SVEUČILIŠTE U ZAGREBU
METALURŠKI FAKULTET

UNIVERSITY OF ZAGREB
FACULTY OF METALLURGY

SELF-EVALUATION REPORT
OF THE
FACULTY OF METALLURGY

University of Zagreb
Faculty of Metallurgy

Sisak, April 11th, 2018

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1. INTRODUCTION

1.1. Introduction

Self-evaluation Report of the Faculty of Metallurgy of the University of Zagreb in the process of the reaccreditation of the Faculty[1] has been compiled by the members of working groups nominated by the *Decision on the Nomination of Working Groups for the writing of the Self-evaluation report of the Faculty of Metallurgy as part of the reaccreditation of the Faculty of Metallurgy* brought by the dean of the Faculty, Assoc.Prof. Zdenka Zovko Brodarac, PhD, on November 2nd, 2017:

1. Working group for the topic ''Internal quality assurance and social role of the higher education institution''

   Assoc.Prof. Stjepan Kožuh, PhD, Head of working group
   Full Prof. Ladislav Lazić, PhD
   Assoc.Prof. Ljerka Slokar, PhD
   Željko Grubišić, Master in Metallurgy, professional associate
   Goran Šljivić, Bachelor in Electrical Engineering, system engineer
   Martina Lovrić, accounting officer
   Dominik Pavlović, student

   Krunoslava Kosina Milutinović, Master in Metallurgy, external associate
   Applied Ceramics d.o.o., Sisak (alumna)

2. Working group for the topic ''Study Programs''

   Assoc.Prof. Anita Begić Hadžipašić, PhD, Head of working group
   Assoc.Prof. Ivan Brnardić, PhD
   Assoc.Prof. Anita Štrkalj, PhD
   Assist.Prof. Ivan Jandrlić, PhD
   Sandra Brajčinović, Master in Metallurgy, assistant
   Ljiljana Matić, Head of the Student's Desk
   Ljiljana Srečec, technical associate

   Branislav Branković, Master in Metallurgy, external associate
   Ferro-Preis d.o.o., Čakovec (alumnus, Commission for Quality Management FM)

3. Working group for the topic ''Teaching Process and Student Support''

   Assist.Prof. Martina Lovrenić-Jugović, PhD, Head of working group
   Assoc.Prof. Zoran Glavaš, PhD
   Assoc.Prof. Robert Pezer, PhD
   Tin Brlić, Master in Metallurgy, assistant
   Tomislav Rupčić, Master in Metallurgy, assistant
   Biljana Skender, acting Head of the Dean's Office
   Tea Čavrak, student

   Full Prof. Jožef Medved, PhD, external associate
   University of Ljubljana Faculty of Natural Sciences and Engineering

[1] in further text: *Self-evaluation, Faculty of Metallurgy, Faculty, FM*

4. Working group for the topic ''Teaching and Institutional Capacities''

   Full Prof. Mirko Gojić, PhD, Head of working group
   Full Prof. Damir Hršak, PhD
   Assist.Prof. Ivan Ivec, PhD
   Katarina Terzić, Master in Metallurgy, MSc, professional advisor
   Igor Jajčinović, Master in Environmental Engineering, assistant
   Sonja Kraker Zednik, Master in Economics, Head of Accounting Office
   Sanja Vujnović, inf., Head of Library

   Full Prof. Borut Kosec, prof., PhD, external associate
   University of Ljubljana Faculty of Natural Sciences and Engineering

5. Working group for the topic ''Scientific Activity''

   Full Prof. Ankica Rađenović, PhD, Head of working group
   Assoc.Prof. Natalija Dolić, PhD
   Assoc.Prof. Tamara Holjevac Grgurić, PhD
   Assist.Prof. Jakov Baleta, PhD
   Franjo Kozina, Master in Metallurgy, professional associate
   Ante Kalvarešin, technical associate
   Barbara Tubić, student

   Full Prof. Božo Smoljan, PhD, external associate
   Polytechnic Pula

   Gordana Gojsević Marić, Master in Metallurgy, external associate
   ELKEM AS, Norway, Sisak branch (alumna)

By the *Decision on the nomination of individuals responsible for data entry and working on the Mozvag system* of the January 18th, 2018, the dean determined which individuals were in charge of the Analytic Supplement to Self-evaluation Report: Assoc.Prof. Robert Pezer, PhD (head), Assoc.Prof. Natalija Dolić, PhD and Assoc.Prof. Ljerka Slokar, PhD.

The coordinator of all activities connected with the writing of the Self-Evaluation Report was Lana Vanić, Master in Law, president of the Commission for Quality Management of the Faculty of Metallurgy.

The Self-Evaluation Report[2] was adopted at the 8th extraordinary session of the Faculty Council held on Apri 11th, 2018.

[2]Expressions that are used in the Self-Evaluation Report and which indicate a specific gender are used neutrally and refer equally to people of male and female gender.

1.2. A Word from the Dean

Metallurgical production is considered to be one of the main factors that influence the development of the world economy. Abroad, metallurgy is profitable, whereas in the Republic of Croatia a number of problems have been identified with the field, among which are poor working environments, a lack of investment, as well as bad communication between small and medium-sized businesses in the area of the metal industry, scientific institutions, higher education institutions (HEIs), and local and regional authorities.

Taking into account theoretical knowledge, the metallurgical profession strongly relies on the economy in the common exchange of knowledge and experience. The activities of research and development, along with other activities connected with the introduction of innovation into companies, are indispensable if the economy is to become more competitive.

The main strength of the production of metals and metal products in the countries of the European Union is based upon products of high quality, innovative products, and technological development, as well as effectiveness and experience. Since the Croatian market is too small for any significant growth in production, companies that specialize in the observed activities must primarily direct their production capacities at the countries of the European Union, which means increasing levels of both productivity and manpower, in order to be able to compete against foreign competition. Therefore, if they want to be competitive, today's products have to be based upon modern technology and efficient production processes, but also on a highly qualified workforce. For the development of every field, including this one, the imperatives are cooperation between the higher education community and business, investment in science and research, and common efforts towards the education and the development of top-quality metallurgical experts. At the same time there is a need for an innovative vision of all-encompassing qualifications, competencies, and skills of young experts based on relevant documents for the consideration of the development strategy of the Faculty of Metallurgy.

- Industrial Strategy of the Republic of Croatia for 2014–2020, 17 October 2014;
- Innovation Stimulation Strategy of the Republic of Croatia for 2014–2020, 17 December 2014;
- Strategy for Intelligent Specialization;
- Strategy for Education, Science, and Technology, 17 October 2014;
- A European Strategy for Key Enabling Technologies – A bridge to growth and jobs, European Commission, June 2012.

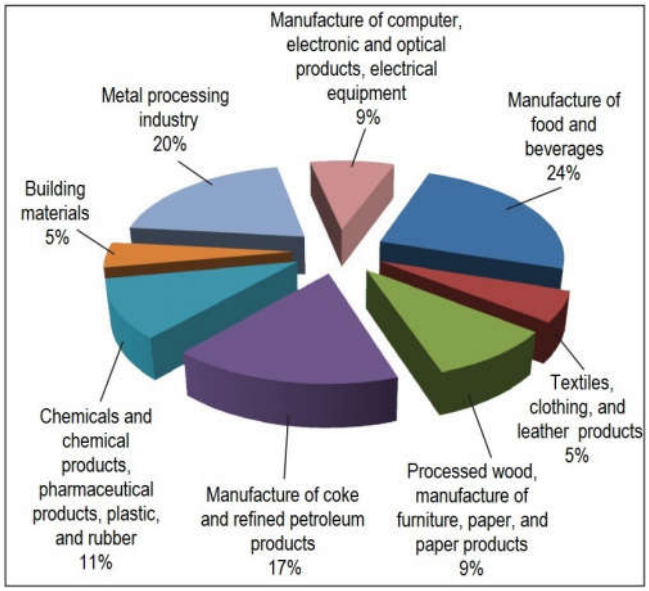
In the *Industrial Strategy of the Republic of Croatia for 2014–2020*, which was brought by the Croatian Parliament during its session of October 17th, 2014, by establishing the key problems of industry, on one hand, and defining industrial subactivities that have the strength and ability to solve key problems between the industrial activities, ranking and evaluation were carried out on the subactivity level. As the basic goal of the model is the establishment of those subactivities that can contribute significantly to the cessation of negative trends, the division (grouping) that was carried out enables the definition of horizontal measures of the industrial strategy, but also the definition of sector directives in cases when horizontal measures are not sufficient. The Industrial Strategy of the Republic of Croatia establishes with strategic goals the following activities from the area of the production and processing of metals: C25 Manufacture of final metal products and C28 Manufacture of machinery and equipment. In the Strategy of the Evaluation and Ranking of Industrial Subactivities, all subactivities are divided into five basic groups. *Metal casting* is classified in the first group of so-called "initiators", large export-oriented subactivities which

generate positive Earnings Before Interest Tax Depreciation and Amortization (EBITDA) and employ a significant number of employees. These subactivities are expected to create higher growth and employment rates from a rise in GDP (over 5%) that is based primarily on an increase in exports.

C24	**Production of metals**	Manufacture of basic iron, steel, and ferro-alloys; Manufacture of steel pipes and accessories; Manufacture of other products of primary steel processing, Manufacture of basic precious and other non-ferrous metals, **Casting of metals**
C25	**Manufacture of final metal products**	**Manufacture of metal constructions;** Manufacture of metal tanks, reservoirs and similar containers; Manufacture of steam generators, except central heating hot water boilers; Manufacture of weapons and ammunition; Forging, pressing, stamping, and roll-forming of metal, powder metallurgy; **Treatment and coating of metals, machining;** Manufacture of cutlery, tools, and general hardware; Manufacture of other fabricated metal products
C28	**Manufacture of machinery and equipment n.e.c.**	Manufacture of general-purpose machinery; Manufacture of other general-purpose machinery; **Manufacture of agricultural and forestry machinery**; Manufacture of metal forming machinery and machine tools; Manufacture of other special-purpose machinery
C29	**Manufacture of motor vehicles, trailers, and semi-trailers**	Manufacture of bodies (coachwork) for motor vehicles, manufacture of trailers and semi-trailers; Manufacture of motor vehicle parts and accessories
C30	**Manufacture of other transport equipment**	Building of ships and boats; Manufacture of railway locomotives and rolling stock; Manufacture of air and spacecraft and related machinery; Manufacture of military fighting vehicles; Manufacture of transport equipment n.e.c.

Source: Industrial Strategy of the Republic of Croatia for 2014–2020

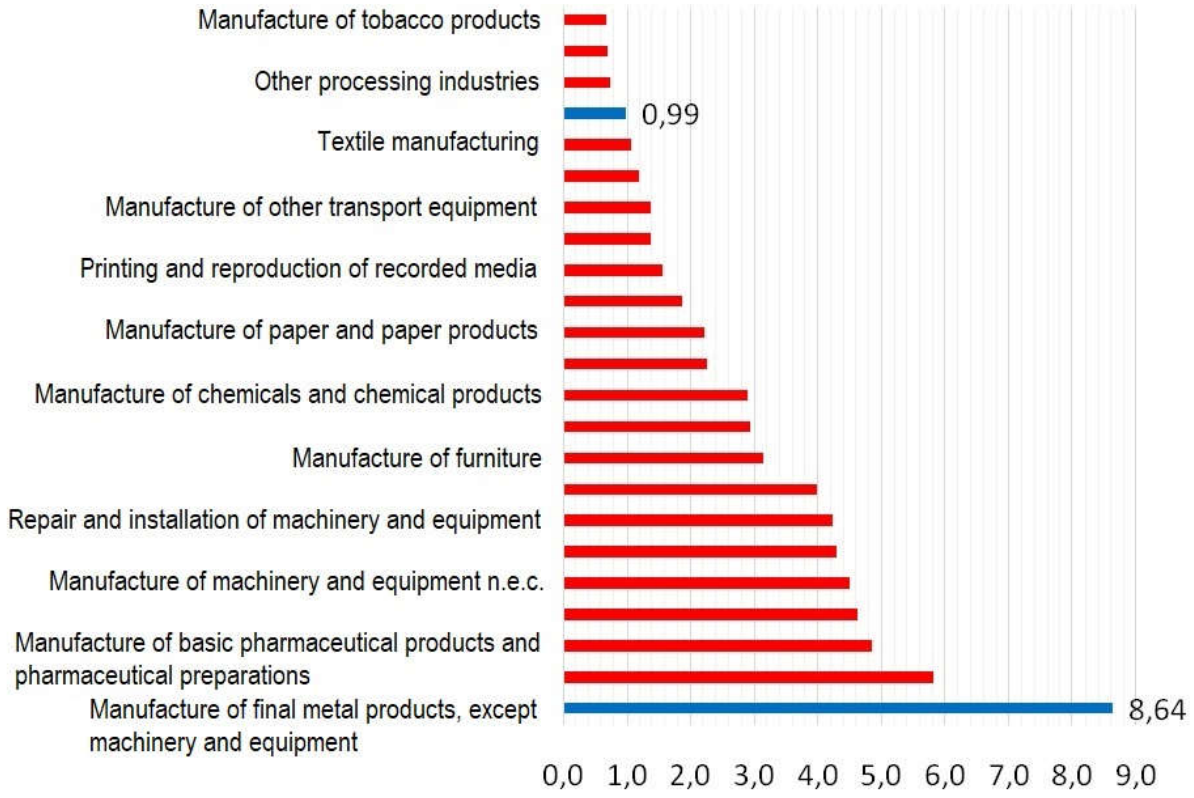
In the overall structure of the Gross Domestic Product (GDP) of the Republic of Croatia, manufacturing accounted for 21.2%. Manufacturing of food and beverages accounts for the largest share (24%) of the total revenue in the manufacturing industry, but this is followed closely by the set of manufacturing branches included in the Sector for Agriculture and Forestry and the wood-processing industry. After that, a 20% share goes to the metal-processing industry, which in addition to the manufacture of metals also includes the manufacture of fabricated metal products; the manufacture of machinery, motor vehicles, trailers, and other transport equipment; and other manufacturing.



Source https://www.hgk.hr/documents/republikahrvatska2016hrweb5824783267fa1.pdf

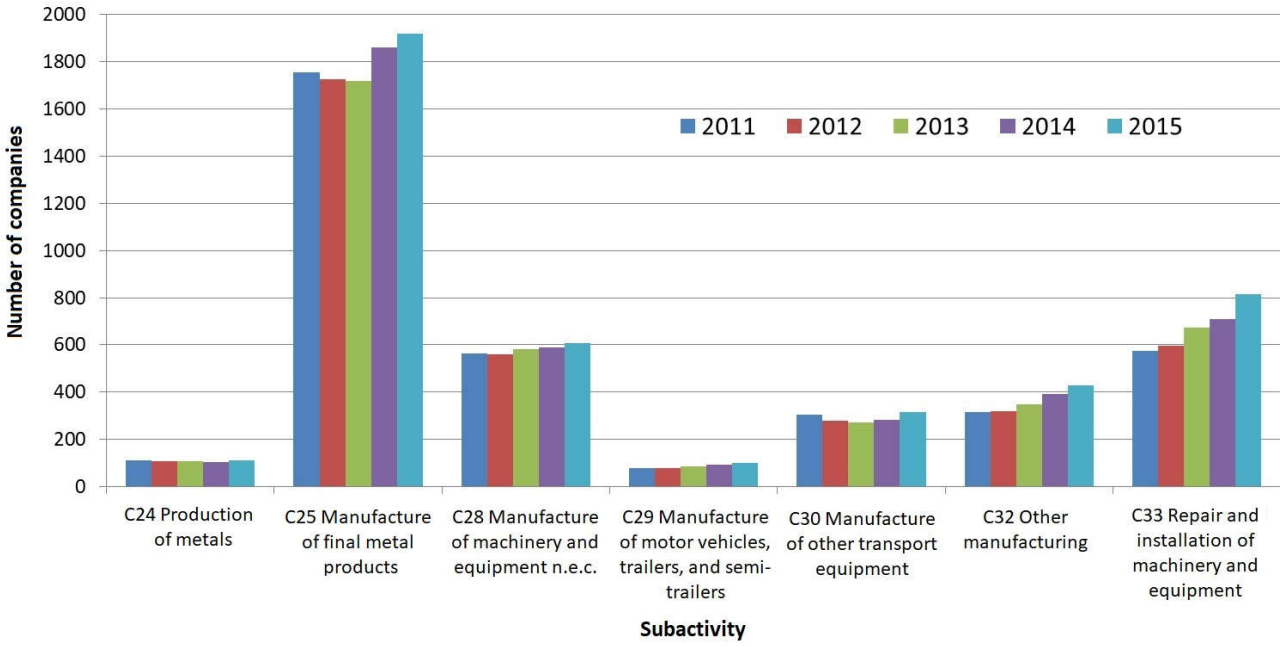
According to the data of the Croatian Bureau of Statistics and Financial Agency (FINA) and based on an analysis of the Sector for Financial Institutions, Business Information and Economic Analysis of the Croatian Chamber of Economy (HGK), for 2016, the last analysed year, in the structure of Croatian industrial production primary production of metal is only 0.99%, which is a result of the nonexistence of economically profitable locations of primary raw materials and market fluctuations of their price, but also the lack of contemporary production capacities. However, the valorisation and export component of finished metal products stand out with a considerable share of almost 8.64%

The graph below presents a breakdown of industrial production in the Republic of Croatia in 2016 (measured in terms of percentage):



Source: Croatian Bureau of Statistics

These data refer to 102 companies in subactivity C24.5 Production of metals, industry branch Casting of metals, with earnings of 109,339,226.00 kuna (c. €14,700,000) and 3,278 employees in 2016. The number of companies in industry branch C for the period 2011–2015 is shown in the following graph:



Source: FINA, Calculation: HGK

The financial indicators in the manufacturing branch Casting of metals (2 24.5) in the Republic of Croatia for 2016 are given below:

C 24.5/2016	MICRO	SMALL	MEDIUM	LARGE	TOTAL
No. of companies	31	11	6	3	51
Total income	36,283,244 [c.€4,889,925]	97,128,460 [c.€13,090,088]	501,570,077 [c.€67,597,045]	707,338,749 [c.€95,328,672]	1,342,320,530 [c.€180,905,731]
Profit in kunas during the period	760,520 [c.€102,495]	2,500,086 [c.€336,938]	18,437,426 [c.€2,484,828]	87,641,194 [c.€11,811,481]	109,339,226 [c.€14,735,744]

Source: FINA, Calculation: HGK

The basic characteristics of Croatian industry is stable quality and reliability of products in accordance with EU standards, available professional work force, support from scientific institutions, good manufacturing infrastructure and transport connectedness with the rest of the world.

