



SHare, Improve, develop: today's excellenCe for tomorrow's HVET
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Intellectual Output 1 – National surveys

Croatia

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Contents

Contents	3
Summary	4
Description of national and regional context, economic and social features.....	5
NATIONAL EDUCATION SYSTEM.....	8
Methodology.....	10
Description of practices.....	11
Master craftsmen exam	11
Short professional study degree for Smelter (University of Zagreb, Faculty of Metallurgy)	16



Summary

HVET on EQF 5 in Croatia consists of Master craftsmen exam, specialisation training programmes and Short Professional Study programmes (less than 180 ECTS points).

For Good practice examples we have chosen Master exam as a unique system which allows progression from EQF lvl 3 and 4 to level 5 and as an excellent recognition of formal, non-formal and informal acquired knowledges oriented directly to labour market. The second good practice is Short professional study degree for Smelter (University of Zagreb, Faculty of Metallurgy) which allows students more detailed knowledge and skills in conventional and modern technologies of production metal cast than on EQF level 4 or 6.

Master Craftsman Exam is regulated by the Ministry of Entrepreneurship and Crafts and approved by the Croatian Chamber of Trades and Crafts. The master's exam is the highest level of education in craft's professions in which one acquire professional qualification and title of master craftsmen. After successful passing of master's exam master craftsmen acquires the 5th level in according to the Croatian Qualifications Framework (CroQF). It is associated with the same level of education in European Qualifications Framework (EQF) and thus provides competitiveness and mobility on the European labour market. The regional chambers of trades (20 chambers) and crafts are conducting Master exams. A master craftsmen exam is assurance of quality because of its recognition of formal, non-formal and informal acquired knowledges.

At the University's short professional degree for Smelter, students are trained for production of casts from ferrous and non-ferrous alloys, which allows them immediate employment process. The curriculum differs significantly from curriculum for Metallurgy of university undergraduate and graduate students. It features distinctive items that will provide students a more detailed knowledge and skills in conventional and modern technologies of production metal cast, while the other non-relevant fields of metallurgy (eg, plastic processing) are not included in curriculum.

Short Professional Study for smelter ends with submission and defence of the dissertation of the selected area of the profession. Finishing the study participant is given title of stručni pristupnik/stručna pristupnica (150 ECTS points). It is possible to continue with professional study for baccalaureus or achieve extra credits for continuation on university study programmes.



Description of national and regional context, economic and social features

The Republic of Croatia (Republika Hrvatska) is located in South-eastern Europe, it is part of the Danube valley and to the east it is bordering the Adriatic Sea. Neighbouring countries are Slovenia, Hungary, Serbia, Bosnia and Herzegovina and Montenegro.

The land area of Croatia is 56 594 km², and the sea and interior sea waters are 31 479 km². The coast line is 6 278 km long (mainland 1 880 km and islands 4 398 km). Croatia has more than a thousand islands, islets, rocks and reef, a fact that is of importance for the "geographical identity" of the country. Although the land area of Croatia is not very big (19th in size among Member States of the European Union), it has an extremely varied relief, with the three main types being: lowland Pannonian, mountainous Dinaric and coastal Adriatic. About 62 % of the territory covered by the river network belongs to the Black Sea catchment basin, 38 % of the territory to the Adriatic catchment basin. Croatia is considered to be one of the classic karst countries in Europe, and it has large reserves of underground drinking water: in terms of the size of its per capita water reserves, Croatia is the third in Europe (behind Iceland and Norway). In addition, 47 % of its land and 39 % of its sea is designated as specially protected areas and areas of conservation: 19 National and Nature Parks, with some- designated as United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage sites.

According to the 2011 Census (Croatian Bureau of Statistics), the population of Croatia is 4 284 889 people, of which 48.2 % are men and 51.8 % are women. Eurostat data for 2015 reports the population (the number of persons having their usual residence in a country on 1 January of the respective year) to be 4 225 316 persons. The majority of the population are Croats (90.42 %). The biggest minority with 4.36 % of the population are the Serbs, but a wide range of other ethnicities are also present in the country, including Bosnians, Hungarians, Slovenes, Italians, Czechs, and Romas (each ethnicity being less than 1 % of the total population). The official language is Croatian, and the currency in use is kuna.

Croatia became independent from the former Yugoslavia on 25 June 1991; it joined the UN on 22 May 1992 and NATO on 1 April 2009. Croatia became candidate country for EU membership in June 2004 and accession negotiations were opened on 3 October 2005. The European Union (EU) Accession Treaty was signed on 9 December 2011; and at the referendum at the beginning of 2012, 66.27 % of Croatian voters supported accession to the EU. The parliament unanimously ratified the Accession Treaty and Croatia became the 28th EU Member State as of 1 July 2013. Croatia is a unitary state, with a unicameral parliamentary system (the parliament is called Sabor), and it has three levels of governance: • central (national) level, • "regional" 1 level with the 20 Counties (županija) plus the City of Zagreb (The capital city of Zagreb has a special status, as it is both a Town and a County), • local level with the 428 Municipalities and 128 Towns.

