, respectively.

ucation Teachers. This is not a real deviation, but it is very difficult to define the approximate deviation level due to the lack of records for repeated vacancies. It can be concluded that from 2008 to 2018 there was a labor deficit according to the CES database.

In the Human Health and Social Work sector, the ten most sought occupations were: (1) Biologists, Botanists, Zoologists and Related Professionals – 2131, (2) Generalist Medical Practitioners – 2211, (3) Specialist Medical Practitioners – 2212, (4) Nursing Professionals – 2221, (5) Dentists – 2261, (6) Physiotherapists – 2264, (7) Legal Professionals Not Elsewhere Classified – 2619, (8) Economists – 2631, (9) Psychologists – 2634, and (10) Social Work and Counseling Professionals – 2635. Figure 2 shows the relation between supply and demand for occupations from major group 2 in the Human health and social work sector. Unlike Figure 1, Figure 2 shows a real deviation in supply and demand for occupations in major group 2 in the Human Health and Social Work sector.

Figure 2: The annual relation between supply and demand for occupations from major group 2 in the Human Health and Social Work sector from 2008 to 2018 (total value)



Source: Croatian Employment Service

The largest deviation was seen in Nursing Professionals, where the total deficit in the working-age population with this qualification was 32.404. The value refers to the observed period. The next largest deviation was in General Medical Practitioners, where the total deficit was 11.488 people for the same period of time. The smallest deviation was for Dentists and Biologists, Bota-

nists, Zoologists and Related Professionals. As in the Educational sector, in this sector, it could also be concluded that there was a labor deficit according to the CES database in the period from 2008 to 2018.

From the above-mentioned documents, it was not possible to accurately allocate qualifications acquired after finishing tertiary education into occupations classified in the NKZ 2010, so a projection of the number of graduates in 2019 has been made according to the recommendations⁹ of the Croatian Employment Service from January 2019. In the recommendations, deficits were reported in the following science fields: medicine, speech pathology, pharmacy, computer science, teaching the study of physics and teaching the study of math. According to recommendations, a projection was made of the number of graduates in the academic year 2018/2019. The comparison of demand according to the number of vacancies in the period from October 2018 to March 2019 was also made. Both are shown in Table 2. From Table 2, it can be seen that in all fields of science there will be a surplus in the labor market. According to CES, there is no insight into the detailed structure by profession, so the given values are only approximate.

Table 2 Projection of the number of graduates in the academic year 2018/2019 and the demand from 10/2018 to 03/2019

Study program	Students enrolled ¹⁰	Projection of the number of graduates in the academic year 2018/2019 ¹¹	Demand from 10/2018 to 03/2019
Medicine	11.995	6.597	4.445
Speech pathology	264	145	6
Pharmacy	1.443	794	58
Computer science	6.416	3.529	30
Teaching the study of physics	904	497	9
Teaching the study of math	2.719	1.495	1

Source: Agency for Science and Higher Education (ASHE) and CES

To be able to make a prognostic picture, there is a need for more quality

⁹ CES (2019): "Recommendations for enrollment education policy and the policy of scholarships", Croatian Employment Service

¹⁰ Data refer to the number of enrolled students in different academic years since the duration of the study is not the same for all scientific fields. For medical studies, the total number for Clinical Medical Sciences and Fundamental Medical Sciences in the academic year 2013/2014 was taken. For Speech pathology and Computer Science, the academic year 2016/2017 was taken. The same academic year was taken for teaching the studies of math and physics; however, it was noted that there was no available number of enrolled students in the studies in the teaching field but just the general number of those who enrolled in physics or mathematics was available. For the study in pharmacy, the data was taken for the 2014/2015 academic year.

¹¹ According to Babić, Z., Matković, T., Šošić, V. (2006): "Structural Changes in Tertiary Education and Impacts on the Labor Market", Croatian Economic Survey, Vol.16. (108/10), p.42 approximately 55% of enrolled students actually finish their studies. The same percentage was taken to make a projection of graduate students in the 2018/2019 academic year.

data. The data from both the side of supply (ASHE) and that of demand (CES) are not detailed enough and there is a possibility of multiple deviations¹². CES is also limited to the number of registered people (69.8%¹³), which resulted in the exclusion of a working-age contingent of people who are unemployed but not registered through the CES (30.2%).

There are also cases where graduates are being employed without the need to register with CES. No record has been kept of such cases except in some higher education institutions that have their own record of employment of their own graduate students, but there is no record kept on a national level. The classic example is of students who studies in the field of information-communication technology (ICT). As is known, there is a large deficit in qualifications in this field throughout the European labor market, and there are cases of students changing from being full-time to part-time students during their studies in order to be employed. The European Commission has reported that there is a growing "need for more skilled ICT professionals in all sectors of the economy. It is estimated that there will be 500,000 unfilled vacancies for ICT professionals by 2020."¹⁴

The purpose of the labor market analysis presented in the observed period was to point out the extent, weakness, and scarcity of the quality of data available, with the aim of emphasizing the inability to create a good basis for making quality strategic decisions. According to the results of the research, it can be concluded that there is an urgent need to revise the methodology in use so that the basis for creating a better and more complete prognostic image could be made. Furthermore, the market analysis presented is only one segment in the structure of the model proposed and explained below. To obtain a more complete image, it is suggested that all stakeholders in this process be linked, as shown in the model, and an information database be created, which is accessible to all stakeholders through clearly regulated powers (database filling, data modification, viewing, generating statistical reports, and technical maintenance and updating).