In spite of the profession's recognition and significance, it is undervalued in terms of the level of the net monthly salary per employee in corporations (4,803.00–5,685.00 kn [c. €647–766]). The gross added value of the product is indicative, as well. Since the Croatian market is too small for significant growth in production, companies engaging in the observed activities direct their production capacities primarily towards the countries of the EU, which also means increasing the productivity level of the property and work force in order to keep up with foreign competition. It is possible to base competitiveness exclusively on contemporary technology, effective manufacturing processes, but also on a highly qualified work force. All of this requires investment in infrastructure and educational programs of study that should strive above all towards the acquisition of practical knowledge and skills while stressing development and the application of contemporary materials and technology, so that we can change the current status of the Republic of Croatia.

The Faculty of Metallurgy's educational, scientific-research, professional, and publishing activities, as well as the work of its professional-administrative services, are founded upon the following values: a personal approach to its students and associates, openness, transparency, responsibility, ethicality, communicativeness, collegiality, effectiveness, cooperation, interdisciplinary collaboration, the improvement of work based on analysis results, and readiness to solve problems and difficulties.

Visions of the personal development of individuals, which are an indispensable part of the entire system, directly contribute to the development of the Faculty of Metallurgy in the education of quality university-educated personnel in the technical sciences, specifically in the field of metallurgy. The proposed activities in the framework of the adopted strategic documents of the Faculty of Metallurgy have the goals of better positioning, recognition and visibility of the Faculty in European scientific and educational projects as well as promoting the reputation of the Faculty. The cherishing and development of ethics in educational, scientific, professional, and publishing activities, as well as the ethics of the engineering vocation and at the same time influence on public scientific and professional opinion on all questions of the metallurgical profession, is additionally reflected through the activities of the Association of Former Students and Friends of the Faculty of Metallurgy and other related associations.

Success in the promotion of all activities of work of the Faculty would be impossible without the constant activity of all the employees of the Faculty of Metallurgy in proposing and initiating implementation activities with the goal of improving their personal standard, valorisation, and satisfaction. ***The employees of the Faculty of Metallurgy are a growing intellectual capital, and by learning for the future and working together to gain influence, we will make sure that important things will truly happen.***

Assoc.Prof. Zdenka Zovko Brodarac, PhD
Dean of the Faculty of Metallurgy

1.3. The Historical Development of the Faculty of Metallurgy

The achievements of the development of the metallurgy profession and therefore, of the Faculty of Metallurgy, are important to observe from the historical aspect in order to gain insight into future developmental guidelines:

"History is not useful to us because we would read the past in it – but because we read the future."

Jean Baptiste Say

A short review of the development of the metallurgy profession is available in an excerpt from the Developmental Strategy of the Faculty of Metallurgy 2017–2021[3]:

"When we speak about the metallurgy profession, we cannot ignore the fact that it is the first profession that began to change the structure of nature and accelerated the transition from the period of barbarianism to the development of civilization. This is exactly why the civilized ages were named after the metals that started to be produced and were dominant in those periods. At the beginning of the eighteenth century, the mass production of steel made it possible for the industrial revolution to begin.

Metallurgy has existed on the territory of the Republic of Croatia for six thousand years. For the sake of comparison, we should point out that central Europe entered into the copper age two thousand years B.C., while a copper axe in the village of Rude, near Samobor, dates back four thousand years B.C. In the *Baden Culture* (3500–3000 B.C.), antimonic and arsenical bronze was produced, while in the *Vučedol Culture* (2200–2000 B.C.) true tin bronze was produced. In Europe, the production of iron began in the early *Hallstatt Culture* (from the 10th to the 5th century B.C., labelled as the *Early Iron Age*), and at that time on the territory of today's town of Sisak, Illyrian tribes began to produce iron materials. With the arrival of the Celts, this production rose to a higher level in the settlement of Segestica. In Roman times, Sisak (Siscia) and the broader surrounding region became one of the largest metallurgical centres in the then empire, with numerous mines and workshops for the making of weapons and tools. In the 15th and 16th centuries, the Counts of Zrin opened mines of silver, gold, copper, and other metals in the Banovina region, and later, on Zagreb's mount Medvednica, as well as in the Gorski Kotar region (in Lič and Čabar). In that period there were a considerable number of smelting works for lead and silver. After the Ottoman Turks pulled out of the region in the second half of the 18th century began a very intensive exploration of the minable riches of Petrova Gora and Banovina, which Maria Theresa initiated by decree in 1770. In the period from 1768 to 1788, the main push was for the exploration of copper ore, and from 1788 to 1832, the search for iron ore intensified. At the beginning of the 19th century in Banovina besides smelting works for copper and lead ores, the first stone blast furnaces were built for the production of pig iron.

[3] Development Strategy of the Faculty of Metallurgy 2017-2021, *A Word from the Dean*

Iron production in the industrial sense began in 1939 with the construction of the first modern blast furnace in Caprag (Sisak) with a steel shell. After the Second World War there was a sudden growth in metallurgical production. The most significant manufacturer was Metallurgical Combine Sisak (Metalurški kombinat Sisak), which specialized in the production of both welded and seamless pipes. After the Croatian Homeland War of the 1990s, Croatia experienced a drastic fall in metallurgical production, while neighbouring countries more or less maintained their metallurgical operations. It is important to mention that metal and metal processing production made up 33% of the GDP of the Republic of Croatia."

Full Prof. Ladislav Lazić, PhD
Dean of the Faculty of Metallurgy 1.10.2013–30.9.2017

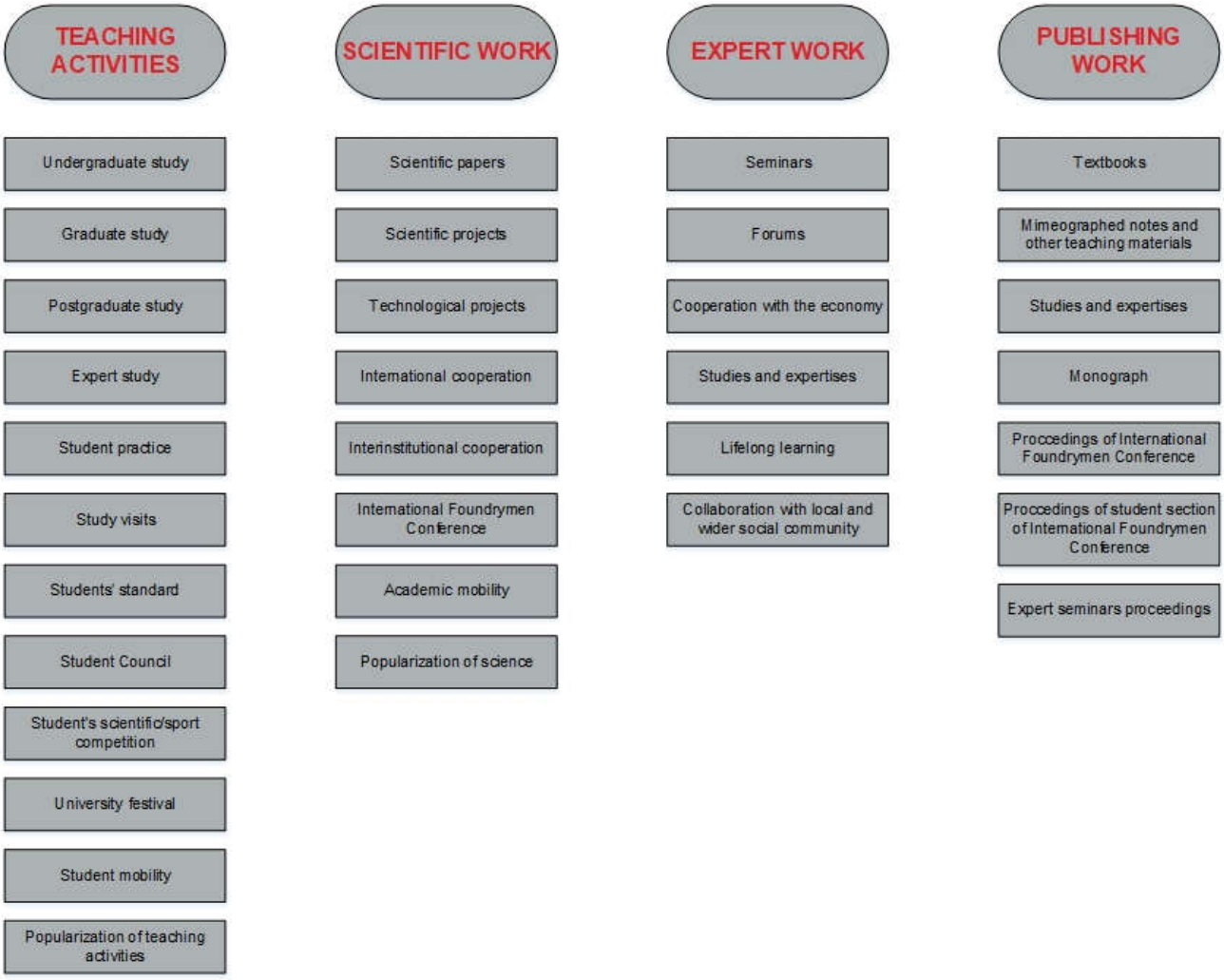
The economic development of the mid-20th century created the need for rapid education of experts and specialists in the Republic of Croatia in technical areas, including metallurgy. The first activities were started in the summer of 1958 with efforts regarding the foundation of the Technical higher education school, which had metallurgy and technical areas of expertise. However, this solution was abandoned, and instead of that the Faculty of Technology in Sisak was founded, containing the Department of Metallurgy and the Department of Oil Technology and Industry. Instruction at both mentioned departments of the Faculty of Technology started in Sisak with the academic year 1960/1961, when 89 students enrolled. The mother Faculty of Technology in Zagreb provided a great deal of support during the foundation and development of the said institution by participating in instruction directly, organizing and building laboratories, as well as further education of the teaching staff. In 1963, the Faculty of Technology in Zagreb went through a restructuring, after which the higher education instruction in Sisak was separated into two departments: the Department of Metallurgy and Chemical-technological oil department. In the late 1960s, there arose a problem with facilities, i.e. lack thereof, due to an increased number of students as a result of instruction in all three levels, which was resolved by awarding new facilities (around 620m2) of The Institute of Metallurgy within the company Željezara Sisak. The Faculty of Technology in Zagreb experienced another restructuring in 1974, when the existing departments in Sisak were abolished and the Faculty of Metallurgy transformed into a Basic organization of joint labour Metallurgy Engineering, as one of six such organizations with the Faculty of Technology. The primary activities of the Basic organization of joint labour Metallurgy Engineering consisted of scientific and educational activities from the field of metallurgical engineering and similar disciplines. Another restructuring, which occurred as a result of social changes with the goal of finding an organizational structure of connecting higher education in the field of metallurgy and scientific and research programs, followed in 1979, when the Basic organization of joint labour Metallurgy Engineering and the Institute of Metallurgy were joined into a Labour organization Institute of Metallurgy Sisak within a Complex organization of joint labour of the Metallurgy Combine of Željezara Sisak. This meant that the Labour organization Institute of Metallurgy Sisak consisted of two basic organizations of joint labour (Faculty of Metallurgy and Technical and Administrative Services), as well as a Labour community for general affairs. Due to this integration, the institution received an increased support in organizing and financing education, scientific and specialist projects. Thus, the Faculty of Metallurgy gained more qualified teaching and scientific staff, more laboratories at its disposal, procurement of new equipment was simplified, etc. The result of integrating the Institute of Metallurgy and the Basic organization of joint labour Metallurgy Engineering into the Labour organization Institute of Metallurgy Sisak was an increase in the number of specialist in staff who did not participate in instruction. Of the total number of 107 employees during the academic year 1979/1980, only 57 of them worked as teachers. The Scientific and Educational Committee of the Faculty of Metallurgy was founded on the 3rd of November 1978. Pursuant to the Act on Higher Education, on the 1st of February 1979, the Faculty

of Metallurgy became one of 56 independent members of the University of Zagreb. In 1979, the Faculty of Metallurgy had 14 PhDs, six of them in the field of metallurgy. Because the Scientific and Educational Committee of the Faculty of Metallurgy at that time still did not fulfil legal requirements which would enable selection to academic ranks and procedures for acquisition of the titles of MSc and PhD, in 1981 the University of Zagreb reached a decision on the foundation of a joint Scientific and Educational Committee of the Faculty of Metallurgy and the Mining-geological-petroleum engineering Faculty in Zagreb in view of conducting the said procedures. On the 14th of September 1987, a new Scientific and Educational Committee of the Faculty of Metallurgy was founded. Since then, the Faculty of Metallurgy fulfils all the prescribed requirements and conditions for the procedure of acquiring a PhD title and has the permission to implement the said procedure for the scientific field of metallurgy within the expertise of technical sciences, as well as the procedure of selection to scientific and research ranks in the same area of expertise and provides opinions on the procedures of selection to scientific and educational ranks in the same scientific area of expertise. In 1989, the Act on businesses started being implemented, after which the Complex organization of joint labour of the Metallurgy Combine of Željezara Sisak was transformed in a way that the Labour organization Institute of Metallurgy became Institute for Research and Development (IRI d.o.o.), and the Faculty of Metallurgy a sector of that business (1989-1991), at the same time remaining within the University of Zagreb. From late 1978 to 1991, the organization and management of the Faculty of Metallurgy took place at three structural levels: scientific, research-developmental and business. During the academic year 1990/1991, the Faculty of Metallurgy separated itself from the Complex organization of joint labour of the Metallurgy Combine of Željezara Sisak and on the 1st of June 1991 became an independent scientific and educational institution of the University of Zagreb for the following activities: Scientific and educational activities in the field of technical sciences (metallurgy); Scientific and research activities in the field of metallurgy, chemical engineering and other technical and technological areas relevant to the field of metallurgy; Auxiliary scientific and research activities. By becoming independent, after almost 31 years of conducting higher education instruction in the field of metallurgy in Sisak, and following numerous organizational changes, The Faculty of Metallurgy remained an independent constituent of the University of Zagreb in its own right. At that time, the Faculty of Metallurgy had 119 students, of which 61 in the first year of studies. In 1991, the internal organization of the Faculty of Metallurgy was changed in a way that operations were organized into Department of Materials and Department of Metallurgy. The main managing body was an expert committee consisting of the Dean, Vice-Dean, Secretary and Chiefs of Departments. Furthermore, the Scientific and Educational Committee of the Faculty of Metallurgy was established, in which the Dean had the presiding role. During the development of the Department of Metallurgy, Metallurgy engineering, i.e. Faculty of Metallurgy, the number of departments and chairs changed a number of times (consequently, their names changed as well) in line with the number of courses, teachers and associates. Based on the Regulations on determining scientific fields and areas of the Ministry of Science and Technology of the Republic of Croatia and the Statute of the Faculty of Metallurgy dating from the 28th of February 1997, from the 1st of October the Faculty of Metallurgy consists of three departments: Department of Process Metallurgy, Department of Mechanical Metallurgy and Department of Physical Metallurgy. Today teaching and research of the Faculty is conducted at the same place (in two buildings at the same location). While the Faculty of Metallurgy functioned within the Institute of Metallurgy (1979-1989), i.e. Institute for Research and Development of Željezara Sisak (1989-1991), the Faculty conducted its activities at the same location and in the same facilities.

1.4. The Activities and Organization of the Faculty of Metallurgy

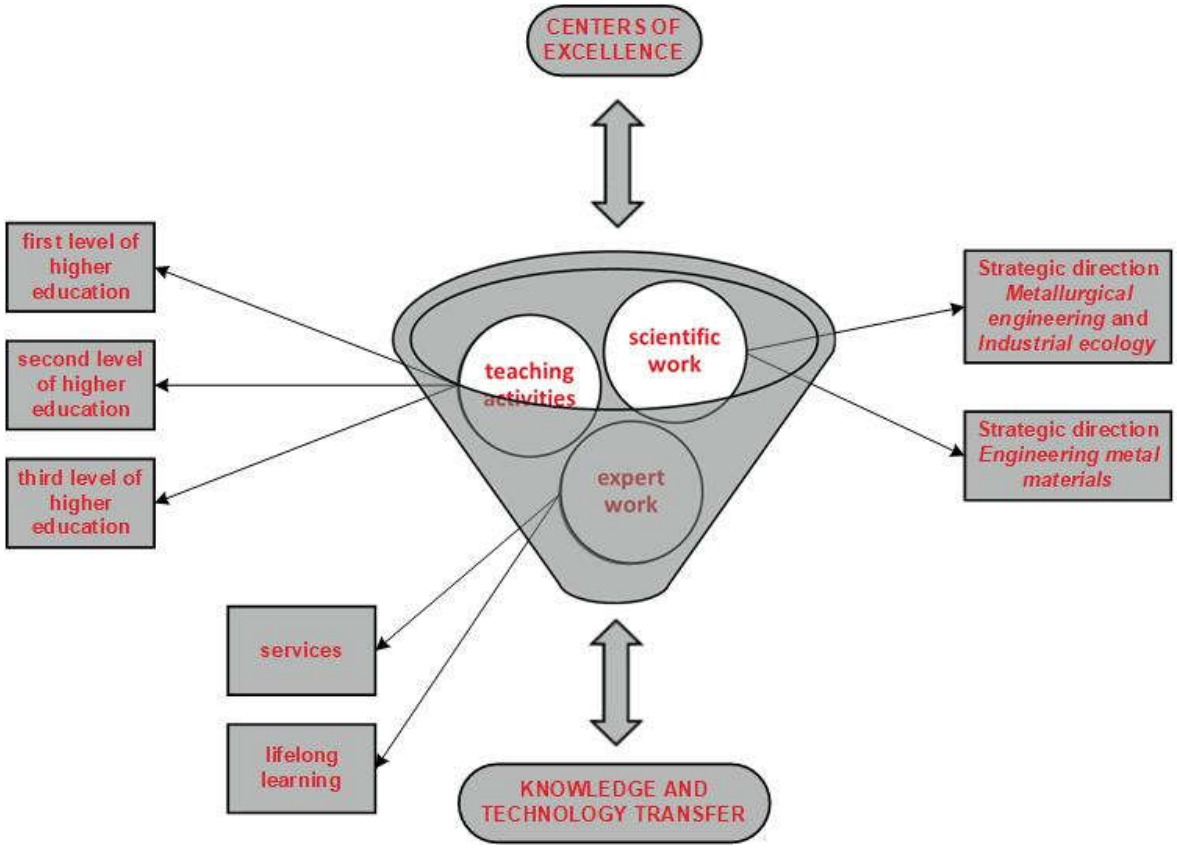
Even today, the Faculty of Metallurgy is the only research and educational institution in the Republic of Croatia that offers higher education, at the undergraduate, graduate, postgraduate, and vocational level, in the fields of metallurgy and industrial ecology, while systematically executing a program of lifelong education and specialization through the organization of conferences, seminars, workshops, public discussions and lectures.

The Faculty of Metallurgy operates as a central point for scientific research and publishing activities in the area of technical sciences, field of metallurgy, and offers scientific and professional support to economic entities in the metallurgical, metal-processing, shipbuilding, and foundry industries in the Republic of Croatia.