Croatia underwent a decentralisation process that started in 2001 when certain functions and responsibilities were transferred from the national to the local level. A Commission for Decentralisation was created by the government in 2004 and overall, the reform of local self-government has long been present on the political agenda, strongly supported by international



organisations and donors (e.g. EU CARDS and IPA, USAID). The division of responsibilities, the territorial organization and budgetary issues of local units are regulated by several pieces of legislation; the financing system of local and regional units is mainly based on sharing of tax revenues (in particular the personal income tax) between the central government and the local and regional units (LRUs). As regards their competences, cities and municipalities carry out locally important operations that directly affect the needs of the citizens (tasks not assigned by constitution or law to state bodies). Obligatory tasks include among others housing and arrangement of settlements, zoning and town planning, pre-elementary and elementary schooling, protection and improvement of natural environment, etc. Counties on the other hand are in charge of operations of regional importance, in domains such as education; zoning and town planning; economic development; transports and transportation infrastructure. The European Commission (EC), in its Croatia Country Report 2015² (SWD(2015)30 of 26.2.2015) concludes that the decentralisation policy in Croatia is suboptimal and it undermines management of public finances and efficient public expenditure. Attribution of policy functions across different levels of government remains complex and non-transparent. Moreover, weaknesses in administrative capacity (partially due to fragmentation of sub-national governance) on local level have an impact on tax collection, the provision of social benefits, the management of European Structural and Investment Funds (ESIF/ESI Funds), public procurement and the provision of public services, etc. Finally, Croatia is divided into two (earlier three) statistical (NUTS 2 level) regions: Jadranska Hrvatska and Kontinentalna Hrvatska.

The economy Croatia had one of the wealthiest economies among the former Yugoslavian republics. Unfortunately, the country suffered heavily during the war of 1991-95, and lost part of its competitiveness compared to other economies of central Europe that were benefiting (at the beginning of the 1990s) from democratic changes. Also due to the subsequent introduction of reforms, Croatia had developed quickly until 2008. Nevertheless, the country's economy turned out to be more vulnerable to shocks than that of the EU-28 average, and the economic crisis affected Croatia strongly. In 2009, the GDP shrank by 6.9 %, and the prolonged crisis has led to Croatia losing over 12 % of its output. In 2014 (Eurostat data), the GDP of Croatia was EUR 43 127.9 million (at market prices), and its GDP per capita (in PPS) reached 59 % of the EU-28 average (this proportion remained relatively stable, in the range of 56-64 % during the period of 2003- 2014). The economy of Croatia is a service-based economy with this sector accounting for 70 % of total GDP (the industrial sector accounts for 25 % of GDP, whereas agriculture, forestry, and fishing for 5 %). Both in the case of imports and exports, the EU market represents more than 60 % of Croatia's total foreign trade activities. The main partners (accounting for 58 % of trade) are: Italy, Germany, Slovenia, Austria, Bosnia and Hercegovina and Hungary.

Eurostat data shows that unemployment rose to 17.3 % in 2013 and 2014, the third highest among the EU 28 countries (after Greece and Spain), more than 7 percentage points above the EU average. Youth unemployment in Croatia (annual average being 45.5 % in the age group below 25 years) has the exact same ranking among the EU Member States (again after Greece and Spain), in this case 23.3 percentage points above the EU-28 average. In 2014 58.4 % of the unemployed were registered as being on long-term unemployment (10.1 % of the active population). According to the analysis of the World Bank, most jobs were lost in manufacturing, construction, and trade. The downward development spiral has an impact on the profile of the poor, as in principle economically active,