¹² This refers to the examples as the students enrolled in the teaching studies of math and physics, where only general numbers are available. On the other hand, the data from CES only has the data of registered unemployed people, and the unemployed people from the 2008/2009 academic year registered with qualifications according to the Bologna study system but classified in major group 2 in some (unknown) way. Internal instructions as to how to classify each qualification is not given, and everything is let to the will of the referents. From all the above- mentioned issues, it is clear that there are multiple possibilities for deviations in the data.

¹³ Labor force survey, 11/01/2019, link: https://www.dzs.hr/Hrv_Eng/publication/2018/09-02-06_03_2018.htm access 01/04/2019

¹⁴ <https://ec.europa.eu/digital-single-market/en/policies/digital-skills> access 01/04/2019

3. RELATIONAL MANAGEMENT MODEL FOR HIGHER EDUCATION QUALIFICATIONS IN THE REPUBLIC OF CROATIA

As a possible response to the above-mentioned deviations, a unique management model of supply and demand for higher education qualifications in the Republic of Croatia was created.

3.1. MODEL BACKGROUND

The model (Figure 3) was created after extensive research on qualifications obtained through tertiary education in Croatia and within the doctoral dissertation¹⁵. One of the aims of the research was to establish interactions between education, technical, technological and scientific development, and their impact on creating new occupations. As through the research, it was not possible to clearly distinguish which of the three above-mentioned parties most influences the creation of a new occupation, and it is clear that they all have a part to play, this was the starting point for creating a model. All key stakeholders of each of the three parts were explored and analyzed, as were the laws and documents regulating the field of work of the stakeholders, and their relationships, on the basis of which a synthesis was made in the form of a relational model. The theoretical basis for the creation of such a model was the application of knowledge management theory (Nonaka et al., 1995), starting from the assumption that knowledge increases through sharing (North 2008) and that through the use of information-communication technology, this process will accelerate and the necessary knowledge will, in a short time, be available to those who know how to apply and upgrade this knowledge wisely to create new knowledge (Novotny 2015, Srića 2017). In this way, the development trends will be observed faster, and thus implemented earlier in the educational policies, and at the operational level, in study programs. The latter leads to the assumption that graduates will come out from the study system more ready and skilled for the labor market especially in the following skills: "capabilities in analytical problem solving, innovation and creativity, self-direction and initiative, flexibility and adaptability, critical thinking, and communication and collaboration skills" (Boyles et al. 2012). The theoretical basis for the graphical representation of the model is the system theory itself (Žaja 1993), which is applied to define the model as a system with the corresponding subsystems (elements) and defined by their relationships – which make up the system structure, inputs and outputs, and the internal and external environment. In the model, the internal environment is more elaborated while the

¹⁵ Marušnik, B. (2015) *Utjecaj tehničko-tehnološkog i znanstvenog razvoja na stvaranje novih zanimanja*. Doctoral dissertation. Osijek: University J. J. Strossmayer (The impact of technical, technological and scientific development on creating new professions)

involvement of the external environment is visible only in interactions related to external influences and external cooperation. The model function can be defined by arranging into three groups:

- *from the Education aspect* – faster implementation of scientific, technical and technological development, better planning of subscription quotas and creation of education policies, and the creation of Education according to the needs of the economy,
- *from the employers' aspect* – getting a more competent workforce, decreasing the time required to integrate new workers into the business, which directly influences the acceleration of business processes and ultimately the business result,
- *from the economic aspect* – faster processes, reduced waiting time (all necessary data and information are available in a common base to the person who needs it when it is needed), easier generating of required reports, better quality reports and more relevant data (real state), better quality strategies and policies in Education, but also in other economic sectors, and ultimately faster and more adaptable development of the economy in line with global development.

3.2. MODEL IMPLEMENTATION

The basis for the implementation of such a model already partially exists. The system of higher education has been using various information systems for years, such as MOZVAG¹⁶ (the newer version in use is MOZVAG2), NISpVU¹⁷ and ISVU¹⁸, while through the implementation of the Croatian Qualification Framework (CROQF), ISRHKO¹⁹ was also implemented. In addition, there are national-level information systems connected to e-citizens by providing citizens with digital services of various institutions in Croatia, which makes a good foundation for connecting into such a model.

There are three basic questions regarding the possibility of implementing the model: (1) Is there a technical possibility of linking key information systems to a common database? (2) What would be the cost of implementing such a model and is there any possibility of such funds being allocated for that purpose in the future? and (3) What must be regulated by law in order to allow the unobstructed application of the proposed model by all stakeholders in the process?