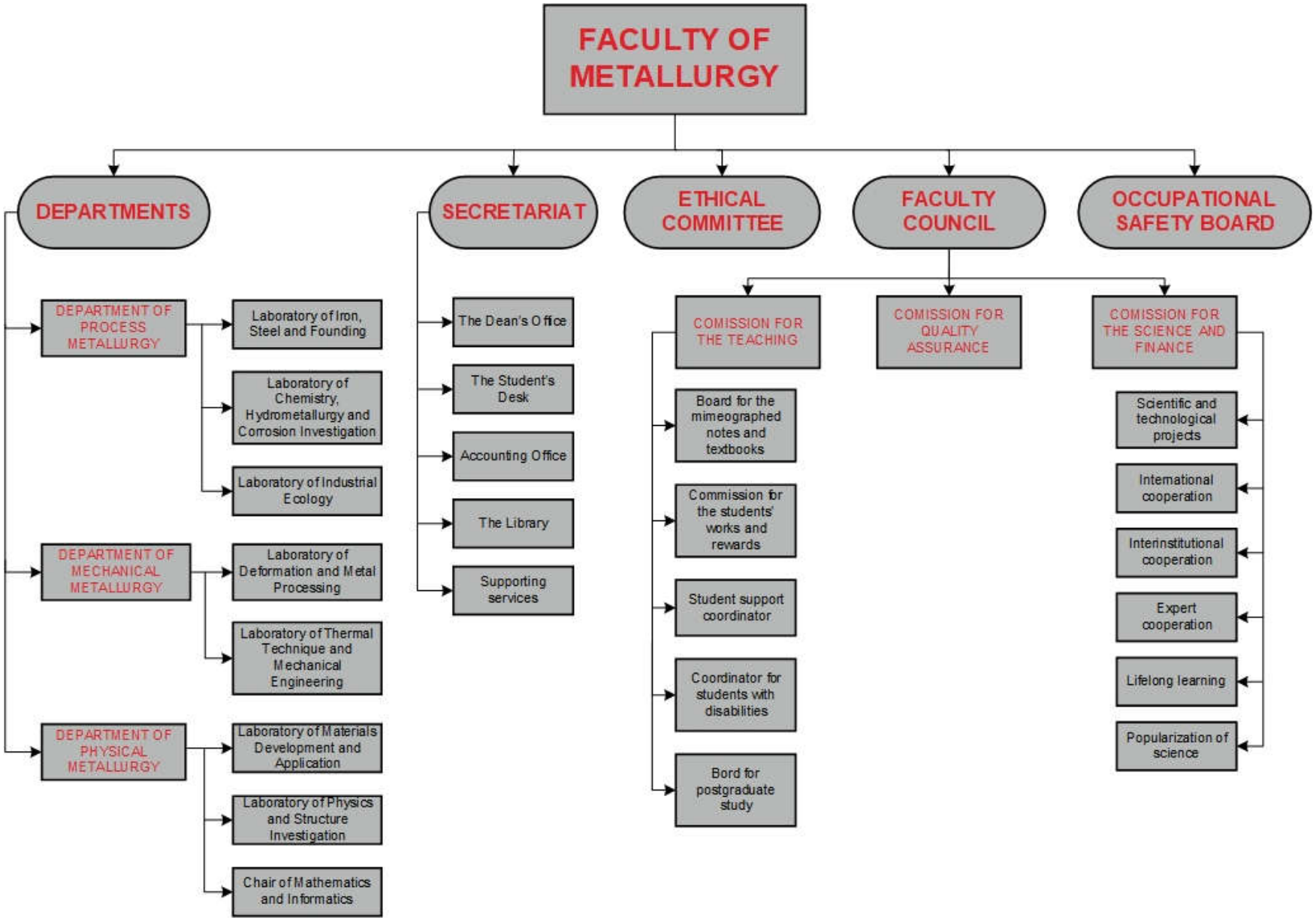
Scheme of the activities of the Faculty of Metallurgy

Each of the activities of the Faculty of Metallurgy – educational, scientific research, professional, publishing – has the goal of the transfer of knowledge and technology, and centres of excellence have the task of connecting threads of transfer as a whole on the national level. The Statute of the Faculty of Metallurgy foresees the possibility of founding centres for applied and developmental research and various forms of knowledge transfer in the fields of metallurgy and other related branches. Currently, the Faculty is in the process of founding a Centre for Founding – SIMET through European funds. In addition, it participates in the work of the following centres of excellence: KIC Raw Materials, QuantiXLie Center of Excellence for the Theory of Quantum and Complex Systems and LIE Algebra Representation, Nano-technology: Investigation, Innovation, Investment, Industry / Nano4IN, VIRTULAB – Integrated laboratory for primary and secondary raw materials, and the Croatian Centre for Advanced Materials and Nanotechnology (C2AMN).



Scheme of the transfer of knowledge and technology

Since its beginnings, the structure of the Faculty of Metallurgy has continually adapted to developments in the profession, the needs of the economy, and the development of the system of higher education. According to the Statute of the Faculty of Metallurgy, the basic structural units of the Faculty are three departments, which consist of associated laboratories and one chair. The departments are in charge of educational, scientific research, and professional work, while the laboratories are used for practical training in the teaching process and for scientific research.



Scheme of the structure of the Faculty of Metallurgy

Pursuant to the Statute of the Faculty of Metallurgy, the Faculty is governed by the Dean and the Faculty Council.

The **Dean** of the Faculty is an employee with special authorities elected in a manner prescribed by the Scientific Activities and Higher Education Act, the Statute of the University of Zagreb and the Statute of the Faculty. The Dean governs the Faculty and is its head and leader. The Dean is responsible to the Faculty Council and to the Rector of the University of Zagreb. The dean is aided in his work by the **vice-dean for education** and the **vice-dean for science and finances**, who, together with the **department chiefs**, the **Faculty secretary**, and the **Head of accounting**, comprise the **Dean's Collegium**, which functions as a board that helps and advises the dean.

The **Faculty Council** is an expert council of the Faculty consisting of all employees holding research-and-teaching positions, one representative of the employees holding teaching positions, one representative of the employees in non-tenure-track positions, one representative of other employees, and representatives of students, who make up 15% of the entire number of members of the Faculty Council.

The Faculty Council nominates three foundational commissions – the **Commission for Teaching**, the **Commission for Science and Finances**, and the **Commission for Quality Management** as well as specific commissions and committees: the Ethics Committee, the Postgraduate Studies Commission, the Commission for Student Works and Awards, the Board for Textbooks and Course Notes, the Board for Safety at Work.

With its services, the **Secretariat** provides professional and administrative aid to enable the Faculty to function smoothly and in an organized fashion.

1.5. Mission, Vision, and Values of the Faculty of Metallurgy

By the *Development Strategy of the Faculty of Metallurgy 2017-2021* mission, vision and values of the Faculty of Metallurgy have been defined, as well as three main postulates of the Strategy:

MISSION

The Faculty of Metallurgy of the University of Zagreb is the only scientific and educational institution in the Republic of Croatia that, respecting a culture of quality, offers higher education in the fields of metallurgy and industrial ecology at the undergraduate, graduate, postgraduate, and vocational level, while systematically executing a program of lifelong learning and specialization through the organization of conferences, seminars, workshops, public discussions, and lectures, in addition to offering support to economic entities from the metallurgical, metal-processing, shipbuilding, and foundry industries. The Faculty bases its activities on high academic and ethical values and on responsibly contributing to society, aware of its strengths and weaknesses, but also ready to find solutions to difficulties.

VISION

The Faculty of Metallurgy of the University of Zagreb will strengthen its recognizability as a place of constant advancement and improvement of studying and acquiring knowledge and competences in the fields of metallurgy and industrial ecology. Students who have completed study programs at the Faculty will be sought after as broadly educated experts competent at effectively solving problems from their scope of work and knowledge. Using its location in the industrial town of Sisak and connection with economic entities from the metallurgical, metal-processing, shipbuilding and foundry industries, the Faculty will strengthen its influence in the region and at the national level. The Faculty will continue its institutional care for the development of scientific research and professional work on domestic and international projects for the development of innovative technological processes, products, and materials, as well as the promotion of existing technological processes, products, and materials. The Faculty will be publicly recognized as a responsible institution that contributes to society by raising the level of education and expertise of engineers within the technical field, to the development of economic branches related to metallurgy, materials, and the protection of the environment, as well as work in accordance with academic ethical principles. The Faculty of Metallurgy will attain a position of an integrative and competitive scientific and educational institution in the European higher-education and research area.

VALUES

The educational, scientific research, professional, and publishing activities, as well as professional-administrative services, of the Faculty of Metallurgy are founded upon the following values:

- personal approach to students
- openness
- transparency
- responsibility
- ethicality
- communicativeness
- collegiality
- effectiveness
- cooperativeness
- interdisciplinary cooperation
- promotion of work based upon the analysis of results
- readiness for the solution of difficulties

BASIC POSTULATES OF THE STRATEGY

CONTINUITY

continuous questioning, suggestion, induction, verification

SYNERGY

common effort, strength, deliberation, action

STARTING POINT

what the Faculty of Metallurgy means to me – to me as a student, to me as a teacher, to me as a professional employee, to me as an alumni, to me as a partner?

1.6. Study Programs at the Faculty of Metallurgy

The Faculty of Metallurgy is accredited to conduct the undergraduate and graduate university study program in *Metallurgy*, the undergraduate university vocational part-time study program in *Founding*, the postgraduate university study program in *Metallurgy* and postgraduate doctoral study program in *Mechanical Engineering, Naval Architecture, Aeronautical Engineering, Metallurgical Engineering.* The general goals of all study programs are in accordance with the mission and strategic goals of the higher education institution as described in the Development Strategy of the Faculty of Metallurgy for the period 2011-2016 (pp. 11–16) and the Development Strategy of the Faculty of Metallurgy 2017–2021 (pp. 16-18).

The university undergraduate study program in *Metallurgy* has been adapted to the Bologna system since the 2005/2006 academic year (accreditation), and since the 2012/2013 academic year, it has been offered in two orientations: *Metallurgical Engineering* and *Industrial Ecology* (accreditation). A revision of this program was carried out during the 2016/2017 academic year (accreditation) and is performed since 2017/2018 academic year. The study program is six (6) semesters long, has 180 ECTS credits, and upon completion the student earns the academic title Bachelor in Metallurgy (univ.bacc.ing.met.), with a specified orientation.

The university graduate study program in *Metallurgy* has been adapted to the Bologna system since the 2005/2006 academic year (accreditation), and since the 2012/2013 academic year, three elective groups have been conducted in the 4th semester: *Process Metallurgy and Metal Casting*, *Mechanical Metallurgy* and *Engineering Metal Materials* (accreditation). A revision of this program was carried out in the 2016/2017 academic year, after which the elective groups were discontinued and two subject oriented fields were introduced: *Metallurgical Engineering* and *Industrial Ecology* (accreditation). Revised program is performed since 2017/2018 academic year. The program is four (4) semesters long, it has 120 ECTS credits, and upon completion the student earns the academic title Master in Metallurgy (mag.ing.met.).

The university vocational part-time study program in *Founding* has been offered since the 2011/2012 academic year (accreditation). It is five (5) semesters long, and has 150 ECTS credits. Upon completion of the program, the student earns the academic title of Associate of Founding (pristup.ljev.).

The Faculty of Metallurgy has offered the university postgraduate (doctoral) study programme in *Metallurgy* since the 2007/2008 academic year (accreditation). The programme is six (6) semesters long and has 180 ECTS credits. Upon completion of the program the student earns the academic degree of PhD in Metallurgy. The accreditation for conducting this study program expires at the end of the 2020/2021 academic year.

Since the 2015/2016 academic year, the Faculty of Metallurgy, together with the Faculty of Mechanical Engineering and Naval Architecture of the University of Zagreb, has conducted a joint university postgraduate (doctoral) program in *Mechanical Engineering, Naval Architecture, Aeronautical Engineering, Metallurgical Engineering* (accreditation) and the Faculty is present with orientation *Metallurgical Engineering*. The program is six (6) semesters long and has 180 ECTS credits. Upon completion student earns the academic degree of PhD in Metallurgy.

1.7. The Process of Writing the Self-Evaluation Report of the Faculty of Metallurgy

The Faculty of Metallurgy has by now undergone two processes of external independent periodic assessments of quality assurance and one process of reaccreditation. On the basis of the results of those processes, the Faculty of Metallurgy began its preparations for the current process of reaccreditation which is preceded by the writing of this Self-Evaluation Report.[4] The process of writing this Self-Evaluation Report is also accessible on the website of the Faculty of Metallurgy.

Although discontented with how the second process of external independent periodic assessment of quality assurance was carried out, the Faculty of Metallurgy accepted the recommendation from the *Final Report on the results of external independent periodic assessment of the system of quality assurance at the Faculty of Metallurgy of the University of Zageb* and immediately began preparations for the upcoming reaccreditation.

In that sense, the Commission for Quality Management presented the results of the processes of external assessment and reaccreditation to the members of the Faculty Council during its session on July 17th, 2015 and gave suggestions for further action. In particular, the development and improvements in the application of ESG standards at the Faculty of Metallurgy from 2010 to 2015 were presented. On the basis of all of this, at the same session, the Faculty Council passed the *Decision on the plan of activities in preparation for the process of reaccreditation of the Faculty of Metallurgy* in which two areas were pointed out as those which we especially need to work on and which require long-term preparations and realizations: study programs (revision of existing programs, the establishment of new programs) and documents in the area of the system of quality assurance (rulebook, handbook, strategy). On the basis of the said Decision, working groups were nominated for each area.

One year later, in the session of the Faculty Council on July 13th, 2016, the Commission for Quality Management presented to the members of the Faculty Council what progress had been made in preparing for the reaccreditation process.

After the completion of the activities foreseen in the plan from July 2015, in March 2017 the dean proclaimed the *Decision on the Appointment of Working Groups for the Assessment of Conditions for the Continuation of Activities and Performance of Study Programs of the Faculty of Metallurgy* for the purpose of preparing documentation for the reaccreditation process of the Faculty of Metallurgy. Included in the working groups were all of the employees of the Faculty, except the cleaning staff, and their goal was to assess the current state in terms of the Standards and guidelines for quality assurance in the European Higher Education Area (ESG) and the Standards for the quality assessment of universities and constituent entities universities in the process of reaccreditation of higher education institutions. This work was completed in June 2017, and its results served as the basis for the writing of this Self-Evaluation Report.

[4] In section 1.2 of this Self-Evaluation Report one can read a detailed description of the above-mentioned processes, along with their results, the recommendation, and the application of the recommendation.

Although the Faculty of Metallurgy expressed its readiness to participate in a trial implementation of reaccreditation and even applied for the same, it was placed in the regular process of reaccreditation according to the *Plan of reaccreditation of HEIs in 2018* of June 20th, 2017. Immediately upon receipt of this decision, all employees of the Faculty of Metallurgy were notified about the official beginning of the process of reaccreditation of the Faculty, and on November 2nd, 2017, the dean proclaimed the *Decision on the Nomination of Working Groups for the compilation of the Self-Evaluation Report of the Faculty of Metallurgy as part of the reaccreditation of the Faculty*. All employees of the Faculty of Metallurgy were nominated to the working groups, except cleaning staff, and one or two external associates (eminent professors and experts and alumni of the Faculty of Metallurgy) were assigned to each working group.

President of the Commission for Quality Management of the Faculty of Metallurgy Lana Vanić, Master in Law, was appointed as a coordinator of all activities connected with the writing of the Self-Evaluation Report.

In her *Decision on the nomination of individuals responsible for entering data and work on the Mozvag system* of January 18th, 2018, the dean determined which people would be in charge of the segment of the Analytic Supplement to Self-Evaluation Report: Assoc.Prof. Robert Pezer, PhD (head), Assoc.Prof. Natalija Dolić, PhD and Assoc.Prof. Ljerka Slokar, PhD.

The coordinator of all activities in connection with the composition of the Self-Evaluation Report drew up the *Working plan for the Self-Evaluation*, which includes all segments of work on the said document: consultations between the coordinator and the dean, preliminary discussions with the heads of the working teams, the work of the working groups on the text, proofs and appendices, setting up the Mozvag system and the training of those nominated for work on the system, review of the text by the dean and the coordinator, delivery of the text to external associates, ratification of the Self-Evaluation Report by the Faculty Council, and translation of the text into English.

During the preparation of the Self-Evaluation Report, the then administration of the Faculty (the dean, the vice-deans, and the president of the Commission for Quality Management) participated on February 20th, 2017 in the seminar ''Implementing European Standards and Guidelines for Quality Assurance (ESG) at Croatian Higher Education Institutions'', while part of the current administration of the Faculty (the dean, the vice-dean for science and finances, and the president of the Commission for Quality Management) participated on October 24th, 2017 in a workshop for compiling self-evaluations. The person responsible for working on the Mozvag system took part in a workshop on the reconstructed system of Mozvag for the new cycle of reaccreditation of HEIs on December 17th, 2017, and the Head of the Library participated in workshops for administrators of the Croatian scientific bibliography CROSBI and administrators of databases of project activities in the system of science and higher education on January 24th, 2018.

When writing the Self-Evaluation Report, the compilers used data from various databases – ISVU, CROSBI, internal databases of the Faculty of Metallurgy, as well as the Statute, rulebooks, advisories, and decisions of the Faculty of Metallurgy. Finally, it should be stressed that recommendations from earlier assessment processes were taken into account.

The Self-Evaluation Report of the Faculty of Metallurgy was accepted by the Faculty Council in its 8th extraordinary session on April 11th, 2018, and that it contains 95 pages as well as Analytic Supplement to Self-Evaluation Report and proofs.

2. SELF-EVALUATION REPORT

I.
Internal Quality Assurance and the Social Role of the Higher Education Institution

IMPORTANT→CLEAR→FOUNDED→APPLICABLE→VERIFIABLE

The Faculty has to be managed in keeping with the accepted strategic and legal documents and with the help of an appropriate organisational structure for following, assuring, and improving the quality of education as well as scientific and professional work.

weaknesses ☒ threats

- inadequate personnel education / certification
- failure to construe the quality system as an important component
- resources
- the Deming Cycle (**P**lan**D**o**C**heck**A**ct cycle)

strengths ☑ possibilities

- initiative
- enthusiasm

1.1. The higher education institution has established a functional system of internal quality assurance

The internal quality assurance system encompasses and evaluates the overall structure and all the activities of a higher education institution (study programs, teaching process, student support, support intended for students from underrepresented and vulnerable groups, resources for learning, scientific/artistic activity, professional activity, etc.), and corroborates the above-mentioned facts with documents.
The internal quality assurance system actively includes all the participants of the higher education institution (students and external participants – employers, alumnus, representatives of trade and professional associations, organizations of civil society / associations and internal stakeholders).
The institution of higher education has accepted a quality assurance policy, which is part of the strategic management of the higher education institution and is realized through the implementation of a strategy, including the strategy of scientific-research work for a period of at least five years.
The implementation of the strategy encompasses SWOT analyses and similar goals, strategic goals, goals from program contracts (where applicable), an operational plan, defined responsibility for implementation, follow-up mechanisms, and a report on its realization. The stakeholders recognize the strategy as a useful tool for the advancement of the higher education institution.
The higher education institution systematically collects and analyses the data on its processes, resources, and results and uses them for efficient management, the advancement of all its activities, and further development.
The higher education institution uses different methods of collecting information on quality (student opinion polls relating to teaching, opinion polls on satisfaction with the study program, external collaborator assessment, employers' and/or external collaborators' feedback, as well as feedback from graduate students, etc.).
The higher education institution is dedicated to the development and implementation of policies of management of its human resources (managerial, scientific research, educational-artistic, administrative, professional, and technical) in keeping with the principles and standards of the profession.