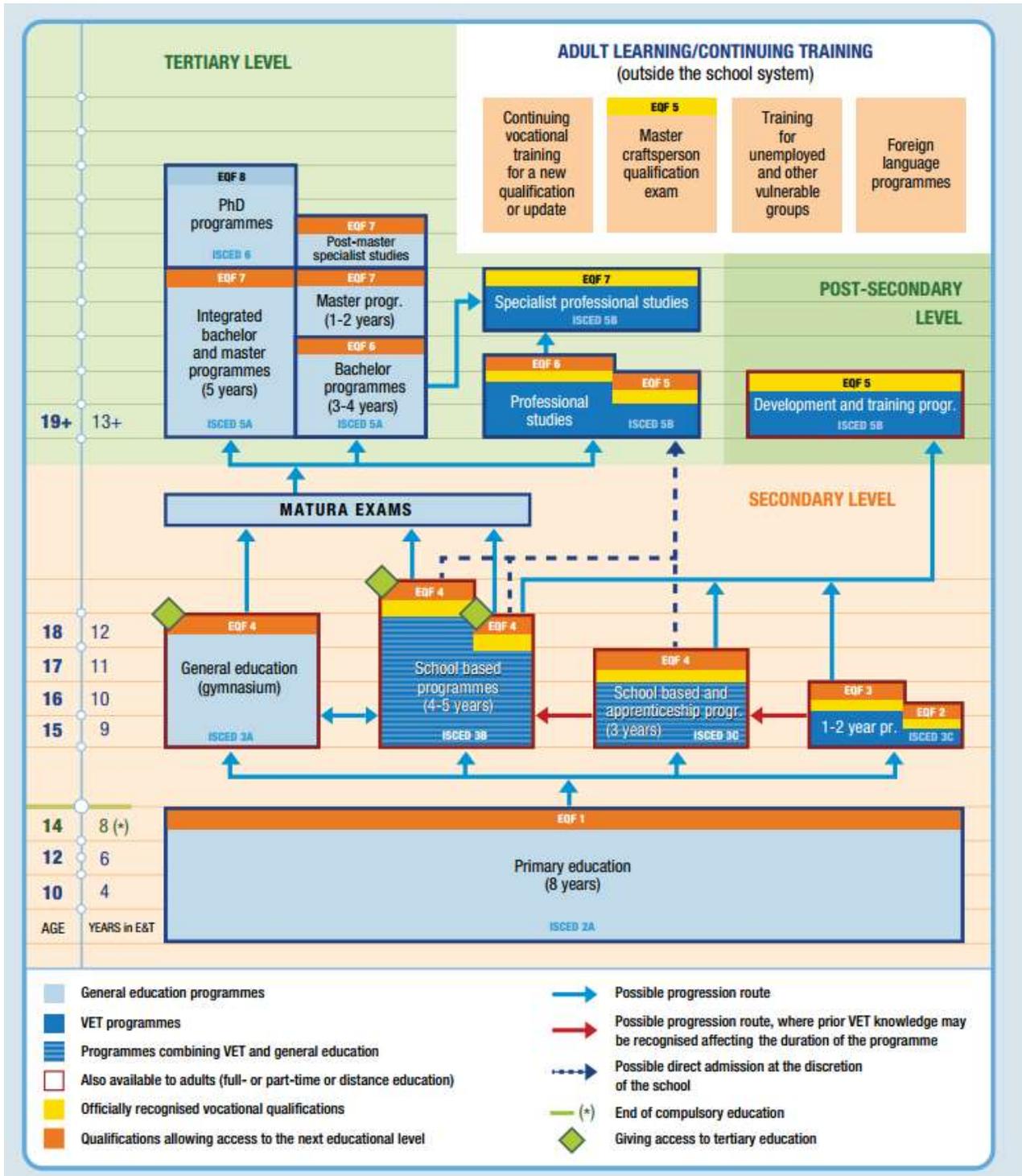
better educated (and younger) persons in urban areas fall into poverty. According to Eurostat data, in 2013 the at risk of poverty rate (after social transfers) was 19.5 %, the proportion of people at risk of poverty or social exclusion amounted to 29.9 % (the respective indicators were 16.7 % and 24.5 % for the EU-28). Both indicators show a slightly decreasing trend. The annual average consumer price index (previous year=100) in 2014 was 99.8 (in 2013 102.2), fluctuated in the period 2003-2014, between 106.1 measured in 2008 and the lowest value being that of 2014. The annual average harmonised consumer price index, an indicator comparable across the EU, had the value of 100.22 (the EU-28 value for 2014 was slightly higher, 100.6, that of the Euro area 100.4.) in 2014 (Eurostat). According to the analysis of the World Bank, even though the outlook in the short term remains difficult, privatisation, the availability of EU funds and structural reforms should help growth prospect, stimulate jobs and social cohesion in the medium term. The below table shows the Commission's macro-economic forecast for 2015 and 2016:

Croatia	2013	2014	2015	2016
GDP growth (% , yoy)	-0.9	-0.4	1.7	1.8*
Inflation (% , yoy)	2.3	0.2	0.3	1.3*
Unemployment (%)	17.3	17.3	16.8	16.6*

* Forecast December 2015

Tourism is one of the most important and visible sectors of the Croatian economy. Both tourist arrivals and tourist nights have steadily been growing since 2009, with seaside resorts accounting for over 80 % of the total arrivals and over 90 % of the tourist nights. The share of foreign tourist is very high, about (and sometimes above) 90 %.