¹⁶ Supporting Information System for the evaluation procedures carried out by the ASHE

¹⁷ National Information System for application to higher education institutions

¹⁸ Information System of higher education institutions

¹⁹ Information System of the CROQF register

By researching this segment, it was found that there was a previous attempt to create an information system in Croatia to link science and higher education to a common system called NISVOZ²⁰, which should have been completed by June 2011. It was planned that NISVOZ would include "a much larger number of parameters for generating analysis and statistics in the field of higher education and science, which are currently insufficient to make decisions based on accurate information in this field. NISVOZ will be the path to harmonize the decisions and recommendations made by the various bodies in the system and for their transparency and the establishment of realistic standards and objective criteria and ratings. The system would include business process management applications at all levels where strategic or operational decisions are made regarding the functionality of the higher education system and scientific activities and the conditions for the quality functioning of the system and its components"²¹. This information system would also incorporate some of the above-mentioned information systems, which would allow easier search and statistical reporting in the field of higher education. NISVOZ is the closest to the idea of the management model of supply and demand for higher education qualifications in the Republic of Croatia. What is not foreseen through NISVOZ are the data from employers and the labor market that would be useful in the field of managing higher education qualifications although it would present a very useful foundation for its development. Inside NISVOZ, a possibility of monitoring through CES and the Ministry for Labor and the Pension System (MLPS) was planned, but not the possibility that those who have access to part of the base also have the option of updating the base according to their responsibilities and field of work. Through NISVOZ, monitoring of graduates and their employment after graduation, which would also be very useful for higher education institutions as well as for higher education policy-makers, was also planned. The contest for creating and pilot testing of NISVOZ was canceled²² hence the NISVOZ project has still not been implemented.

3.3. MODEL DESCRIPTION AND IMPLICATIONS

The application of the CROQF and the largely completed register is implied in the model. The current state of the CROQF register is: 11 occupational standards and 135 competency sets have been set, while 47 are in the process of entering the register²³. All these are the result of projects implemented at various higher education institutions funded by the European Social Fund in recent years.

²⁰ National Information System of science and higher education

²¹ <https://www.azvo.hr/hr/novosti/751-objavljena-lista-ponuaa-u-uem-izboru-za-projekt-nisvoz> access 03/01/2015

²² <http://www.ljudskipotencijali.hr/Nacionalni-informacijski-sustav-za-visoko-obrazovanje-i-znanost.html> access 03/01/2015

²³ ISRHKO link: <https://hko.srce.hr/sustav/standardi> access 01/04/2019

The use of CROQF would make it possible to search for new and old occupations, learn outcomes and competencies, and so on. On the other hand, within the model, it would be possible to update in real-time, technical, technological and scientific changes that would enable those who create educational policies to have better quality and timely information and the direction of development, which would encourage the creation of new or updated existing study programs. This would enable our country to respond faster to developments in the surrounding countries and in the world, but also to react at the appropriate time and with flexibility in the educational programs. The possibility of educating students for occupations that are outdated and will not exist in the near future is minimized. The focus is on the timely update of development trends as there is a fast-growing and changing knowledge in the world in general, and especially in the ICT sector.

The model can be elaborated and an information database for all stakeholders in this process can be created. The purpose of the model is to synthesize key parameters of economic development and, in line with that, to adjust the education system to the needs of the economy in a more efficient and faster way. The model is actually very simple, but prior to its implementation, there is a need for more elaboration, which requires a significant financial investment.

The concept of the model is based on existing relations, but these should also exist for all stakeholders in this field.

cooperation on projects and general cooperation, reporting the need for a new occupation, sharing information about scientific, technical and technological development, the exchange of information from abroad, et cetera.

The successful synthesis of key information for each of these institutions can accelerate the process of implementing the necessary changes to existing education programs, creating new study programs, designing future policies and the direction of the development of education in the function of needs for knowledge, skills, and competencies in the contemporary Croatian economy. This would enable higher quality employability and the recognition of qualifications in the labor market, as well as economic development as a whole.

4. CONCLUSION

According to the conducted research and labor market analysis in the period from 2008 to 2018, it can be concluded that the information available is insufficient for quality guidance and hence the creation of educational sector policies. There are a number of deficiencies in the current methodology, mainly because of legal inconsistency, which contributes to the inability to numerically determine the supply and demand for higher educational qualifications. In this way, it is not possible to obtain an insight into the actual state of supply and demand, which makes the labor market ineffective and difficult to manage. The fact that students who finished their studies from 2008 onwards and obtained a qualification, the allocation of which in 2019 is not clear according to NKZ 2010, reflects the sluggishness of the system.

Through the research of supply and demand according to the CES recommendations it was established that in 2019 there would be a surplus in the workforce for the required occupations. However, since the survey covers only 69.8% of the working-age population, such a conclusion cannot be considered as final.

Based on the above, it is only possible to make a rough assessment of the labor market movement that does not include the parameters of technical, technological and scientific development. In order to implement this aspect, a unique relational model was created. A detailed elaboration of the model and the consolidation of the existing information systems of key stakeholders could create the prerequisite for more effective management of the supply and demand for higher education qualifications in the Croatian labor market, management of scientific and technological development and improvement in study programs, and ultimately, the creation of competent higher education experts capable of responding to the demand of modern business.

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