The internal system of quality assurance at the Faculty of Metallurgy is defined by the Quality Policy, the Rulebook on the Quality Assurance System, the Quality Assurance Manual and the Development Strategy of the Faculty of Metallurgy 2017-2021 (up to that point, Development Strategy of the Faculty of Metallurgy for the period 2011-2016 and the Scientific Research Strategy of the Faculty of Metallurgy for the period 2013-2016). The process of quality assurance and advancement is integrated in the everyday teaching, scientific, and professional activity of the Faculty of Metallurgy. In this way, quality management is based on self-evaluation, student opinion polls, and internal and external evaluations. The adopted quality policy respects the following guidelines and principles: the basic purpose of quality assurance and advancement is the advancement of teaching, scientific, professional, and administrative work; the mission has been laid out, but also the vision, values, and strategic goals and the way of their realisation; the quality assurance system is based on the appropriate Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG standards); the establishment of procedures of external judgments and evaluations; putting permanent efforts into the improvement of teaching, scientific research, professional work, and administrative work and knowledge transfer; the promotion of intensive cooperation with internal and external stakeholders; and the respect of academic and ethical values.

The quality assurance system at the Faculty of Metallurgy, introduced in 2008, with its systematic upgrading, development, and improvement, has created a platform for the continuous improvement of all segments of the system, especially teaching plans and programs in keeping with the requirements of economy and the community relating to the introduction of specialist and interdisciplinary programs and programs of lifelong learning and mobility. The strategic determinant is that the Faculty, through its documents and educational, scientific research, and

professional activities, adopts and continually develops the defined standards and achieves the highest quality standards to the satisfaction of all the stakeholders in the system of science and higher education.

At the Faculty of Metallurgy, the activities relating to quality assurance and advancement are directly conducted by the permanent Commision for Quality Management whose members are employees of the Faculty of Metallurgy from the ranks of teachers and administrative staff, as well as an external stakeholder and a student.

The inclusion of external stakeholders in the work and development of the Faculty is a continuous process visible in their participation and the teaching and professional work segment of the work of the Faculty of Metallurgy. The Faculty's alumni have a special role which is visible through two segments – alumnus in the teaching process and alumnus in the scientific research and professional work. The alumnus in the teaching process regularly and actively participate in the revision of teaching plans and programs, in the execution of the teaching process (professional internship, grade-related, and other work), and in the promotion of study programs. In their scientific research and professional work, alumnus give their contribution as professionals, doing experimental parts of grade-related and other works, external collaborators in the process of analysing innovative technological solutions, participants and co-organizers of activities relating to lifelong education. The role of employers is reflected in the support and implementation of the aforementioned activities, and for that purpose, the Faculty of Metallurgy signs cooperation contracts or agreements with them. Scientists at the Faculty of Metallurgy participate in the work of several competitiveness clusters, professional associations in accordance with their focus of interest, with associations from the foundry industry having a more important role (Društvo livarjev Slovenije, Foundry Planet, World Foundry Organization). The organisations of civil society participate in the promotion of the student standard of living and student mobility.

The Faculty of Metallurgy has an accepted Quality Policy which is a part of the strategic management of the higher education institution, incorporated in strategic documents. The guidelines and principles of this Policy are founded on the doctrine of behaviour universally accepted by the administration and all the employees and participants of the Faculty of Metallurgy, and for the realization of the Policy, the Faculty has formal mechanisms of continuous follow-up and adjustment. The quality policy is the basic framework for the determination of a strategy of quality and quality goals at the Faculty of Metallurgy that all the employees and participants of the Faculty are acquainted with, a strategy which is continuously revised, adjusted and improved if needed. By accepting the fact that the Faculty has a modest staffing capacity and by the rational involvement of its staff, the Faculty of Metallurgy has introduced an integrated system of quality assurance. The basic feature of this system is that the founding documents of the Faculty are connected in a logical sequence, so that, through documents and activities (teaching, scientific research, professional, publishing), one may adopt and continually develop standards and proper mechanisms for the purpose of acquiring the highest quality standards to the satisfaction of all the participants in higher education. In light of all these facts, the Faculty of Metallurgy has approached a Development Strategy by connecting it with the founding documents of the institution and its quality assurance systems. This connection is reflected in the way that the Statute, being the primary founding act, defines the activities of the institution, the Development Strategy defines the goals of their realization, the Rulebook on the Quality Assurance System closely defines the ways of realization, while the Quality Assurance Manual speaks about ways of critically examining the effectiveness of goal realization.

On the basis of the adopted mechanisms, an internal evaluation is carried out that focuses on the effectiveness of the institution's system of quality assurance for the purpose of continuous improvement of the system. The internal evaluation also includes the evaluation of the strategic plan, the mission and vision, the quality policy, and other strategic documents. The realisation of the Strategy is verified by means of the Quality Assurance Manual. The Quality Assurance Manual was devised in order to define the activities and procedures through which the quality of higher education can be improved and assured, in other words, to keep track of the realization of the defined Strategy. By means of this Manual, one ensures the continuous follow-up of various indicators of quality and the creation of measures relating to improvement and advancement. The quality manual connects accumulated experience and activity on the improvement of quality with ESG standards in an acceptable whole, by presenting the necessary terms, standards, procedures, plans, and activities to the wider professional public, and by serving as a reminder, instruction, and aid to all the stakeholders in the higher education system in their effort to build and improve the quality assurance system and to promote a culture of quality. The internal evaluation of the quality assurance system is a systematic procedure by which it is determined whether the activities and their results comprised in the quality assurance system are effective and whether they meet the requirements of national and ESG standards. It also assesses contributions to the continuous improvement of quality culture and determines the level of development and effectiveness of the quality assurance system.

The Faculty of Metallurgy consistently gathers and analyses data on processes, resources, and results by carrying out the procedure of internal evaluation. Upon the completion of internal evaluation, a proposal of improvement measures is adopted, and a Report on the Introduction of Improvement Measures to the Quality Assurance System is submitted. Apart from internal evaluation, a quality preparation of this reaccreditation was also made on the basis of results from past external independent periodic evaluations of the quality assurance system. In 2010 (AZVO [Agency for Science and Higher Education] report, December 2010 / AZVO final report, November 2011) it was suggested that the Agency for Science and Higher Education to conduct after 18 months a renewed external independent periodic evaluation of the quality assurance system of the Faculty of Metallurgy of the University of Zagreb. In the year 2014 (AZVO report, June 2014 / AZVO final report, July 2015) the Commission suggests that the Agency for Science and Higher Education conduct the procedure of reaccreditation of the Faculty of Metallurgy of the University of Zagreb in the second cycle of reaccreditation in accordance with the plan that will be adopted by the Accreditation Council. On the basis of the results of past external independent periodic evaluations of the internal quality assurance system, preparations were conducted for this reaccreditation procedure. Preparations for the reaccreditation procedure consisted of a detailed analysis and revision of the undergraduate study program, a detailed analysis and revision of the graduate study program, the revival of the professional study program and consideration of new university or professional study programs, a revision of the Quality Manual, the enactment of a new Strategy of the Faculty of Metallurgy, the appointment of task groups to compose the Self-evaluation, etc. The reaccreditation of the Faculty of Metallurgy was conducted in 2011 (AZVO final report, July 2012) with the issuing of the MZOS (Ministry of Science, Education and Sport) certificate of fulfilment of necessary conditions for the provision of higher education and scientific activity.

The higher education institution uses various methods of gathering information about the quality of all areas of its work: student opinion polls on teachers, student opinion polls on satisfaction with study programs, opinion polls of former students and employers, opinion-polls of participants in the activity of lifelong education, data from ISVU systems and the systems of the state secondary school graduation exam (i.e., Matura). The data gathered by these methods are publicly presented either orally at the meetings of the Faculty council or in written reports.

In accordance with the accepted Strategy, the strengthening of the Faculty of Metallurgy is encouraged in terms of the teachers' capability in research-and-teaching, teaching, and collaborative (i.e., teaching assistants and post-docs) positions, so various activities are carried out, such as the planning of teaching potentials, the gathering of data on teaching staff and teaching workload, the planning of employment of new teachers, and the promotion of existing teachers. In accordance with the Statute of the Faculty of Metallurgy, the scientific research work has two strategic directions: ''Metallurgical Engineering'' and ''Industrial Ecology,'' which belong to the activity *of Advanced Production Technologies*, verified across Europe, while within the framework of the European activity *New Advanced Materials*, the Faculty of Metallurgy can competently be included through the strategic direction ''Engineering Metal Materials.'' The Faculty of Metallurgy, as the only state institution that educates experts in the field of metallurgy, as one of its most important goals, focuses on the professional improvement of its employees. In accordance with the adopted Strategy, the Faculty of Metallurgy carefully monitors the number of its employees (teachers, collaborators, and administrative-professional staff), the establishment of an optimal number of teachers in relation to the number of students, and the uniform representation of teachers according to their academic rank, as well as the quality of the personal standard of living of employees and students.

1.2. The higher education institution applies the quality improvement recommendations from previously conducted evaluations

The higher education institution has analysed the suggestions for improvement and carries out activities based on previously conducted evaluations (internal and external).
The higher education institution analyses its improvements, on the basis of which it plans its further development.

Up until now, two external independent periodic reviews of the quality assurance system and one reaccreditation have been conducted at the Faculty of Metallurgy. The first external independent periodic evaluation of quality assurance was conducted in 2010 (AZVO [Agency for Science and Higher Education] report, December 2010 / AZVO final report, November 2011), and in its final report, it was suggested that the Agency for Science and Higher Education conduct, after 18 months, a renewed external independent periodic evaluation of the quality assurance system of the Faculty of Metallurgy. After that, an independent periodic evaluation of quality assurance was carried out in 2014 (AZVO report, June 2014 / AZVO final report, July 2015), whereby the Commission for External Evaluation of the Quality Assurance System determined that, during the follow-up period, the Faculty of Metallurgy had carried out activities by means of which it partially improved the functionality and effectiveness of the already existing system of quality assurance. In its Final Report, the above-mentioned Commission also submitted recommendations for the forthcoming period in order to boost the functioning of the quality assurance mechanism and the continuous improvement of the system, thus improving the overall quality of all activities. Moreover, the Commission that conducted the evaluation suggested to the Agency for Science and Higher Education to carry out the procedure of reaccreditation of the Faculty of Metallurgy. During its meeting held on July 17th, 2015, the Council of the Faculty of Metallurgy rendered the Decision on the Plan of Activities in Preparation for the Reaccreditation Procedure.

Recommendations (suggestions for improvement) from past evaluations:

External independent periodic evaluation

a) The recommendations from the first external independent evaluation within the framework ESG 1.1. "Quality Policy and Procedures for Quality Assurance" (for the follow-up phase) encompassed the following: the procedure for internal evaluation should be carried out in accordance with the procedure stated in the Manual, or if necessary, one should revise the procedure in the manual and conduct the internal evaluation in accordance with the above-mentioned procedure, define the composition of the Commission for Internal Evaluation, which would be independent of the Quality Management Commission, and define their tasks and responsibilities, mandate, and criteria for election, define in the Manual the ways of monitoring the quality of scientific research and professional work, define in the Manual the indicators of quality and remedial measures, entrust the compatibility of the documents of the system, and if necessary, revise the facts written therein that have not been practically implemented, ensure the training relating to the quality assurance system (*SOK*) for the members of Commission for Quality Management and Internal Evaluation.

Upon completion of the analysis of the circumstances after the follow-up period (after the second external independent evaluation), the following facts were determined: a quality policy had been adopted and publicly published; the internal evaluation of the quality assurance system for the academic year 2013/14 had been carried out; upon the inspection of the report it was determined that it revolved around data gathering and an analysis of the circumstances at the institution for

higher education, and that the goal specified in the Manual had not been fulfilled. ("The goal of this procedure is to determine the momentary state of functionality and effectiveness of the existing system, i.e. coherently established mechanisms of quality assurance"). The recommendations for the forthcoming period referred to the following: all the recommendations stated in the recommendations relating to the follow-up period, if need be, one should adjust the Ordinance on Quality Assurance System (2nd chapter Quality Assurance Areas) to the guidelines for the new *ESG*, the quality assurance system is to be improved on the basis of results of internal evaluations by the quality assurance system (*SOK)* and the analysis of the realization of operative plans, accepted measures for the improvement and verification of their implementation. On the basis of these recommendations, the Quality Assurance Manual was revised (2016) so that the quality assurance system of the Faculty of Metallurgy would adhere to the *European Standards and Guidelines for Quality Assurance in the Field of Higher Education (ESG)*, as well as to the university and national strategies in the system of science and higher education; defined in the Manual were the ways of quality evaluation of scientific research and professional work; the Rulebook on the Quality Assurance System was brought into line (2nd chapter Quality Assurance Areas) with the guidelines for the new *ESG* (2015); and there was an attempt to enhance the quality assurance system on the basis of results of internal evaluations of the quality assurance system *(SOK)*, the analysis of the realisation of operative plans, the accepted measures for improvement, and the verification of their implementation.

b) The recommendations from the first external independent evaluation within the framework of *ESG* 1.2 "Approval, follow-up, and periodic verification of the program and qualifications / scientific research work" and ESG 1.2.1 "Approval, follow-up and periodic revision of the study programs and educational degrees" (for the follow-up phase), encompassed the following: in the Manual it is necessary to finalize the procedure and mechanisms of follow-up and revision of the study programs and the learning outcomes, and to carry out the revision of the learning outcomes.

Through the analysis of circumstances after the follow-up period, it was concluded that it would be optimal to carry out a revision of the study programs after each cycle of education, and that the Faculty of Metallurgy plans to include representatives of external stakeholders in the revision of educational programs and learning outcomes. The recommendations for the forthcoming period referred to the following: in the Manual it is necessary to finalize the revision procedure of the study programs and learning outcomes and to define the follow-up mechanisms, the revision of educational programs and learning outcomes has to be carried out after the completion of a cycle of a given study program. On the basis of the above-mentioned recommendations in the Quality Assurance Manual (Quality Assurance Area 2. Approval, Supervision, and Periodic Evaluation of the Study Programs, p. 15-21, activities 1-20) it was necessary to finalize the procedure and mechanisms of follow-up and revision of the study programs and learning outcomes, and to carry out the revision of learning outcomes and the revision of the undergraduate and graduate study program (2017), whereby representatives of the external stakeholders were included in the procedure of revision of the study program.

c) The recommendations from the first external independent evaluation within the framework of *ESG* 1.2.2 "Scientific research work" encompassed the following: in the Manual it was necessary to define the modes of verification of quality of scientific research and professional work. Upon the completion of the analysis of the circumstances after the follow-up period, it was concluded that the follow-up of quality of scientific work was included in the new Rulebook on the Quality Assurance System, but that a part of the Manual still was not. The recommendations for the forthcoming period referred to the

following: in the Manual it was necessary to define the modes of verification of quality of scientific research and professional work, and to monitor the effectiveness of the established mechanisms.

On the basis of the aforementioned recommendations in the Quality Assurance Manual (Quality Assurance Area 5. Scientific, Research and Professional Activity and Academic Mobility, pp. 35-36, activities 6-12) the modes of verification of scientific research and professional work were defined.

d) The recommendations from the first external independent evaluation within the framework of *ESG* 1.3. "The Grading of Students" encompassed the following: the quality assurance system should be used for the analysis of the possibilities for an increase in passed exams; it is necessary to link grading with learning outcomes, and grading was linked with the learning outcomes (undergraduate and graduate study programs were revised).

e) The recommendations from the first external independent evaluation within the framework *ESG* 1.4. "Quality Assurance of the Teaching Staff" encompassed the following: it was necessary to carry out the training of teaching staff, include in the Manual the mechanisms of monitoring the quality of scientific work, regularly (at least once a year) poll students (during or after each subject or course), by using either the university's or the Faculty's own forms, and apart from the student opinion poll, also carry out a self-evaluation of teachers and a peer review.

Upon the completion of the analysis of circumstances after the follow-up period, the following facts were determined: the regular polling of students about the work of teaching staff had been initiated by means of a university opinion poll, within the framework of the Internal Evaluation of the Quality Assurance System, a self-evaluation of teachers was carried out with regard to scientific and professional work. The recommendations for the forthcoming period referred to the following: it was necessary to continue the activities that were already under way and implement the recommendations given for the follow-up phase and establish mechanisms for the monitoring of the quality of teachers in accordance with the guidelines stipulated in the ESG. On the basis of the recommendations mentioned in the Quality Assurance Manual (field of quality assurance 4. Quality Assurance of Teaching Staff, pp. 30-32, activities 10-16) the ways of monitoring teachers' work were defined.

f) The recommendations from the first external independent evaluation within the framework *ESG* 1.5 ''Resources for Learning and the Support of Students'' encompassed the following: to synchronise the standard of all subjects on the *LMS* system, to modernize and increase the number of computers available to students, to improve the student standard of living, and especially to establish a student restaurant near the Faculty and insure accommodation to students who need it.

Upon completion of the analysis of circumstances after the follow-up period, the following facts were determined: the procedure of opening of a faculty canteen was initiated, in the form of a students' restaurant opened at the Faculty of Teacher Education in Petrinja, whereby the Administration made efforts to improve the students' standard of living. The recommendations for the forthcoming period referred to the implementation of recommendations given for the follow-up phase, and these recommendations have been acted on in accordance with available possibilities. On the basis of the recommendations mentioned in the Quality Assurance Manual (Field of Quality Assurance 6. Resources for Learning and Support for Students, pp. 38-44, activities 1-24) the ways of ensuring the students' standard of living were defined.

g) The recommendations from the first external independent evaluation within the framework *ESG* 1.6. "Information Systems" encompassed the following: to improve the inclusion of external participants in the quality assurance system, to compare the Faculty's efforts with those made by similar institutions of higher education in the European Higher Education Area.

Upon completion of the analysis of the circumstances after the follow-up period, the following facts were determined: it is necessary to enhance the inclusion of external stakeholders in the work of the Faculty and its quality assurance system, especially during the revision of teaching programs, a task group entrusted with the making and implementation of the intranet of the Faculty of Metallurgy, prepared the technical conditions for its introduction, an Intranet workshop was held for internal stakeholders, and it was planned that intranet be used at the beginning of the academic year 2015/16. The recommendations for the forthcoming period referred to: including the external stakeholders in the process of revision of educational programs and learning outcomes through an enhanced cooperation, complete the installation of the Faculty's intranet. On the basis of the aforementioned recommendations, the external stakeholders were included in the revision of educational programs. The formal framework of the Intranet was introduced on 31 August 2016.

h) The recommendations from the first external independent evaluation within the framework *ESG* 1.7. "Informing the Public" encompassed the following: it was necessary to finalize the web site in the English language, increase the visual appeal of the web site and possibly reorganize it with regard to new trends in concepts, organization, and appearance of web sites.