NATIONAL EDUCATION SYSTEM



VET and HVET

Vocational education and training (VET) plays a major role in Croatia. Overall responsibility for VET lies with the Ministry of Science, Education and Sports supported by the Agency for VET and Adult Education (ASOO). The agency is responsible for developing VET curricula, continuous professional development of VET teachers, skills competitions and quality assurance. The 2009 VET Act



strengthened cooperation through increased involvement of line ministries, social partners, chambers of trades and crafts, the employment service, professional associations and other stakeholders. It also established multipartite VET sector skills councils that informed VET on the needs of the labour market and higher education. Since the 2013 Act on the Croatian qualifications framework (CROQF), 25 sector skills councils cover general, vocational and higher education. The Human Resource Development Council assesses, validates and coordinates education, employment, and lifelong professional guidance policies, regional policy and CROQF development, aiming to encourage human potential development, stimulate competitiveness and achieve Croatia's strategic goals. All VET programmes combine professional and general competences, to varying degrees; most include mandatory work-based learning (WBL), though duration and type varies. Learners from lower-level programmes can progress to higher levels at the discretion of their schools. Initial VET is publicly financed and free of charge. Learners start VET on completion of compulsory education (ISCED-P 244) at the age of 14/15. A high proportion (71.3%) of learners at upper secondary level participated in IVET at the beginning of the 2015/16 school year. Around two thirds of VET learners were in four-year school-based programmes, one third in three-year programmes. Some learners participated in shorter, one- to two-year VET programmes (ISCED-P 351).

Four-year, mostly school-based VET programmes (ISCED-P 354) with a WBL component lead to qualifications at CROQF level 4.2/EQF level 4. These 'technician' programmes allow progression to tertiary education, after completing external matura exams, administered by the National Centre for External Evaluation of Education (NCVVO). Most students in four-year VET programmes use this opportunity. Three-year VET programmes (ISCED-P 353) give access to the labour market and lead to qualifications at CROQF level 4.1/EQF level 4; they are mostly run as apprenticeships, with significant work-based learning at companies. Since 2014, graduates from these programmes can enter an optional one- to two-year bridge programme and, if successful, take matura exams to qualify for higher education access. This programme corresponds to the fourth year of the school-based programme. At higher education level, VET is provided at polytechnics in the form of short-cycle programmes (ISCED-P 554) and professional studies (ISCED-P 655) with a focus on applied sciences. Learning in these programmes typically involves extensive practical work experience and leads to a qualification at CROQF and EQF levels 5 and 6. Shorter programmes also exist. Adult education and training (for those over 16) covers a broad range of options, mainly in the form of short (re)training programmes, which range from basic or technical skills courses to complete formal secondary education and training. Entry requirements for post-secondary adult VET programmes include relevant IVET training and/or a number of years of professional experience. If adult education providers want to issue formal certificates at secondary education level, the education ministry has to approve their programmes.



Methodology

Croatia has two different types of level 5 qualifications: a post-secondary non-tertiary education qualification (master craftsman qualification, *Majstorski Ispit*), and the SCHE qualification (*stručni studij*). The master craftsman qualification leads to the acquisition of 'additional competences compared to ones previously acquired' (Croatian Agency for Science and Higher Education)

Holders of a master craftsman qualification (Croatian qualifications framework level 5) have the opportunity to progress to Croatian qualifications framework level 6 if they pass the matura exam in obligatory subjects (Article 7 of the Law). The master craftsman exam is a way of formally recognising acquired competences (through work experience). The SCHE qualification (*stručni studij*) is provided by higher education institutions (universities, university constituents such as faculties and academies, polytechnics and colleges). A general requirement to access this qualification is to have three or four year upper secondary education; specific requirements are defined by higher education institutions in accordance with the qualification profile. Following the completion of SCHE (which last a minimum of two years) students are able to access first cycle professional degree programmes or enter the labour market.

As a good practice, we wanted to include two examples from both fields. Master craftsman exam is conducted on national level by the Croatian chamber of trades and crafts in cooperation with regional chambers of trades and crafts. This example of best practice was taken to show the progression from EQF level 2 and 4 to EQF level 5 and as an example of recognition of formal, informal and informal acquired knowledge.

The second good practice is EQF level 5 in High Education, tertiary level. Unfortunately the biggest problem in Croatia is EQF Level 5 on tertiary level is near extinction. Most of the programmes for Short Profession degree (*Pristupnik* - less than 180 ECTS points) has been transformed into Baccalaureus degree (*Prvostupnik* - more than 180 ECTS points) because Academy Profession degree wasn't accepted well in public. One of the last standing Academy Profession degree is for smelter which will be described below. With the Comprehensive Curriculum reform in Croatia which is in process, intention is to include EQF Level 5 in it with an emphasis on connection between secondary and tertiary level.

Description of practices

Master craftsmen exam

Postsecondary adult education programmes lead to additional competencies compared to ones previously acquired, but are not university education. As opposed to training programmes, a condition for enrolment in additional training programmes is the previously acquired expert knowledge of the area in which participants want to be additionally trained.

Upon the completion of these programmes, participants who finished secondary school improve and extend previously acquired professional knowledge to meet labour market demands and to gain knowledge of new techniques and technologies, as well as of their use. The programme for the Master Craftsman Exam is regulated by the Ministry of Entrepreneurship and Crafts and approved by the Croatian Chamber of Trades and Crafts.

Postsecondary professional education and training Entry requirements: An appropriate vocational education and training programme (the same profile), and at least 2 years of experience in the profession in which the candidate wants to take majstorski ispit (the Master Craftsman Exam); or An inappropriate vocational education and training programme (different profile), and at least 3 years of experience in the profession in which the candidate wants to take the Master Craftsman Exam; or Appropriate 1 or 2 years of a vocational education and training programme, and at least ten years of experience in the profession in which the candidate wants to take the master craftsman exam. Education and training: Preparation for the Master Craftsman Exam is not compulsory, but can be organized by institutions for adult education and other entities.

Master craftsman schools are not part of formal education and can be established under provision of the Act on Trades and Crafts.

- Financing: Public and private
- Teachers qualifications: Higher education second cycle qualifications in different subjects and/or Master Craftsman Exam as well as other specialists in different areas
- Expected learning outcomes: To perform work at a high professional level, to manage an independent company, to employ all legislation defining an activity within a craft sector, to ensure quality, to know the technologies related to higher levels of productivity, to organize one's own work processes and the work of others, to transfer practical and professional knowledge and skills to apprentices, to produce a business plan and analyze business results, to ensure a creative working atmosphere, to motivate and develop co-workers, and to ensure safety at work.
- Assessment and awards: Master Craftsman Exam is offered by a committee of the Croatian Chamber of Trades and Crafts consisting of five persons. Two persons are master craftsmen in the related craft, one examiner is an expert in professional theory, one examiner is an expert in legislation and business management, and one examiner is an expert in skills related to the education of apprentices.



For example, Additional Training Programmes as defined by the Ordinance on Standards and Specifications in Adult Education Institutions (OG 129/08, 52/10) Referencing and Self-certification Report of the CROQF to the EQF and to the QF-EHEA 29

Progression routes: NA Labour market: Passing the Master Craftsman Exam is a precondition for running businesses regulated by special Act (OG 42/08).

Quality assurance: The programme for the Master Craftsman Exam is regulated by the Ministry of Entrepreneurship and Crafts and approved by the Croatian Chamber of Trades and Crafts. The exam is held by five member committee. The procedure of the exam is regulated by an Act delivered by the Minister responsible for entrepreneurship and crafts and approved by the Croatian Chamber of Trades and Crafts.

The Croatian Chamber of Trades and Crafts has prepared catalogues for the standardization of exams. The catalogues precisely describe the learning outcomes for each master profile.

Example: Gas installer: The Master Craftsman Exam consists of 4 parts: a practical part, a professional theoretical part necessary for crafts businesses, a business-management and legislative part, and a pedagogical part related to the education of apprentices. If a candidate does not pass the practical part of the exam he/she is not allowed to perform other sections until the next exam. A candidate who has passed the Master Craftsman Exam is awarded a diploma of the master craftsman profession and title of majstor plinoinstalater (Master gas installer). Labour market: Master gas installer may run his/her own gas workshop, employ other workers, and educate apprentices attending an education and training programme for gas installers.

Preparation for the Master Craftsman Exam is not compulsory, but can be organized by institutions for adult education and other entities.

Master craftsman schools are not part of formal education and can be established under provision of the Act on Trades and Crafts.

The master's exam is the highest level of education in craft's professions in which one acquire professional qualification and title of master craftsmen. After successful passing of master's exam master craftsmen acquires the 5th level in according to the Croatian Qualifications Framework (CroQF) which is associated with the same level of education in European Qualifications Framework (EQF) and thus provides competitiveness and mobility on the European labour market. The master's exam is a state recognized exam, and master Diploma is a document that is proof of expertise and quality and will open the possibility for further career advancement, in the workplace, opening company-craft, in practical work exercises, apprenticeship and greater competitiveness in the presentation and entrepreneurship.

Master craftsmen exam is precondition to open a craft and its management in following occupation:

car electrician, car mechanic, electric installer, electric mechanic, house and woodwork painter, heating and AC installer, joiner, plumber, bricklayer, car body painter, roof-tile layer, cook, baker, turner, machinist, hairdresser, butcher, locksmith, car body mechanic and tinsmith.

Number of completed Master exams is very stable year-by-year:

2012.	2013.	2014.	2015.
1.220	1.333	1.097	1.283

IVET in combination with HVET and vertical progression

The current IVET system (upper secondary education) covers approximately 140,000 secondary VET students or on average 72 % of the total secondary school population in 307 schools.

The IVET system is comprised of the following types of the VET programmes: - Adapted VET programmes for students with disabilities; - one-year VET programmes - two-year VET programmes - three-year VET programmes - four-year VET programmes, including relevant five-year VET programmes.