Upon completion of the analysis after the follow-up period, the following circumstances were determined: the web pages were constantly being improved in such a way that the latest news was regularly introduced especially for students, web pages were regularly updated, the *RSS* news of the University were regularly followed and broadcast, and the visual appearance of the home page had been increased, the news was introduced, especially for students and the following of the *RSS* news of the University, and the visual appeal of the home page had been improved. The recommendations for the forthcoming period referred to the implementation of recommendations given for the follow-up phase.

Reaccreditation of the Faculty of Metallurgy of the University of Zagreb

a) Translation of the study programs into the English language – This recommendation was accepted and realised, so the study programs for each course have been translated into the English language.

b) Provision of better support to students in order to curb the high drop-out rate – In this area we continually ponder over the possibilities of improvement and this is how the tutorial system was introduced (tutor-tutee) in the first two years of the undergraduate study program in order to help students master the program and reduce the drop-out rate. Moreover, each year in the month of September a workshop titled ''Preparatory Semester'' is held, covering physics, mathematics, and chemistry in order to help students master the teaching material from the aforementioned courses and thus reduce the drop-out rate. However, a high drop-out rate is significantly affected by the low level of previous knowledge that the enrolled students acquired in secondary school, as well as the bad economic environment (which has caused the devastation of the metallurgical industry in Croatia) that reduces the interest of top quality students.

c) Narrow focus on metallurgy – The recommendation of the Reaccreditation Commission was accepted, and the undergraduate and graduate study programs of metallurgy have been revised (in the graduate study program, a new stream, Industrial Ecology, has been introduced); the preparation of the undergraduate study program in Safety, Occupational Health and the Environment is still pending (a preliminary curriculum proposal has been made), and preliminary activities are being carried out in order to determine the possibilities of introducing an undergraduate and graduate study program related to the field of materials (in cooperation with other faculties that teach subjects from that field). Moreover, in accordance with the recommendation from the first reaccreditation, the Faculty is actively considering employing experts (coordinators) for international cooperation and scientific projects in order to enhance the number of international projects, but this significantly depends on the available salary coefficient and the perspective taken by the competent ministry.

d) The presentation of the Faculty's success to the public – In this field significant progress has been made, whereby there has been a continuous promotion of activities carried out by the Faculty in order to present itself to students in secondary schools (within Sisak-Moslavina County and elsewhere), Open-door days are organised (promoting activities and popularizing the profession through the promotion of cooperation with business entities). The Faculty also participates in the Festival of Science and Leap into Science, while employees of the Faculty continuously participate in ARCA international exhibitions of innovations organised by the Croatian Innovators' Association, Kupa Nights, Sisak MetalFest, Soela, the Festival of the University of Zagreb, etc.

1.3. The higher education institution supports academic integrity and freedoms and prevents all forms of unethical conduct, intolerance, and discrimination

The higher education institution supports academic integrity and freedom and also ensures ethics of work and academic integrity and freedom.
The higher education institution efficiently uses mechanisms for the prevention of unethical conduct, intolerance, and discrimination.
The higher education institution conducts activities aimed at the sanctioning of unethical conduct, intolerance, and discrimination.
A system of competencies for the resolution of conflicts and irregularities is functional at all levels of the higher education institution.
The higher education institution employees, students, and external stakeholders base their work on the principles of academic ethics.
The higher education institution systematically resolves the problems of plagiarism, exam cheating, and result-tampering.

Being part of the University of Zagreb, The Faculty of Metallurgy has not adopted its own Ethics Code but works in accordance with the Ethics Code of the University of Zagreb. The Ethics Code of the University of Zagreb contains the moral principles and principles of professional ethics and public activities that need to be observed by all employees of the University of Zagreb and each of its elements. The establishment of ethics in research is regulated through the Ethics Commission of the Faculty of Metallurgy. The research conducted at the Faculty of Metallurgy does not call for any particular statements/agreements in view of research ethics, since scientific research is not conducted on humans or animals. However, the Ethics Commission may establish, if such a need arises, whether in the proposed scientific research all the ethic and professional principles that all researchers need to abide by has been observed and implemented and give its views on this. Since the time of the establishment of the Ethics Council of the University in Zagreb in 2008, the Faculty has had one of its members in this body, and as of 2015, this member has been at the body's helm.

The Faculty of Metallurgy in line with the Ethics Code sees as unacceptable any form of direct or indirect discrimination based on religion, ethnicity, nationality, race, gender, sexual orientation, lifestyle, property status, origins, family and marriage status, pregnancy, family obligations, age, disability, physical appearance, political affiliation and health status. The only assessment criteria should be expertise, abilities, and professional merit, as well as relevant education and results in performing certain types of activities, jobs, and tasks. Any type of harassment happening between members of the University community (for example: verbal, non-verbal, or physical acts, which may create or contribute to the creation of an unpleasant or hostile working and teaching environment or which is aimed at scaring the other person, insulting or humiliating the other individual, or any type of sexual harassment) is forbidden.

Apart from the obligation of the implementation of the Ethics Code, in the first year of its undergraduate program, the Faculty of Metallurgy offers the class Ethics and Communication Skills, introducing students to ethics in both conduct as individuals and in research. Apart from this, at the start of their studies, first-year students are shown promotional materials/films (first-year student guide) on the possible forms of unethical behaviour in academia. Similar promotional material on the possible forms of unethical behaviour of the members of academia is presented from time to time at employees' gatherings.

The University of Zagreb Ethics Code is followed in the resolution of possible conflicts and irregularities at the Faculty of Metallurgy. A possible occurrence of unethical behaviour is established based on the opinion of the Ethics Commission. The Rulebook on the Disciplinary Responsibility of Students and other Course Participants at the Faculty of Metallurgy regulates the procedure of the establishment of a breach of obligations by students and other course participants, as well as the establishment of punishable acts, and also regulates authority regarding the launching and conducting of procedures, deadlines for the implementation of acts, the activities of the relevant Commission, the handing down and implementation of disciplinary measures, and also regulates all other relations that may arise from the disciplinary responsibility of students/participants.

As part of the procedure of being granted their scientific title and employment position, scientists at the Faculty of Metallurgy have the obligation of signing a Statement of Originality, in which they confirm that all the works they have provided in the procedure of being granted their scientific title and employment position are original results of their own work. Also, students base their research connected to the writing of final papers, theses, or doctoral theses on the principles of academic ethics and are obliged to sign a Statement of Originality, by which they confirm the originality of their final paper/thesis/doctoral thesis.

Students are provided with aid in the protection and the securing of their rights via the Students' Ombudsman at the level of the University.

At the Faculty of Metallurgy, a person is appointed to protect the dignity of employees, who operates in line with the Rules on Labour (article 120), as well as a person in charge of protecting the privacy of employees, in addition to a clerk who is in charge of the protection of personal data (links).

By implementing the provisions and principles of the University of Zagreb Ethics Code, one case of scientific paper plagiarism has been established. Based on the implemented procedure and statements given by those involved in the procedure, the Ethics Commission presented its views in which it established a case of plagiarism. The scientist in question was blocked from promotion to higher research-and-teaching positions.

The discovery of plagiarism, exam cheating, and tampering with results is conducted on the assessor's own initiative by means of the available free program packages. Following the discovery of plagiarism, the procedure continues in line with the Ethics Code of the University of Zagreb. Due to lack of funds, the Faculty of Metallurgy has no official program package/tool used to discover plagiarism (such as PlagScan, Turnitin, Unplag, and Urkund). However, teachers on their own initiative can utilize available free program packages such as Plagiarism Checker, Viper The Anti-plagiarism Scanner, etc.

1.4. The higher education institution secures the availability of information about important aspects of its activities (education, scientific, and social roles)

Information on study programs and other activities of the higher education institution is publicly available in Croatian and one of world languages.
The higher education institution informs the interested public about the criteria of enrolment, enrolment quotas, study programs, learning outcomes and qualifications, and forms of support available to students.
The higher education institution informs the interested public about scientific and professional topics, projects, and results in the transfer of knowledge and technology.
Information on the social role of the higher education institution is available to the interested public.
The higher education institution informs members of the interested public about other indicators (for example: examination passing rates, the employment of its graduates, dropout rates, results of earlier evaluations, etc.)

The Faculty of Metallurgy continually publishes all the data and information relating to all segments of its activities on the www.simet.unizg.hr web portal.

In the Catalogue of Information in accordance with the Access to Information Law, the Faculty of Metallurgy of the University of Zagreb, as a body of public authority, enables access to information in the manner, time-frame, and scope as stipulated in the Catalogue. The Faculty of Metallurgy has named an information officer who regularly submits annual work reports to the state Information Commissioner, which are published and are available to the public.

The Faculty of Metallurgy web portal is divided into several segments that follow the Faculty's activities:

1. TEACHING
   - Teaching plans and programs, course assignment (i.e., who teaches each subject), syllabus, time table, consultations schedule, requirements for enrolment and exam taking, quotas, conditions, enrolment procedure, progress during studies, student support, work of faculty bodies, decisions, rules, directions, instructions regarding the teaching process, learning outcomes, acquired qualifications
2. SCIENCE
   - Post-graduate education; scientific research projects; professional, technological projects; research support; publications; mobility; international, professional, and business cooperation; equipment and research available at the Faculty; the work of the Faculty bodies; decisions, rules regarding scientific research and professional activities
3. ABOUT THE FACULTY
   - The historical development of the Faculty; the social, economic, educational, and civilian role of the Faculty in the local community and at the state level; the structure of the Faculty; contacts; schedule of the Faculty of Metallurgy bodies' sessions; public procurement; ethics activities; information package
4. DOCUMENTS
   - The Faculty Statute, rulebook, instructions, employment position vacancy tenders and results, job offers, financial reports, student elections
5. LINKS
6. INFORMATION CATALOGUE
   - A catalogue of information, the right to access information, annual reports, reports on public procurement contracts

7. QUALITY ASSURANCE
   - The quality assurance system, strategic documents, archive of documents, analyses, reports, external evaluation, re-accreditation, internal assessment, university polls on the work of teachers, the work of Faculty bodies, decisions, rules regarding the Quality Assurance System (SOK)
8. POPULARIZATION OF SCIENCE
   - Adult lifelong learning, promotional activities, seminars, workshops, conferences, panel debates, expert visits, Faculty presentations, open-door days
9. ALUMNI
   - The Associations of former students and friends of the Faculty of Metallurgy, academic/professional titles acquired at the Faculty of Metallurgy, recipients of student awards, employment vacancies
10. STUDENT CORNER
    - Technology competitions, student information, FB student page, job offers

1.5. The higher education institution understands and promotes the development of its social role

The higher education institution contributes to the development of the economy (the economic, business, and technological mission of the University).
The higher education institution contributes to the development of the local community.
The higher education institution contributes to the foundations of the academic profession and the responsibility of university teachers for the development of the University and the local community.
The development of the social role is part of the mission of the higher education institution (for example: the development of civil society, democracy etc.).

The Faculty of Metallurgy contributes to the development of the economy by offering support to business entities within the metallurgy, metal processing, shipbuilding, and foundry industries based on requests and signed agreements and cooperation contracts, which result in the drawing up of studies and reports containing solutions to problems and containing proposals for the technological enhancement of the process. It also organizes scientific-professional seminars and conferences for foundrymen with the aim of strengthening links and the transfer of knowledge and technologies between the scientific research and business sectors in the field of metal processing with an emphasis on the foundry industry and the outcome of life-long education based on the level of expressed interest. The Faculty of Metallurgy actively participates in the activities of the relevant state bodies from its field of research – e.g., by participating in Information Day for the Research Fund for Coal and Steel.

The Metallurgy Faculty has published the Catalogue of Equipment and Research that can be conducted at the Faculty's laboratories, making its services transparent and available to all interested business entities.

As the only higher education institution in its community, The Faculty of Metallurgy has for more than 55 years been integrated in the local community, contributing indirectly to its development, through its scientific and teaching activities, and directly through other types of involvement, both as an institution and through the individuals who work there.

Through its status as a higher education institution, the Faculty of Metallurgy has contributed to the development of the local community in the segment of student standard incentives. With its knowledge and expertise in the field of technical sciences, the Faculty of Metallurgy contributes to the development of the local community through the organization and implementation of lifelong education activities. Through the realization of the Centre for Founding – SIMET project, the conditions for innovations in the public sector of research will be improved and will help upgrade the overall competitiveness of Croatia's economy.

The Faculty of Metallurgy also operates as a central point for the development of the CARNet network in the Sisak–Moslavina Country and through which some 48 institutions have been connected with the goal of the optimization of information technology of the scientific and education system in the county.

Through the institution, but also individually, the Faculty of Metallurgy's employees take part in the activities of other organizers whose goal is to promote the profession and the development of the local community. Examples of this are SOELA, Sisak Energy Day, Metals are IN again, Job Fair, and ARCA.

The Faculty of Metallurgy operates as a responsible institution which contributes to society by increasing the level of education, the expertise of engineers within the technical field, the development of industries related to metallurgy, materials and environment protection, as well as working in line with the principles of academic ethics. In this respect, the Faculty of Metallurgy fulfils its civil role through taking part in numerous activities of the city bodies and civilian institutions: presentations for secondary school pupils, Kupa Nights, presentations in libraries, Metalfest, Open-Door Days, Science Festival, Leap into Science, Leap into the Arts.

The Faculty of Metallurgy takes part in the life of the local community also by the social engagements of their existing intellectual, human, and physical resources at the higher education institution (for example: pro bono consulting, teaching of informal education classes, offering lecture hall, equipment and infrastructure of the higher education facility in catering to the needs of the local community, for example for MENSA, The Librarians' Society of Sisak-Moslavina County, the Central State Office for Public Procurement, HMD, the County CARNET node, etc.). The engagement of employees and students of the Faculty of Metallurgy in all the above-mentioned activities is voluntary and is not paid.

The Faculty of Metallurgy is the hub of the scientific and research and publishing activities in the field of metallurgy and industrial ecology, and since it is the only such institution in the local community, the Faculty has for years been playing a key role in the establishment and sustaining of the academic atmosphere in the area.

The social role of the Faculty of Metallurgy has been recognized in its mission, vision and values, which are described in its Strategy. The Faculty of Metallurgy bases its activities on high academic and ethical values and the contribution to society and social responsibility, fully aware of its strengths and weaknesses, but at the same time ready to work on resolving problems. The Faculty first needs to be publicly recognized as a responsible institution which contributes to society by upgrading the level of education, the expertise of engineers within the technical field, the development of industries related to metallurgy, materials and environment protection, as well as working in line with the principles of academic ethics.

II.
Study Programs

IMPORTANT→CLEAR

Higher education teaching has to be set up so that its programs and learning outcomes attract ambitious young people and support them, so that they can become independent solvers of business challenges. This should be done through the development and support of their curiosity, analytical minds, and communication skills in order for them to become exactly the graduates that are necessary on the labour market.

weaknesses ☒ threats

- lack of interest for the profession
- enrolment rate
- exam passing rates
- resources (student standard of living, interactive classes)
- attractiveness of study programs

strengths ☑ possibilities

- new study programs at the first level directly linked to industry
- expansion of study programs at the second level towards industrial ecology
- understanding and implementing the interests of industry
- making young people aware of their interest in industry (challenge, personal development, prosperity)
- scholarship contracts / student internship / expert visits with emphasis on modern production capacities
- good studying conditions, access to research equipment at the facilities' laboratories
- support of public and local and economy authorities (Triple Helix)

2.1. General goals of all study programs in accordance with the mission and strategic goals of the higher education institution and social needs

The higher education institution provides proof of the harmonization of the general goals of all study programs with the mission and strategic goals of the higher education institution.
Justification for running the study programs is given in relation to social/economic needs and includes an analysis of the necessary capacities of the higher education institution for the implementation of such programs.
If it is offering study programs that lead to regulated professions, the higher education institution takes into account the suggestions of professional organisations that closely monitor their licensing.
The higher education institution educates experts that are competitive on the domestic as well as the international labour market.

Metallurgy is an engineering profession which belongs to the field of technical sciences and includes the extraction of metals from ores, their formation using different processes of casting and deforming, and methods of environment protection in the process of the production and recycling of materials/raw materials with the aim of reuse. The Faculty of Metallurgy has been operating for more than 55 years as the only scientific and teaching institution in the Republic of Croatia which offers undergraduate, graduate and postgraduate, and vocational level higher education in the area of metallurgy and industrial ecology, while by organising conferences, seminars, workshops, panel discussions and lectures it systematically implements life-long education and further training.

The Faculty of Metallurgy has accreditation to conduct the undergraduate and graduate university study programs in Metallurgy and the undergraduate university vocational part-time program in Founding, as well as the university postgraduate program in Metallurgy and the postgraduate doctoral program in Mechanical Engineering, Naval Architecture, Aeronautical Engineering, and Metallurgical Engineering. The general goals of all study programs have been harmonized with the mission and the strategic goals of the higher education institution in the Development Strategy of the Faculty of Metallurgy for the Period of 2011–2016 (pp. 11–16), as well as the Development Strategy of the Faculty of Metallurgy for 2017–2021 (pp. 16–18).

The main feature of the Faculty of Metallurgy is the fact that it emerged directly out of production. In other words, the economic development in the mid-twentieth century had resulted in the need for quicker training of a highly educated and specialized work force in the Republic of Croatia in the technical sciences, including metallurgy. The first activities began in the summer of 1958 and resulted in the first courses being taught in the 1960/1961 academic year at the Technology Faculty of the University of Zagreb – in the Metallurgy Department in Sisak. The Faculty of Metallurgy became an independent part of the University of Zagreb on June 1st, 1991. During all this time, changes were continually made to the syllabus with the aim of adjusting it to economic changes and developments.

Today's metalworking industry in the Republic of Croatia is characterized by the production being scattered and the lack of a clear development strategy. Today's companies were mostly created during the restructuring process of large industrial companies from which the vast number of expert staff and knowledge in the metal processing industry came. The largest metal processing companies sell their products on foreign markets and are mostly owned by foreign corporations. Also, legislation is based on eco-friendly production which sets fresh challenges before the industry and calls for constant training and the adjustment of production to changing conditions and an upgrade in quality. The European market also calls for the observance of ecological and corporate norms.

In the period between 2011 and 2017, two revisions of the undergraduate and graduate university programs in Metallurgy were conducted. Through an analysis of the existing study program and information gathered from students who had graduated, it became apparent that there was a need for a revision of the university undergraduate and graduate study programs in Metallurgy, and the first revision was carried out in 2011. Through an analysis of market needs and with the support of economic entities and the local community, as part of the revision of the existing undergraduate study program in Metallurgy, in 2012/2013 orientations in Metallurgical Engineering and Industrial Ecology were introduced, the two sharing 22 joint courses (Proof 2.1). The University of Zagreb Senate subsequently adopted a decision to accept intrinsic changes and amendments to the undergraduate and graduate university study programs in Metallurgy.