VET programme / features	ISCED level	CROQF / EQF level	Number of programmes	Primary progression routes
1-year VET programmes / Two-year VET programmes	ISCED 3C	2 / 2 3 / 3	49	Labour market / Master craftsmen exam/EQF5
3-year VET programmes for professions in industry	ISCED 3C	4.1 / 4	72	Labour market
3-year VET programmes for professions in crafts	ISCED 3C	4.1 / 4	63	Labour market / Master craftsmen exam /EQF5
4-year VET programmes (including 5-year VET programme)	ISCED 3B	4.2 / 4	95	Labour market / Higher education (via StateMatura)

Figure: Possible VET progressions in collation with Master craftsmen exam (EQF5)

VET programme / features ISCED level CROQF / EQF level Number of programmes Primary progression routes
 1-year VET programmes / Two-year VET programmes ISCED 3C 2 / 2 3 / 3 49 Labour market / Master craftsmen exam
 3-year VET programmes for professions in industry ISCED 3C 4.1 / 4 72 Labour market
 3-year VET programmes for professions in crafts ISCED 3C 4.1 / 4 63 Labour market / Master craftsmen exam
 4-year VET programmes (including 5-year VET programme) ISCED 3B 4.2 / 4 95 Labour market / Higher education (via StateMatura)



One-year and two-year VET programmes One-year and two-year VET programmes lead to lower professional qualifications at Croatian Qualification Framework level 2/ EQF level 2 and CROQF level 3/EQF level 3 respectively. On average, they are attended by on average 1-2% of the total number of the secondary VET school students. The entry requirements for one-year and two-year VET programmes are: primary school certificate of completion of 7th and 8th grade (8 years of compulsory primary school), health and psychological conditions prescribed by curricula according to the law. Currently, there are 49 programmes that offer relevant lower professional qualifications. VET students holding relevant certificates can apply for master craftsmen exam (majstorski ispit) after 10 years of working experience. Three-year VET programmes Three-year VET programmes for acquiring competencies in industry, trades and crafts lead to qualifications at CROQF level 4.1/EQF level 4. It is worth noting that the respective three-year VET programmes underwent the largest number of changes/reforms in the course of 1990s - 2000s. The complete overhaul of all crafts and trades programmes started with the introduction of dual system programmes in the school year 1995/1996 (consisted of 53 mostly very narrow specialisations / occupations that can be exercised in the crafts sector or other small businesses). To overcome the parallelism of dual and the school-based models as well as a number of hindrances in the implementation, a transition to the Unified Model of Education (JMO) for crafts and trades was made during the school years 2003/2004 and 2004/2005, respectively, which combines characteristics of both models.

Subsequently, there are two main sub-types: (i) predominantly school-based programmes for industrial and trade occupations; and (ii) JMO, which includes an apprenticeship-type scheme. On average, the three-year programmes are attended by 35-36% of the total number of the secondary VET school students. The entry requirements for three-year VET programmes are: primary school certificate of completion of 7th and 8th grade (8 years of compulsory primary school), health and psychological conditions prescribed by curricula according to the law. An additional condition before beginning education for crafts occupations is a signed contract on apprenticeship. Currently, there are 72 three-year VET programmes for professions in the industry and 63 three-year VET programmes for trades and crafts. Three-year VET programmes focus exclusively on preparing graduates for labour market entry. These programmes do not enable access to the State Matura exams. Nor do they provide a direct pathway to tertiary education - VET students need to complete the fourth year and take the State Matura exams to qualify for tertiary level entry. As of the year 2014, students who have completed VET programs for crafts or other three-year VET programs can continue his education at the expense of the State Budget in the fourth year in the same or in another VET sector or in gymnasium programs. The student take additional and supplementary exams of the first, second and third year of a particular qualification and then enter the fourth grade. Student can complete equivalent of a four-year program during period of two years. Upon successful completion student can take State Matura Exams that enable enrolment into the higher education institutions On the other hand, graduates holding relevant qualifications can apply for master craftsmen exam after 2 years of working experience within the occupation at stake if they have the certificate in crafts, and after 3 if they have the certificate in other three years programmes. The status of master craftsmen enables them to start their own businesses, employ workers and train apprentices. About 1 000 people per year pass this exam. Number of students enrolling into three-



year industrial and craftsman programmes is in steady decline in recent years. Four-year VET programmes Four-year VET programmes, including five-year VET programmes for regulated occupations in the health sector, lead to qualifications at CROQF level 4.2/EQF level 4. When it comes to the five years VET programmes for regulated professions, a five-year nursing education model has been established in line with the framework of vertical integration within a university education for all health professions, as was proposed by the EU Directive 36/2005/EU addressing the harmonization of the EQF. On average, four-year VET programmes (including five-year VET programmes) are attended by 65-67 % of the total number of the secondary VET school students. The entry requirements for four-year VET programmes are: primary school certificate of completion of 7th and 8th grade (8 years of compulsory primary school), health and psychological conditions prescribed by curricula according to the law. Currently, there are 95 programmes that offer relevant qualifications. Students having spent four years (or 5 years for regulated professions) at vocational schools also have the option of taking the State Matura exams, which is an external assessment. Students holding this qualification/ vocational certificate as well as a certificate on the passed State Matura exams can apply to higher education. This puts the four-year graduates on track to tertiary education with no formal restrictions. Number of students enrolling into four-years programmes is relatively stable in recent years.

This example of best practice was taken to show the progression from EQF level 2 and 4 to EQF level 5 (Master craftsman exam) and as an example how to recognise formal, unformal and informal acquired knowledge.



Short professional study degree for Smelter (University of Zagreb, Faculty of Metallurgy)

Design of metal by casting has been known for a long time, at least 5,000 years. Although it is a technology whose principles remain the same, it is still competitive manufacturing process as by its characteristics one of the fastest and most efficient mode of production of metal, eco-friendly items of different sizes and complexity, with the possibility of making replicas and recycling.

Smelting keeps raw material supply and protects the environment. In the production of iron and steel casts, share of primary metal is still only 12.0%, and casting of aluminum cast iron uses only 15.0% of primary aluminum. Metal smelting is important for many industries. Eg. In the more developed countries, 1/3 of total manufactured smelters refers to a car industry. Competitiveness of smelting technology has survived thanks to its ability adoption of innovations related to technology, as well as the so-called high modern technologies. Great diversity of methods for casting and options provides wide range of choices which procedures are ideally suited to the required configuration, the dimensional accuracy and the amount of moulds considering expended Lifetime.

At the University's professional degree for Smelter, students are trained for production of casts from ferrous and non-ferrous alloys, which allows them immediate employment process. The curriculum differs significantly from curriculum for Metallurgy of university undergraduate and graduate students.

It features distinctive items that will provide students a more detailed knowledge and skills in conventional and modern technologies of production metal cast, while the other non-relevant fields of metallurgy (eg, plastic processing) are not included in curriculum. Goal in the first year of study is gaining adequate basic knowledge of mathematics, physics, chemistry, physical metallurgy, thermodynamics and kinetics of metallurgical processes, heat engineering, technical drawing, elements of machinery, chemical analysis and measurement in the melting. In the second and third year students take courses in the field of technology of cast making, melting technology and quality control of the melt, pouring system design and supply, the application of information technology in the foundry, casting technology of iron and non-ferrous metal analysis with flaws in castings, materials testing, welding, surface protection castings and disposal and recovery of materials. In addition to lectures exercises are performed as well. In addition, students must complete a certain number of hours of professional practice in the foundries. Short Professional Study for smelter ends with submission and defence of the dissertation of the selected area of the profession. Finishing the study participant is given title of stručni pristupnik/stručna pristupnica (150 ECTS points). It is possible to continue with professional study for baccalaureus or achieve extra credits for continuation on university study programmes.

Based on experience of Faculty of Metallurgy and queries from economic subjects it is obvious that there is a need for this profile of experts. In Croatia there are about 60 foundries (26 industrial and 34 crafts) that employ around 4,419 workers and produce a variety of structural castings, castings for the automotive industry, mechanical engineering and shipbuilding, radiators, solid fuel stoves, etc.



Faculty of Metallurgy successfully cooperate with the most of foundry mentioned. Year after year the Croatian foundry recorded an increase in production castings. In 2008 it produced 72 515 t of castings, of which 72.8% were exported (exports amounts to 155.0 mil. €). Analysis of foundry in Croatia shows that it is export-oriented, competitive, market-capable and flexible industrial sector, whose products meet high quality criteria of the world market. However, one of the biggest problems of Croatian foundry is the lack of qualified personnel and insufficient implementation of modern technologies.

Through Short Professional study for Smelter, students are, in a shorter period of time compared to the undergraduate and graduate Metallurgy studies, trained for professional work in the field of casting, which allows them immediate employment process.

Today, the prevailing opinion is that the total world's knowledge doubles in less than ten years. Considering this fact Foundry cannot develop successfully without constant monitoring of innovation aspect. Therefore it is necessary continuous quality improvement of Education experts in this profile. Modern scientific knowledge in the field of foundry and alloys is definitely incorporated as an essential component in the curriculum of the Expert Study for smelter. This is especially visible in the field of modern technologies, computerization, automation and rationalization of production, the use of modern concept of casting production (process modeling, concurrent engineering etc.). For this purpose the scientific and educational cooperation has been established with the Faculty of Natural Sciences in Ljubljana - Department of Materials and Metallurgy and Hutnícka faculties in Košičiach (Slovakia).