Through the introduction of the orientation in Industrial Ecology, the impact on the environment is followed through the movements of materials and energy in industry and for the needs of consumers, including the impact on economic and social relations. It is necessary to mention that no other study program or orientation in Industrial Ecology exists in Croatia. This newly-introduced orientation is in close relation with the restructuring and privatization of the industrial and energy sectors, including the adjustment of other branches of the economy. In order to meet ecology standards, it is necessary to have qualified experts in the form of metallurgy industrial ecology undergraduates. In other words, everything that has been mentioned here has also been recognized by the local community, since the Technical School in Sisak now for the first time offers a new course of study titled Ecology Technician, whose graduates have to a large degree enrolled in the Metallurgy program's Industrial Ecology orientation. In this way, the Faculty of Metallurgy enable secondary school pupils to continue their education at a higher education institution and to earn a university bachelor's degree in Metallurgy, with a orientation in Metallurgical Engineering or Industrial Ecology.

It should be stressed that ecological issues are particularly pronounced in the very town of Sisak and Sisak–Moslavina County, due to its once being inundated with industry. The Sisak–Moslavina County area used to account for 20 percent of the overall industrial output in the Republic of Croatia. In view of the experiences in environmental protection so far, the Faculty of Metallurgy is the logical and only possible institution to offer and implement an Industrial Ecology orientation, as part of its undergraduate Metallurgy program. Thanks to incentives, the so-called 'southern industrial zone' in Sisak has been named one of the 10 top locations for entrepreneurs out of the existing 317 industrial zones in the Republic of Croatia. As a result of these efforts, the Applied Ceramics company has started operating in Sisak, which places Sisak on the map as being a nanotechnology town. The Željezara Sisak metalworks, which in the past employed some 14,000 workers and which was government-owned, was privatised some 10–15 years ago and changed hands several times in the process (Mechel, CMC, ABS). The entry of foreign companies into the former Željezara Sisak metalworks has resulted in the modernisation of the overall production process. In the same zone, several companies, such as Felis, Obernsdorfer, Rohrwerk Maxhüttem, Cial, and Depos, have been operating for years. Croatia's entrance into the EU has resulted in several moves related to new legislation based on the need for integral prevention and monitoring of pollution under the European Parliament Council Directive 96/61/EZ. An integral approach to the monitoring of pollution, taking into consideration waste management, has as its goal the prevention of emissions into the air, water, or soil; determining where this is possible and where it is not; and cutting it to a minimum in order to achieve a high level of environmental protection overall. The Directive had undergone changes on several occasions and it had to be codified. The codified version of the Directive is the Directive of the Council 2008/1/EZ of January 15th, 2008. The provisions of the Directive have been made part of the Croatian legislation known as the Law

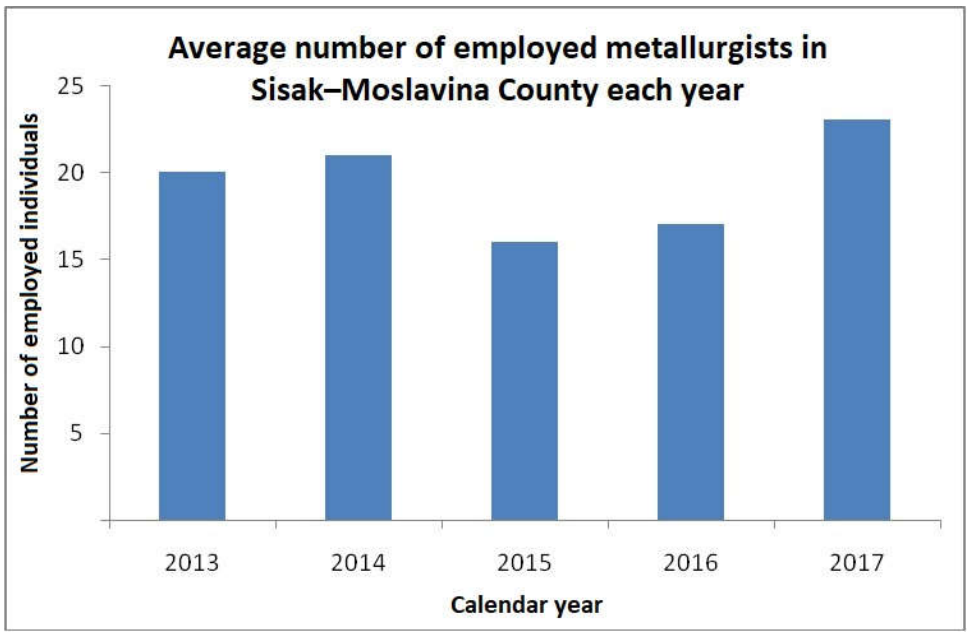
on Environmental Protection (NN 110/07) and the Regulation on the procedure for the establishment of joint environment protection conditions (NN 114/08). This raises the issue of the competencies of future generations of third-year graduates in different professions to be able to adjust to and recognize the legal regulations connected to pollution.

The new findings in the development of metallurgy, metal materials and sustainable development are a necessary prerequisite for the successful joining of national economic development trends. This also calls for the necessary adjustment of study programs to the requirements of the market in the public and private sectors. Based on the 55 years of experience and tradition of the Faculty of Metallurgy, as well as the support of the local community and economic entities, it has been estimated that there is a definite need for metallurgy experts in the Republic of Croatia, including those studying industrial ecology and their relevant competencies.

The Republic of Croatia has a long tradition in the field of metal production and metal processing, as well as the production of items from the field of metallurgy. It is important to mention that the general goals of all the study programs (Metallurgy, Founding) are in accordance with the Industrial Strategy of the Republic of Croatia 2014-2020, adopted by the Croatian parliament on 17 October 2014, where, apart from the said activities also C24 Manufacture of basic metals and C25 Manufacture of fabricated metal products, except machinery and equipment, is mentioned. Apart from directly working in the industry (Casting and processing of metal materials, metal processing, shipbuilding, etc.) experts in the field of metallurgy, i.e. industrial ecology, are employed in institutes and research laboratories, as designers of industrial production halls, in the field of environmental protection in the public and private sector, in offices for standardization, offices of state administration for technical issues, etc. Without their contribution, it would be impossible to expect the maintenance of current industrial production, let alone development and market competitiveness.

It is a fact that, in the Republic of Croatia, the only genuine space for the growth of exports exists in the industries with high added value, for which a vast engineer population is an absolute necessity. The introduction of the Industrial Ecology orientation as part of the undergraduate program in Metallurgy ensures the acquisition of competencies for the completion of all complex tasks related to comprehensive environment protection during the activities of an organization or company in all of its segments.

According to the Croatian Employment Service data, employment figures of metallurgy graduates (all forms of higher education) in the Sisak–Moslavina County between 2013 and 2017 were the highest in 2014 and 2017.

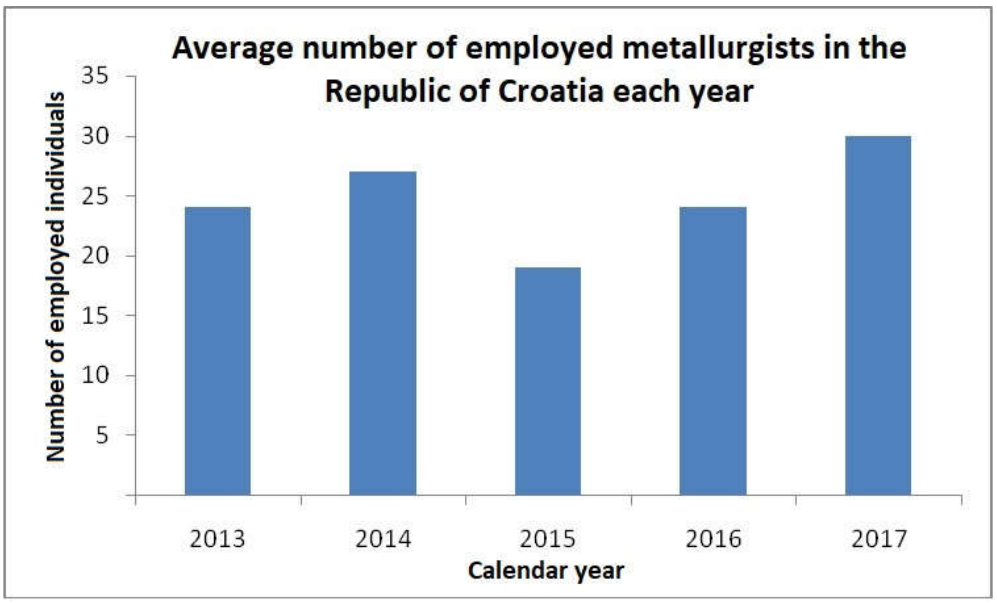


Comparing the number of employed individuals with professional qualification, it is clear that most of the employed metallurgists are ones who have completed the undergraduate program (bachelor's degree in metallurgy) and graduate university studies (master's degree in metallurgy). The metallurgists who have graduated from undergraduate programs are employed regardless of their age, work experience, or duration of joblessness. A significant number of employed metallurgists are between the ages of 25 and 34 and have graduated from the graduate university program. It also needs to be stressed that metallurgists of this level of education, as well as undergraduate metallurgy engineers become employed after they complete their studies or are unemployed for only between 3 to 6 months after graduating, something which is not true of other levels of education (Proof 2.2., Tables 1,2,3).

Depending on work experience and age, according to data provided by the Croatian Employment Service, the smallest number of employed metallurgists in the period between 2013 and 2017 were those who had completed undergraduate university programs and were older than 30 years of age, considering the start of the introduction of the Bologna process (Proof 2.2., Table 4). Also, there were very few unemployed metallurgists who had completed the former so-called Ist degree (four-year university degree, engineer [I. stupanj – VŠS, inženjer]), as the Faculty of Metallurgy no longer provides this type of education (Proof 2.2, Table 4). At the same time, it can be seen that over the past five years a larger number of metallurgists of the said level of education had been employed – i.e., metallurgists who had been on the Croatian Employment Service's unemployment list have gained employment due to the changes in the metallurgy sector (Proof 2.2., Table 2).

In Sisak–Moslavina County during the period between 2013 and 2017, a total of 26 metallurgists were unemployed, looking at all levels of education, but at the same time 97 metallurgists were employed, mostly in the processing industry and education. Some 51 metallurgists were employed in these sectors, mostly those who had finished the undergraduate or graduate program. Also, metallurgists who completed the undergraduate program are employed in nearly all other branches of economic activity (Proof 2.2., Table 5).

According to the data provided by the Croatian Employment Service, the number of employed metallurgists (all forms of higher education) in the Republic of Croatia in the period between 2013 and 2017 was highest in 2014 and 2017.



On the territory of the Republic of Croatia in the period between 2013 and 2017, some 124 metallurgical experts were employed, most of them holders of undergraduate or graduate degrees (a total of 110) (Proof 2.2., Table 6). The employment of metallurgists according to level of education, age and work experience in the Republic of Croatia is the same as in Sisak–Moslavina County (Proof 2.2., table 6,7,8)

Unemployment among metallurgists in the Republic of Croatia in the period between 2013 and 2017 are identical to the rates in Sisak–Moslavina County. The reason for this is the fact that most of the Faculty of Metallurgy students live in the area of Sisak–Moslavina County, so that all the figures on them are kept by the relevant regional office of the Croatian Employment Service. The number of out-of-work metallurgists (all types of education) in the Republic of Croatia was 26 (Proof 2.2., Table 9).

In the Republic of Croatia, the highest numbers of employed metallurgists are recorded in the processing industry and in education, with Sisak–Moslavina County being at the helm together with the City of Zagreb. In the period between 2013 and 2017, two metallurgists were employed abroad, one had completed the undergraduate program and the other, the graduate program (Proof 2.2, Table 11).

In the 2014/15 academic year commenced a process of in-depth analysis and revision of the existing undergraduate and graduate university study programs in Metallurgy based on the state of the economy and the labour market's need for metallurgy-profile workers. Teachers at the Faculty of Metallurgy took part in the analysis and revision, as well as outside partners: Almos d.o.o. Kutina, TPK zavod d.d. Zagreb, SinterMAK d.o.o. Zagreb, RS metali Virovitica, Ferropreis Čakovec, and the Students' Association of the Faculty of Metallurgy (Proof 2.3). During the revision, the participants took into consideration the results of a survey about the existing programs that had been conducted among former students, as well as data on the employability of the students who had graduated, which can be found in the internal evaluation of the quality assurance system of the Faculty of Metallurgy, conducted each academic year. Also, the defining of the guidelines for implementation of the revision of the existing study programs was heavily influenced by the 2012 Report of the Commission for Reaccreditation of the Faculty of Metallurgy of the University of Zagreb.

A working group for the in-depth analysis and revision of the undergraduate and graduate Metallurgy programs was named, and one of its members was an external stakeholder from the economic sector. After an analysis of the existing study programs and programs of comparable accredited programs of the European Union was carried out, the working group put together a proposal of revised teaching plans that were harmonized with programs at similar higher education institutions abroad. After a public discussion was held, the final decisions on revising the study programs were adopted at a session of the Faculty Council, while the university procedure ended with the adoption of the Decision on the Adoption of Significant Changes and Amendments to the Undergraduate University Study Programs in Metallurgy: orientation in Metallurgical Engineering and Industrial Ecology, and the Decision on the Adoption of Significant Changes and Amendments to the Graduate University Study Program in Metallurgy. The enrolment of students and the holding of lectures under the revised teaching programs started in the 2017/18 academic year.

In the process of revision, the proposals of external stakeholders from the economic sector were taken into consideration: knowledge of the material, its acquisition, material characteristics, different technologies from classical metallurgy to powder metallurgy, the automatization of industrial processes, the reading of plans and knowledge about working with the program packages AutoCad, Catia etc., introduction to norms for the testing of product quality, the protection of environmental elements (water, soil, air), more practice and practical examples for students, which also means more education in the field, more emphasis on the optimization of chemical composition and the desired quality of the product, education on the preparation of samples for microstructure testing and metallographic analysis of samples, etc. Having this aim in mind, new courses were introduced which encompass all of the aforementioned: Quality Management, Automatization and Computer Monitoring of the Production Process, Computer-Aided Design, Best Available Techniques of Environmental Protection in Metallurgy. Additionally, the teaching programs of existing courses were modernized. The ECTS points were either increased or decreased for some courses with the aim of harmonizing the ECTS points with the workload of the students, while some courses were placed in different semesters to ensure the continuity of teaching with other courses. The learning outcomes were also revised at the course level and the program level and adjusted to Bloom's taxonomy.

The Faculty of Metallurgy focused its new efforts into new study programs which were to be aimed at safety at work and engineer metal materials. Within the framework of the Operational Program "The Development of Human Resources" 2007–2013 and with the aim of improving quality in higher education with the implementation of the Croatian Qualifications Framework, the project ENGINEERING OF MATERIALS – BASIS OF INNOVATIVE ECONOMICS was implemented between June 18th, 2015 and August 17th, 2016. The project elaborated the proposal of the concept, program, and organization of the new university study program. Information about the project was published as publicly available documents on the internet pages of the Faculty of Mechanical Engineering and Naval Architecture and the Faculty of Metallurgy. The project bearer is the Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb, while its partners are the Faculty of Metallurgy, University of Zagreb, the Croatian Chamber of Economy, and the Croatian Society for Materials and Tribology.

2.2. The expected learning outcomes of study programs offered by the higher education institution match the level and profile of the qualifications acquired through them

The higher education institution has clearly defined learning outcomes of study programs that are harmonized with the mission and goals of the higher education institution.
The higher education institution has efficient mechanisms of review and assurance of the harmonization of the learning outcomes at the level of study programs and courses.
The learning outcomes that are achieved by the completion of the study programs match to the descriptors of the Croatian Qualifications Framework and European Qualifications Framework that the program is implemented at (level).
The higher education institution works in line with the demands of the profession and internationally recognized standards in defining learning outcomes
The expected learning outcomes clearly reflect the competencies necessary for joining the labour market, continuing one's education, or other needs of the individual/society.

The Rulebook on Studying in the undergraduate and graduate study programs of the Faculty of Metallurgy regulates all aspects of studying in the university undergraduate and graduate study programs at the Faculty of Metallurgy of the University of Zagreb. The said Rulebook defines the types of study programs offered at the Faculty of Metallurgy, the academic titles that are acquired with the completion of those programs, the content of each study program, syllabi, etc. In line with articles 6 and 36 of the mentioned Rulebook, the Faculty of Metallurgy Council adopts a plan of courses taught each academic year (for undergraduate, graduate, and vocational programs) and the course assignments – i.e., who teaches which course – (for the undergraduate, graduate, and vocational programs) in line with the Act on Scientific Activity and Higher Education. As part of the study program content, a list of learning outcomes at the level of all programs (for undergraduate, graduate, and vocational study programs) has been published, as well as a syllabus (teaching program) for each of the courses with the learning outcomes at the level of program and course, including descriptions of how students are graded and how exams are administered, as well as a list of required and additional literature, etc.

All learning outcomes at the level of programs are harmonized with the learning outcomes at the level of each course. In order to show the harmonization of the learning outcomes of study programs with the mission and strategic goals of the higher education institution, we shall first give as an example a list of learning outcomes for the revised curriculum of the undergraduate university study program in Metallurgy with orientation in Metallurgical Engineering and Industrial Ecology, which was first introduced in the 2017/2018 academic year:

General learning outcomes at the program level:

- Explain the physical and chemical basis of phenomena that are characteristic of the technical profession.
- Apply the laws of thermodynamics to production processes.
- Analyse the existing state of affairs, identify problems and formulate and suggest the optimal technological solution by applying acquired knowledge.
- Apply acquired computer science knowledge to engineering practice.
- Apply logical thinking and precision in data processing.
- Compare and choose a certain technological procedure.
- Identify processes and link the acquired results with theoretical models.
- Choose the most favourable form of energy from the viewpoint of sustainable development.
- Use skills and knowledge of qualitative and quantitative analysis.
- Use norms in the technical profession.

- Implement teamwork and ethical principles; promote the development of communication and social skills.
- Explain the current situation and define trends in metallurgy development as a profession and its overall economic impact.

Orientation Metallurgical Engineering:

- Describe the production of materials and select types and explain their properties for a specific area of use.
- Explain and apply the technologies of metal production and processing.
- Calculate the material and heat balance of metallurgical processes.
- Anticipate and solve problems in metallurgical production.
- Design simple computer applications and apply them to existing metallurgical processes.
- Identify material properties and technological process parameters and adapt them to achieve the desired product quality.
- Describe and explain contemporary technologies in metallurgical practice.