Quality educational and professional activity is inconceivable without appropriate scientific and professional work. Tracking global trends and own scientific and practical work in this area resulted with the publication of scientific papers both in reputable international journals and in various foreign publications. This proves our ongoing relationship with modern scientific knowledge.

University short professional study for smelter is designed in accordance with Bologna Declaration, and provides high-quality and effective education.

When developing the curriculum of the short professional study for smelter, the Faculty of Metallurgy was using the experience of following well-known metallurgical foreign universities: Leoben (MUL), Austria; RWTH Aachen and Technische Universität Clausthal (TUC), Germany; University of Birmingham, England; Faculty of Science and Technology, University of Ljubljana, Slovenia and Hutnícka Faculty in Košičiach, Slovakia. University short professional part-time study at the Metallurgy University of Zagreb is comparable with corresponding studies on Naravoslovnotehniškoj colleges (NTF), University of Ljubljana, Slovenia and Montanuniversität in Leoben, Austria. For example, Short Professional study for the smelter at the Naravoslovnotehniška college (NTF) in Ljubljana takes 2 years (IV semester) and contains 28 courses.

The analysis conducted proves that the curriculum for Short professional study on University of Zagreb in line with similar programs in European universities.

Faculty of Metallurgy acts for fifty five years and is the only institution of this kind in Croatia, which specializes in research and teaching, scientific and work in the field of technical sciences and the field of metallurgy. It is part of the Department of Metallurgy Faculty of Technology in Zagreb, founded in 1960. In the reorganization of Technology Faculty in 1978 and foundation of the Faculty of Metallurgy, which operates, from 1 January 1979., within the Institute of Metallurgy, and as of 1991 as an independent institution of higher education of the University of Zagreb. The Faculty of Metallurgy has three institutes; Department of Process Metallurgy, the Institute of Mechanical Metallurgy and Department of Physical Metallurgy. It educates engineers, professional study engineers, metallurgical engineers bachelors, masters Engineers metallurgy and PhDs in the field of metallurgy.

So far, short professional study for smelter completed:

2011./2012.	2012./2013.	2013./2014.
12	8	8

The study is organised in a groups of max. 15 students because it includes new teaching methods and practical part.

Scientific and professional work at the Faculty is an essential precondition and background of education, as well as further progress of the profession, and thus the metallurgical industry. Educators of Faculty have published more than 1,000 scientific papers so far, with a result of creation a larger number of studies and dozens of projects. Large part of teaching and research is focused in obtaining, processing, structure, properties and the use of metal materials. Faculty has so far collaborated or have further cooperation with foreign Metallurgy, University of Ljubljana (Slovenia), Freiberg (Germany), Kosice (Slovakia), Zenica (Bosnia and Herzegovina), etc., and many other universities (FSB, RGN, FKIT, Faculty of Dentistry, etc.), University of Zagreb, University of Split, Rijeka and Osijek (Slavonski Brod).

Faculty of Metallurgy has so far organized 10 international conferences for smelters in which gathers a large number of experts in the field of casting. In addition, Faculty of Metallurgy has organized several seminars in the field of casting.

For admission for the Short professional study for Smelter can apply candidates who completed a four-year or three-year VET school and had subjects Chemistry and Mathematics.

All applicants who apply for the competition for enrollment in the first year of study are subject to the admission procedure through which the selection of candidates will be made. It consists of:

- evaluation of overall success in high school,
- evaluating the achieved score in mathematics and chemistry in high school.

State Matura is not a requirement for admission to the University professional part-time study Foundry.



Students on completion of short professional study for smelter can be employed in foundries (ferrous and non-ferrous casting processes). In Croatia there are a total of 60 foundries (26 industrial and 34 craft) that employ 4,419 workers and produce a variety of structural castings, castings for the automotive industry, mechanical engineering and shipbuilding, radiators, stoves, solid fuel etc. Year after year, Croatian foundry recorded an increase in production castings.

For example, in 2008 it produced 72 515 t of castings, of which 72.8% are exported (exports amounted to 155.0 mil. €). Before the 1990s, Croatia has produced around 2.5mil t of casting per year. Today production is around 100 000 t of castings per year and the number is slowly increasing. The state wants to increase the number even more, but there is lack of investments in metallurgy and in education programmes like short professional study for smelter. It can be concluded that the foundry is export oriented, competitive and market-capable flexible industrial sector, whose products to assess the quality of the world market.

From contacts with top foundry industries can be concluded that they are interested in this study because there is a lack of qualified personnel, and opportunities for overall education of students in the field of casting of metal castings. This is why the completion of short professional study for smelter is work oriented practice which gives the labour market complete and well educated smelter which can make the casting industry more competitive and assure investments in the sector which was one of the leading sectors in Croatia 25 years ago.