Orientation Industrial Ecology:

- Describe today's state of affairs and trends in the development of modern industrial ecology.
- Identify ecotoxicological effects on the environment.
- Compare and select the best available techniques (BAT) in environmental protection in metallurgical processes and other industries.
- Foresee solutions for efficient waste management.
- Identify the connections between health and ecological risks.
- Apply regulations relevant to environmental protection in production processes.
- Provide methods and identify samples for the determination of environmental component contamination.
- Describe the characterization of waste.

The learning outcomes of all study programs are in line with the mission and strategic goals of the Faculty of Metallurgy as seen in the Development Strategy of the Faculty of Metallurgy for the period 2011–2016. (p. 9) and the Development Strategy of the Faculty of Metallurgy 2017–2021. (pp. 13–14, 16–22).

From the illustration of two courses from the revised undergraduate and graduate university study program in Metallurgy, it is evident that the learning outcomes at the subject level are in line with the learning outcomes of the study program:

Undergraduate university study program in Metallurgy – revised program of 2017/18.
Course: Ecotoxicology
Learning outcomes at the program level that the subject contributes to:

1. Identify ecotoxicological effects on the environment.
2. Identify the connections between health and ecological risks.
3. Analyse the existing situation, identify problems, and formulate and recommend an optimal technological solution by applying acquired knowledge.

Expected learning outcomes on the subject level:

1. Identify important long-term and current situations of environmental pollution as well as possible ecotoxicological effects.
2. Compare ecotoxicological data related to the presence of individual industrial pollutants or groups thereof in water, air and soil.
3. Identify the ecotoxicological risks associated with the occurrence and distribution of anthropogenic pollutants in certain parts of the environment.
4. Describe the occurrence of pollutants in food samples and evaluate their potential impact on human health.

Graduate university program in Metallurgy – revised program from 2017/18
Course: Numerical modelling of metallurgical processes

Learning outcomes at the program level that the subject contributes to:

1. Use acquired theoretical knowledge in engineering practice.
2. Create and apply modelling of metallurgical and other processes.
3. Plan and manage metallurgical processes.
4. Suggest solutions for the optimization of metallurgical processes.

Expected learning outcomes on the subject level:

1. Apply appropriate modelling methods in the guiding, monitoring and optimization of metallurgical processes.
2. Formulate numerical models for planning, process analysis, design, and optimization of existing technology in metallurgy.
3. Use commercial software packages based on finite elements for determining the temperature distribution by body circumference, for the analysis of thermal stresses, and determining the rate of heating and cooling of metal materials.
4. Analyse and select the optimum heating mode of materials during metallurgical processes.
5. Calculate the adiabatic temperature and the equilibrium composition of combustion products for a known fuel type, fuel-to-air ratio, temperature, and pressure.
6. Formulate and use mathematical models for the development of new technologies in metallurgy.

All programs were organized according to the Standards and Guidelines for Internal Quality Assurance in the European Area correspond to level descriptors of the Croatian Qualifications Framework and the European Qualifications Framework.

According to the guidelines for the development of qualification standards, the proposed name contains a generic and a specific part that is clear and contains all information related to all qualification characteristics (levels 6 and 7). The assigned levels of qualification standards correspond to the prescribed requirements and learning outcomes; cognitive skills, psychomotor skills and social skills. Furthermore, the minimum number of credits (ECTS) awarded to the learning outcomes was met (levels 6 and 7 - 180 and 120 ECTS points). Specific qualifications are specified when acquiring the qualification: passed all exams, completed final exam, completed graduate thesis, completed work study, etc. Guidelines recommending the creation of learning outcomes in the range of 3 to 6 ECTS credits are followed. Learning outcomes clearly indicate what a student must be able to know or do, and they are designed so that by joining them in a group, one can clearly recognize progress in achievement. Clear criteria are given for evaluating whether the learning outcomes have been achieved. When designing the program, the recommendations for learning outcomes were taken into account (the set of learning outcomes should be as small as possible, a set of 3 to 6 ECTS points, using Bloom's taxonomy, so that one set contains 4 to 10

individual learning outcomes at the level of the subject). The material and human resources needed to acquire and evaluate the set of learning outcomes are met.

An analysis of the Survey for the evaluation of studying in general, filled out by students upon completion of their studies and conducted by the Office of Quality Management at the University of Zagreb shows that students in both the undergraduate and graduate programs are satisfied with the study program (the average grade is very good) as well as with the learning outcomes at both levels (Proof 2.4, Proof 2.5).

The Faculty of Metallurgy has a procedure for developing and approving its own study programs, which are designed to meet set goals, including the expected learning outcomes. The qualifications awarded under the program are clearly described and presented, with the appropriate level of the National Qualifications Framework for Higher Education and thus the Qualification Framework of the European Higher Education Area. Study programs have general objectives aligned with the strategy of the HEI and explicitly provided learning outcomes are developed in collaboration with students and other stakeholders using reference points (study programs at other well-known HEIs in the EU and in the world). They are designed to allow students to advance unobstructed through their studies. The expected workload of students was determined by means of ECTS credits; they contained well-structured opportunities for work in practice and passed an approval procedure at the faculty and university level.

During the design of the existing curriculum and undergraduate study program in the field of Metallurgical Engineering, the experiences of well-known foreign HEIs in the field of metallurgy and materials engineering, such as RWTH Aachen, Montanuniversität Leoben, Technical University of Košice and the Faculty of Sciences and Engineering at the University of Ljubljana. During the design of the undergraduate and undergraduate study program in Metallurgy, orientation Industrial Ecology, similarly used were the experiences of the following foreign HEIs in the field of environmental protection: the University of Nottingham, Białystok Technical University (BTU), ETH Zürich, and the University of Nova Gorica. As a result of direct links with industry, the Faculty of Metallurgy joins its program with industrial production, applying a structural comparison of the allocation of the total number of ECTS credits towards groups of subjects. During the drafting of the revised curriculum of the university graduate study program in Metallurgy, the experiences of well-known foreign HEIs in the area of technical sciences in the field of metallurgy and materials were also used. The graduate study program in of Metallurgy at the Faculty of Metallurgy is comparable to study programs at the following institutions: RWTH Aachen, Montanuniversität Leoben, Technical University of Košice and the Faculty of Sciences and Engineering at the University of Ljubljana.

The anticipated learning outcomes clearly reflect the competences needed for inclusion in the labour market. The continuation of education after undergraduate studies is enabled through the graduate program and afterwards in the postgraduate doctoral program. The Faculty of Metallurgy also organizes lifelong learning programs through which additional knowledge and skills can be acquired. This can be found in diploma supplement obtained after completion of the study program (Proof 2.6):

Undergraduate study program in Metallurgy Orientation Industrial Ecology	**Undergraduate program in Metallurgy Orientation Metallurgical Engineering**
Access to further levels of study *Upon completion of the undergraduate university study program, the student acquires the right to enrol in the graduate university study program of the Faculty of Metallurgy with the passing of differential exams. The conditions for enrolment in university or professional diploma programs at other higher education institutions are determined by those institutions.*	***Access to further levels of study*** *Upon completion of this undergraduate university study program, the student acquires the right to enrol in the graduate university study program of the Faculty of Metallurgy. The conditions for enrolling in university or professional diploma programs at other higher education institutions are determined by these institutions.*
Possibility of Employment and Professional Status *The holder of this qualification is authorized to use the legally protected academic title of Bachelor in Metallurgy orientation Industrial Ecology (univ.bacc.ing.met.), and perform professional work in the field of the awarded title. The study program is based on basic knowledge in mathematics, physics, chemistry, sustainable development, ecology, ecotoxicology, ethics, and environmental issues (dangerous substances in the environment, metallurgy, oil and petrochemical industry and environment, pollution and air, soil and water protection, recycling of materials, waste management). As a result, students acquire the necessary knowledge and skills to handle medium complex tasks in all branches of industry (industry, shipbuilding, construction, agriculture, maritime affairs, tourism, and education) as well as to follow ongoing technological changes and innovations.*	***Possibility of Employment and Professional Status*** *The holder of this qualification is authorized to use the legally protected academic title of Bachelor in Metallurgy orientation Metallurgical Engineering (univ.bacc.ing.met.), and to perform professional work in the area for which he has acquired the title. The study program is based on basic knowledge in mathematics, physics, chemistry, electrical engineering, mechanical engineering, the theory of metallurgical processes, physical metallurgy and certain technological subjects (cast iron, iron and steel metallurgy, metallurgy of non-ferrous metals). As a result, students acquire the knowledge and skills needed to solve medium complex tasks in various branches of industry, entrepreneurship and educational institutions, and to follow ongoing technological change and innovation. Employment is not limited to metallurgy.*

Undergraduate vocational part-time study program in Founding	**Graduate study program in Metallurgy**
Access to further levels of study *Upon completion of the specialist study program, the student can continue studying in the undergraduate university study program in Metallurgy by acquiring additional ECTS credits**.***	***Access to further levels of study*** *Upon completion of this graduate study program, the student acquires the academic title of Master in Metallurgy (mag.ing.met.). Continuation of studies is possible in the doctoral program in metallurgy, as well as in other doctoral programs of the Technical Faculty as long as they meet that program's criteria.*
Possibility of Employment and Professional Status *The holder of this qualification is authorized to use the legally protected academic title of Associate of Founding* (pristup. ljev.) *and to carry out specialized work and to handle medium complex engineering tasks in the field of metal casting. The study program is based on basic knowledge in mathematics, physics, chemistry and mechanical engineering, as well as expert knowledge in the area of mould making technology, smelting technology and molten metal quality control, application of information technology in metal casting, iron and non-ferrous metal casting technology, casting error analysis, material testing, welding, surface protection of castings and disposal and recovery of cast iron materials. The holder of this qualification has acquired the necessary knowledge and skills to work in the economy and as an entrepreneur. Employment is not limited to the field of metal casting.*	***Possibility of Employment and Professional Status*** *The holder of this qualification is authorized to use the legally protected academic title of Master in Metallurgy, proving that he / she has acquired / acquired the knowledge and skills required for work in the economy, entrepreneurship and other scientific and professional institutions. Employment is not limited to the area metallurgy.*

2.3. The Higher Education Institution proves that it achieves the anticipated learning outcomes of the study programs that it offers

The Higher Education Institution ensures its achievement of the anticipated learning outcomes in the study programs that it offers.
The Higher Education Institutions, on the basis of evidence on the achievement of learning outcomes (e.g., student tests, research papers, presentations, etc.), continually revises and improves the teaching process.

Within the framework of the program of every single subject in all study programs that the Faculty of Metallurgy offers, the syllabus states the exact way in which the achievement of anticipated learning outcomes will be assessed (undergraduate CRO, undergraduate ENG, undergraduate revised CRO, undergraduate revised ENG, graduate CRO, graduate ENG, graduate revised CRO, graduate revised ENG, vocational CRO, vocational ENG study programs).

Some of the methods of verifying how a higher education institution ensures the achievement of anticipated learning outcomes are performed through: written test (*kolokvij*) (Proof 2.7 passed and failed test), written exam (Proof 2.8 passed and failed written exam), oral exam, term paper (Proof 2.9 term paper), project/program assignment (Proof 2.10) laboratory exercises (Exercise 2.11 laboratory exercise journal), etc. The achievement of learning outcomes at the program level is also ensured through the writing and defence of a final and graduate thesis (Exhibit 2.12).

Based on the monitoring and evaluation of learning outcomes and surveys and the quality assurance system, the Faculty of Metallurgy continually revises and improves its teaching. Learning outcomes are tailored to the needs of the profession and aligned with the needs of the labour market and social needs. Based on the conducted analyses, the results of these studies are reviewed (undergraduate outcomes CRO, undergraduate outcomes ENG, undergraduate outcomes revised CRO, undergraduate outcomes revised ENG, graduate outcomes CRO, graduate outcomes ENG, graduate outcomes revised CRO, graduate outcomes revised EN, vocational outcomes CRO, vocational outcomes ENG.

The Faculty of Metallurgy monitors and periodically revises its programs, and the purpose of regular monitoring, revising, and changing study programs is to ensure that they are appropriately carried out and that they create an effective environment for learning and giving support to students. This includes the evaluation of a variety of things or factors: the content of the program in light of the newest scientific research in the given discipline, by which means the program's contemporariness is ensured; the changing needs of society; the students' workload, progress, passing rates, and graduation rates; the expectations, needs, and satisfaction of the students in terms of the program; the environment for learning and auxiliary services and their usefulness for the program. The revised contents of study programs are published on the Faculty of Metallurgy website, as are changes in the teaching process causing changes of up to 20% to the study program, which are not subject to approval by the Senate of the University of Zagreb but are regulated by decisions of the Faculty Council of the Faculty of Metallurgy.

2.4. The procedures for planning, proposing, and accepting new audits or abolishing existing programs include feedback from students, employers, professional associations, alumni

Development activities related to study programs are systematic and regular and involve different stakeholders.
The planning and proposing of new study programs includes an analysis of justification, capacity, and consistency with strategic goals at the local and national level and other needs in society.
The Higher Education Institution proves the justification for carrying out the same or similar study programs within the same university.
The Higher Education Institution publishes current versions of its study programs.
The Higher Education Institution records the changes in its study programs and analyses their relevance.

Upon the proposal of the Commission for Quality Management, the Dean appoints the members of the Working Group for the Internal Evaluation of the Quality Assurance System of the Faculty of Metallurgy, which conducts an assessment for each academic year and submits a report on the conducted internal evaluation and suggestions for improvements, which are discussed by the Faculty Council, and makes appropriate decisions. These reports are publicly available. Internal evaluation includes the following: an analysis of study program attractiveness, an analysis of successful exams, an analysis of successful completion of studies, an analysis of employment after graduation, an analysis of data on the number of teachers and students, self-evaluation of teachers, SWOT analysis, etc. Based on the results of the evaluations, improvement measures are proposed and decided by the Faculty Council, after which their implementation is monitored. Based on the conclusions of subsequent monitoring, the dean appoints the appropriate working groups, including those whose task it is to carry out a revision of the curriculum and plan of the study programs at the Faculty of Metallurgy. In the case of minor changes (up to 20%), they are proposed and adopted by a decision of the Faculty Council.

For major changes to study programs, a proposal for the revision of a study program must be presented to and accepted by the Faculty Council, after which it is submitted to the Evaluation Committee of the University of Zagreb. The evaluation is carried out by the Working Group on Study Programs, and the final decision is made by the Senate of the University of Zagreb. One example of this was the procedure of revision of the undergraduate and graduate study program at the Faculty of Metallurgy, which started in the 2017/18 academic year (detailed in section 2.1). During the revision, the Student Assembly of the Faculty of Metallurgy and several external stakeholders were consulted, and with their comments and suggestions they helped to revise and harmonize the study programs with the needs of the labour market. In addition, an external party was also a member of the Working Group for the Audit of Undergraduate and Graduate Studies in Metallurgy. In the process of amending a study program and in the process of evaluating the quality of the teachers' teaching, the results of the Student Evaluation Survey as a whole (Proof 2.5, Proof 2.13) are also taken into account.

A significant source of information on the needs of the economy is the feedback received from the participants of the International Foundrymen Conference and the scientific-professional seminars which are organized by the Faculty of Metallurgy. The planning of new study programs takes into account the strategic goals and the development strategy of the Republic of Croatia (industrial, regional). An example of the Faculty's close connection with the economy was the introduction of the specialist study program in Foundry Studies based on the need for the professional training of foundry employees in the Republic of Croatia. Likewise, the lack of experts in the field of environmental protection in industrial production was capitalized on by the Faculty of Metallurgy by introducing the undergraduate orientation in Industrial Ecology in 2011.

2.5. The Higher Education Institution ensures ECTS compliance with actual student workload

The Higher Education Institution harmonizes ECTS credits with actual student load based on the analysis of feedback from stakeholders in the teaching process or other procedures.
Feedback on the results of the analysis of the data collected and the changes made is available to the students

In accordance with the Bologna Process guidelines, the monitoring and analysis of ECTS credit alignment with the actual student load on the course is monitored and analysed. When planning curricula and course content, special attention is paid to the ECTS credits, which are an integral part of teaching assessment and of the curricula all study programs. Each course is assigned a corresponding number of ECTS credits, allocated based on major student activities and workload on courses. 1 ECTS point corresponds to student loads of 25-30 working hours (MF p.17, UNIZG p.13).

ECTS credits are aligned when a study program is revised, and student feedback is taken into account (Proof 2.14). All subjects taught in the undergraduate study program last one semester. The number of subjects (35) is the same for both orientations (Metallurgical Engineering and Industrial Ecology). The revision of the study program reduced the weekly teaching load of the students (141 hours), and the number of specialized subjects in the field of metallurgy increased. Students' weekly obligations were reduced in the 6th semester in both orientations (15 hours) in order to for them to have more time to write as good a final thesis as possible within the foreseen time frame.

For the Self-Evaluation Report, a discussion was conducted with students on the basis of which an analysis of the appropriate allocation of ECTS credits based on student workload was made. For the discussion, students who have so far shown a high degree of success in the program were chosen, but also students with lower grade-point averages, and minutes were compiled from the student conversations. The students were asked the following questions: Do the ECTS credits correspond to the workload required by the student? Do you think that the ECTS credits are correctly allocated according to enrolled subjects (courses) with regard to the workload? Would it be necessary to modify the distribution of ECTS credits on enrolled subjects (courses), if so, why would it be necessary? Other remarks or suggestions on ECTS credits?

The students' answers are given below:

Undergraduate university study program in Metallurgy, orientations Industrial Ecology and Metallurgical Engineering	**Undergraduate university vocational part-time study program in Founding**
In conversation with undergraduate students in both orientations, it was concluded that the students are satisfied with the allocation of ECTS credits according to their main activities and workload and do not consider it necessary to change anything. The students were familiar with the distribution of ECTS credits by subject (i.e., course) and did not have any remarks or suggestions on the overall distribution of ECTS credits.	From the conversation with undergraduate students in the university vocational part-time study program in Founding, we concluded that the students were satisfied with the allocation of ECTS points according to the main activities and the workload, and they did not have any additional complaints or comments.

Graduate university study program in Metallurgy (old program)	Graduate university study program in Metallurgy (new revised program)
Students are partly satisfied with the allocation of ECTS credits. They think ECTS credits are correctly allocated and within a single subject the number of ECTS credits corresponds to the workload that some subject carries (lectures, seminars, exercises, etc.). However, they feel that certain subjects have too few ECTS credits, yet they are aware that the maximum number of credits for the graduate program is 120 ECTS credits, and that it is not possible to assign high scores uniformly on all subjects because then the program would certainly exceed the 120 ECTS credit limit. But in addition, that would also create problems with academic mobility in related EU higher education institutions, where ECTS credits are set very low. Aside from that, the graduate students in this program had no extra comments or suggestions for changing the allocation of ECTS credits.	Graduate students in this program are satisfied with the allocation of ECTS credits according to their main activities and workload, and they do not consider it necessary to change anything because with the study program revision the observed deficiencies were changed. They agreed that 1 ECTS credit corresponds to 25 to 30 hours of regular students and that teaching and exam implementation are therefore coordinated. They also know that the maximum number of ECTS credits in the program is 120, and they offered no additional comments.

Examples of improvement and revision of student workload shown through ECTS credits:

1. A larger number of elective courses was introduced.
2. The subject Introduction to Ecology (undergraduate study program in Metallurgy) had its name changed to Introduction to Industrial Ecology, and its ECTS credits were lowered from 4 to 3 as the student's workload decreased since the seminar was abolished as a form of teaching.
3. In the course Technical Mechanics (undergraduate study program in Metallurgy), the number of exercises increased, while the corresponding ECTS credits increased from 4 to 5 ECTS points, as the student's workload also increases. Rationale: Before the previous revision in the curriculum there were two courses: Mechanics 1 with a weekly schedule of 2 (lecture hrs) + 2 (exercise hours) + 0 (seminar hrs) and Mechanics 2 with a schedule of (1 + 2 + 0). With the last revision, the courses were joined in one called Technical Mechanics with a schedule of (2 + 1 + 0), which is not enough for future metallurgical engineers. Students do not have the time during their auditory exercises to present enough examples of tasks to cover the material from the lectures.
4. For the course Metallurgy of Iron (undergraduate study program in Metallurgy), the exercises were reduced by 1 hour, and as a result, the ECTS credits were reduced from 7 to 5 for the purpose of aligning student workloads. Also, the semester when it is taught was changed from the 5th to the 4th semester due to continuity of subject matter in connection with other subjects.
5. The course Pollution and Protection of Air and Soil (undergraduate program in Metallurgy) was divided into two smaller subjects - Pollution and Protection of Air (2 + 0 + 1) and Pollution and Protection of Soil (2 + 0 + 1) to reduce students' workload. Therefore, instead of one subject with 8 ECTS credits, two smaller subjects with 4 ECTS credits each were obtained, enabling students to follow and master the subject matter more easily.
6. Concerning the course Theory of Metal Forming (graduate program in Metallurgy), the form of teaching was changed, and the weekly schedule was reduced from 3 + 2 + 0 to 2 + 0 + 2. The number of lecture hours was reduced because some of the teaching units were shifted to the undergraduate program when an undergraduate subject entitled Fundamentals of the Theory of Metal Forming was proposed. As a result, student workloads and ECTS credits decreased from 6 to 5 ECTS points.

7. The course Theory of Metal casting has been changed to the Theory of Metals Solidification because it is better suited to the teaching units. The number of ECTS credits from 6 to 4 ECTS points was reduced to align the ECTS credits with the workload of students, as part of this course's essay was transferred to the course named Fundamentals of Metals Solidification at the Undergraduate Study of Metallurgy. One hour of exercise was replaced with one hour of seminar.
8. The course Environmental Protection (graduate study program in Metallurgy) was replaced by a completely new, compulsory course in the field of environmental protection called Best Available Techniques of Environmental Protection in Metallurgy, which was introduced in the 4th semester as a common subject for both specializations of the graduate study program in Metallurgy. Through this subject, students would become familiar with the European Reference Documents (RDNRT) in which the best available techniques (BATs) related to metallurgical processes have been systematically and comprehensively presented. Due to the extensiveness of the subject matter, the weekly schedule increased from 2 + 0 + 1 to 3 + 1 + 1. Therefore, the new course will carry 5 instead of 3 ECTS credits.
9. In the graduate study program in Metallurgy, a new compulsory course with 4 ECTS credits was introduced under the name Socially Responsible Business. It was needed because of the introduction of the new orientation in Industrial Ecology. Reasoning: the holder of a master's degree in Metallurgy with a subject oriented field in Industrial Ecology needs to be acquainted with socially responsible business behaviour and with a strategy of sustainable development for the Republic of Croatia and also needs to be capable of independent work and/or the representation of institutions / companies / municipalities / cities / counties in activities concerning sustainable development.

2.6. Student internships are a constituent part of the study program

The Higher Education Institution enables learning and the acquisition of skills through student internships, where applicable.
Student internships make up part of the study programs and are organized outside the higher education institution in cooperation with the labour market, where this is applicable.
Student internships are implemented in a systematic and responsible way that enables the achievement of the expected learning outcomes associated with practical experience.

According to the Rulebook on Studying, undergraduate students of the Faculty of Metallurgy are required to participate in a 21-day professional internship. The student acquires the right to apply for student internship after having earned 110 ECTS credits in the undergraduate university study program in Metallurgy and in the vocational part-time undergraduate study program in Founding, with 90 ECTS credits. The purpose of the internship is to train students for practicing their jobs in the profession. The Student Internship Guide is an integral part of the Rulebook on Undergraduate Studies and Graduate Studies at the Faculty of Metallurgy. The student can apply for a student internship at the Faculty of Metallurgy or outside of it, and the student application process is initiated by a student by submitting an application to the Students' Desk.

If a student intends to do an internship outside the Faculty of Metallurgy, he asks for this in the student's application signed by a potential supervisor. The Faculty of Metallurgy sends an application to the employer with the student information and the proposed outline of activities. After a positive answer from the employer, the documentation is submitted to the Teaching Committee, which considers the application and proposes to the Faculty Council the approval of student internship, the period of practice, the appointment of a supervising teacher and a professional manager at the employer. The Faculty Council accepts the finalization of the student internship and appoints the supervising teacher and the professional manager at the employer. If required by the employer, a certificate of insurance for a student for work injury and proof of application for compulsory health insurance shall be provided upon the decision of the Faculty Council. The decision of the Faculty Council is delivered to the professional manager, the supervisor, and the student. During the internship, the student keeps a journal that, after his completion of the internship, is signed by the professional supervisor and supervisor. The signed a diary of internship is submitted to the Students' Desk, which submits the index to the vice-dean for certification. After attestation of student internship, the student has completed the 4 ECTS credits (4 ECTS = 21 working days) prescribed by the curriculum (Proof 2.15).

If a student intends to do a student internship at the Faculty of Metallurgy, he asks for this in the application, which is signed by the potential supervisor and the laboratory supervisor if he agrees to the internship. The request is submitted to the Teaching Commission, which considers the request and proposes to the Faculty Council the approval of student internship, the period of internship, the appointment of a supervising teacher and a professional manager in the laboratory. The Faculty Council accepts the finalization of student practice, appoints the supervising teacher and expert counsellor in the laboratory, and they are provided with the Decision of the Faculty Council. During the internship, the student keeps a journal, which, after the internship is completed, is signed by the professional supervisor and academic supervisor. The signed journal of internship is submitted to the Students' Desk, which submits the student's index to the tutor for certification. After attestation of student practice, the student has completed the 4 ECTS credits prescribed by the curriculum. A list of laboratories at the Faculty of Metallurgy in which students can complete their student internship is an integral part of the Faculty structure (ZZPM, ZZMM, ZZFM) (Proof 2.15).

This procedure is described in the Student's Guide to Applying for Student Internships. The Faculty of Metallurgy has signed business cooperation agreements with certain firms, and a list of companies where students have completed their student internships so far are available on the faculty's web site.

An analysis of the feedback of undergraduate students of the Faculty of Metallurgy who have completed their programs on the quality of student internship was made from the evaluation questionnaires of the Office of Quality Management of the University of Zagreb (Exhibit 2.16.). These results show that the students were very satisfied with the organization of student internships outside the Faculty as well as with their cooperation with professionals who work in the field, with average evaluations of "very good" for several years in a row.

Both the students and the employees of the Faculty of Metallurgy are satisfied with such a well-organized and easily applied system of student internships, which provides all stakeholders with only positive and valuable experiences. The Faculty continually monitors this segment of student education and innovates it as needed (valuable information on this topic is available from the *Studies on professional internship in higher education*, Ministry of Science and Education, August 2017).

2.7. Lifelong learning programs offered by the Faculty are harmonized with the strategic goals and the mission of the Faculty and with the needs of the community

The Faculty provides evidence for the consistency of the general lifelong learning program goals with the mission and the strategic goals of the Faculty.
The Faculty provides evidence for the consistency of the general lifelong learning program goals with the needs of the community, the labour market, and with personal needs.
The lifelong learning programs are systematically and regularly revised and developed.

The Faculty of Metallurgy does not carry out lifelong learning through a special study program but conducts individual activities throughout the year. Lifelong learning is defined by the Development Strategy of the Faculty of Metallurgy through the strategic goals of the Faculty for the purpose of teaching and training not only economic stakeholders, but also employees. Lifelong Learning refers to all activities undertaken for the purpose of acquiring knowledge and skills with the aim of their improvement or extension, that is to say personal, social, or professional development, and of an individual or his or her activities. Such learning involves formal and informal programs implemented by the Faculty in order to help the subject adapt to changing circumstances in the work process. Lifelong learning contributes to the increase in the competitiveness and adaptability of the subject in the labour market and for that purpose several education programs have been organized at the Faculty of Metallurgy.

Based on the above, training was held for Adria Čelik d.o.o. with a total of 20 hours of lectures on the topic of environmental protection in steel production in electric arc furnace with the following thematic units:

1. **The metallurgical part** (The Basics of Metallurgy, The Role and Meaning of Steel Production, Basic Reactions in Steel Production, The Steel Production in Electric Arc Furnace, The Basics of Secondary Metallurgy, The Processes of Secondary Metallurgy, Steel Casting, The Basics of Steel Solidification and Defects in Continuous Casting Products);
2. **Environmental Protection in Steel Production in Electric Arc Furnace** (The Principles of Environmental Protection, The Production of Steel in Electric Arc Furnaces (EAF) and its Impact on the Environment, Air Pollution due to Emissions from the Process of Steel Production in Electric Arc Furnaces, Water and Soil Pollution from the Process of Steel Production in Electric Arc Furnaces, EAF Slag: Waste or By-Product, EAF Dust and its Potential Uses as Raw Material, Special Kinds of Waste in Steelwork, Monitoring Steel Waste at the Entrance to the Steelwork, The Importance of the European Directive IPPC (96/61 EC and 2008/1/EC) and IED (2010/75/EU) for Croatian Steelwork.

An educational program for CMC Sisak d.o.o. was also held, with a total of 23 hours with the following thematic units:

1. **Iron** (Pig Iron, Iron Production, Raw Materials in the Production of Iron, By-Products in the Production of Iron, Direct Reduction Procedures (DRI Procedures);
2. **Steel Metallurgy** (The Term and the Systematization of Steel According to Different Criteria (labelling of steel according to EU norms), Raw Materials and Their Preparation for the Production of Steel in Electric Arc Furnace, The Basics of Steel Production in Electric Arc Furnaces, The Basics of Secondary Metallurgy, The Basics of Continuous Steel Casting, The Usability of By-Products (Slag, Electric Arc Furnace Dust), Recent Innovations in Electric Arc Furnaces;
3. **Metal Casting** (Contemporary Concepts and Metal Mould Casting Technology, the Basics of Solidification and the Development of Primary Microstructure);

4. **Final Processing** (The Basics of Rolling Mills and the Characteristics of Rolling Machines, Seamless Pipe Production, Technology of cold forming of profile, Pressing).

These education programs meet the needs of lifelong learning and training programs in order to educate stakeholders for the needs of economic entities, and they are in line with the strategic goals according to the Development Strategy 2011-2016 (pp. 7, 29), Development Strategy 2017-2021 (pp. 11, 22) and Scientific and Research Strategy 2013-2016 (pp. 24, 25).

The Faculty of Metallurgy organizes consultations, panels, and seminars with the aim of improving the skills and competences of the stakeholders. The main objectives of these activities are the personal development of the stakeholders, social responsibility and ultimately meeting the needs of the labour market, i.e. the work process that is subject to change, and improving production technology. The Faculty of Metallurgy continuously conducts thematic workshops, seminars, and professional lectures in order to respond to problems arising from changes in the work process or changes stemming from technological innovations, which require the improvement of the participants of these activities themselves. The Faculty of Metallurgy organizes the now traditional International Foundrymen Conference and scientific and professional seminars in the field of metal casting, and with its popular lectures and workshops it participates in activities such as the Science Festival, SOELA – solar car races, Leap into Science, Leap into Art, Presentation in the Town Library of Petrinja, Metals on the Promenade, Nights on the River Kupa, Metalfest, Open Day at the Faculty of Metallurgy, Energy Day in Sisak, the ARCA International Innovation Exhibition organized by the Croatian Association of Innovators, Zagreb, etc.

The Faculty of Metallurgy offers its employees, as well as students, a chance to enhance and develop their competencies through organized workshops whose goal is to develop skills in line with the advancement of technology, the organization of the working process and the teaching process.

The Faculty of Metallurgy regularly and systematically conducts surveys of the participants of its consultations, workshops, and seminars (examples) through questionnaires after they complete the above-mentioned activities. Based on the data gathered from such surveys, the Faculty considers those activities in order to identify the weak points and to improve them. The data obtained from the surveys filled out by participants of seminars and consultations show a continuous increase of interest in the issues related to industrial ecology, i.e. participants have expressed interest in the fields of metal casting and environmental protection. The monitoring of the participants' satisfaction with the International Foundrymen Conference was presented in the analysis of the questionnaires for 2016 and 2017. The Faculty follows the trends of interest and creates new activities in accordance with the needs and interests of economic subjects. The number of the teaching and research staff of higher education institutions present at the seminars held so far has been stable, which proves that the Faculty sustains continuity in selecting interesting topics for the activities in question. Unfortunately, the lack of high-quality equipment as a consequence of the long-term crisis is causing a decline in the interest of participants for testing methods at the Faculty. However, the Faculty is actively applying for European Funds tenders, trying to provide better high-quality precision equipment for testing and analysing the relevant materials. By acquiring high-quality precision equipment, the quality of scientific research will increase, as well as that of the teaching process itself.

III
The Teaching Process and Student Support

IMPORTANT→CLEAR

The teaching process at the level of higher education institutions must be conceived through the Faculty's program and learning outcomes so that it can attract ambitious young people and support them in becoming independent at solving challenges presented by the realities of business, while developing and supporting their curiosity and their analytical and communication skills so that they will become the kind of graduates the labour market needs.

weaknesses ☒ threats

- lack of interest for the profession
- enrolment
- exam pass rates
- resources (student standard of living, interactive teaching)
- attractiveness of the study program

strengths ☑ possibilities

- new study programs at the first level are directly related to the industry
- expanding the study program at the second level to include industrial ecology
- understanding and applying the interest of the industry
- raising awareness among young people about the industry (challenge, personal development, prosperity)
- scholarships / student practices / professional visits with emphasis on modern production capacities
- good studying conditions, access to research equipment in the laboratory facilities of the Faculty

3.1. The conditions for enrolment or continuation of studies are consistent with the requirements of the study program; they are clear, publicly published, and consistently applied

The criteria for enrolment or the continuation of studies have been published.
The criteria for enrolment or continuation of studies are consistently applied.
The criteria for enrolment or continuation of studies ensure the selection of candidates with the appropriate pre-qualifications, complying with the requirements of the study program.
The Faculty has an effective mechanism for recognizing prior learning.

The criteria for enrolment at the Faculty of Metallurgy are in line with the requirements of the study program and are published on the Faculty web pages. Also defined are the procedures for setting the criteria for enrolment (high school marks, scores on compulsory state secondary-school graduation exams (Matura), optional exams, additional knowledge and skills testing). The criteria for enrolment or the continuation of studies at the Faculty of Metallurgy are consistently applied, because the Dean of the Faculty establishes a commission for enrolment by decree (undergraduate, graduate, vocational study programs), and the commission publishes the candidate ranking list in a timely manner on the basis of a clearly defined scoring method.

The criteria for enrolment or continuation of studies at the Faculty of Metallurgy are established by the Faculty Council (Tender, page 36), and they are aligned with the requirements of the study program. Each potential student applies to the undergraduate study program through the portal of the Central Registration Office. The Central Registration Office (Središnji prijavni ured, SPU) is the national centre for applying to first-cycle study programs, i.e. higher education institutions in the Republic of Croatia. The SPU brings together all the work connected with the process of applying for study programs and the fulfilment of conditions for enrolment in higher education institutions. The enrolment commission publishes the candidate ranking list (undergraduate, graduate) in a timely manner on the basis of a clearly defined scoring method for summer and autumn enrolment schedules. This ensures the selection of the best candidates with the appropriate prior knowledge.

The Faculty of Metallurgy has an effective mechanism for recognizing prior learning. Students in the Undergraduate Study Program in Metallurgy can switch to the part-time vocational Study Program in Founding and have their courses recognized according to the decision of the Faculty Council. The criteria for recognizing these courses are clear and available (Proof 3.1).

Students from other institutions of higher learning who switch to the Faculty of Metallurgy can have some of their completed courses recognized after the ECTS Coordinator's evaluation of their completed courses and with the consent of the concerned teachers. In this way, the procedures and examples of the implementation of the recognition of higher education qualifications, periods of study and prior learning in the case of the continuation of studies have been defined (Proof 3.2).

By conducting a survey, we obtained feedback from students who came from other higher education institutions about their experiences with the recognition of higher education qualifications, periods of study, and prior learning in the case of the continuation of studies. According to the results of the survey, the students were satisfied with the process of recognition of their higher education qualifications and the accessibility of the staff who participated in the analysis of their transition and they were familiar with the financial cost. However, they expected better outcomes of the recognition of prior learning (Proof 3.3).

3.2. The Faculty collects and analyses student progress data on the basis of which it ensures the continuity of studies and student completion

The procedures of student progress tracking are clear and accessible.
The collection and analysis student progress data are regularly conducted.
The Faculty has effective mechanisms for analysing student success and the student exam pass rate, and on the basis of these it initiates appropriate activities.

The evaluation of student work is described in detail in the Quality Assurance Manual (page 23). The procedures of student progress tracking are covered and fully described in the study program conceived on learning outcomes – at the level of courses and at the level of the study program.

As the programs of all courses are conceived on the concept of learning outcomes within each course, continuous tracking of student progress is planned. Data on study progress (exam pass rate, the number of dropouts, graduates, etc.) are available in the IPUP document. The Internal Audit Report (IPUP) is presented regularly every year. The document contains the following elements in relation to this item:

1. The analysis of the attractiveness of the study programs
    a. Revision of the existing study programs
    b. Assessing the exam pass rate
    c. The analysis of the completion of studies rate
    d. The analysis of the data about employment after graduation
2. Ensuring the quality of teaching and the teaching staff
    a. The analysis of the number of teachers and students
    b. Student evaluation of the teaching process and the teaching staff
    c. Scientific research and expert work

The Internal Audit Report (IPUP) is presented regularly every year. The analysis is also conducted through the Teaching Commission (Proof 3.4).

In order to increase the exam pass rate and the graduation rate, the Faculty of Metallurgy has introduced a variety of measures: the workshop "Preparatory semester", a tutoring system (rulebook, reports), a Teaching Commission: 6th regular session in the academic year of 2013/2014 – 1. Univor of the requirements for obtaining the signature and the manner in which the exams are to be taken, 2. The requirements for the enrolment of the courses and the order in which the exams are to be taken.

3.3. The Faculty provides student-oriented education

The Faculty encourages various ways of teaching in accordance with the expected learning outcomes.
Various teaching methods which encourage interactive learning and learning through research, problem solving and creative and critical thinking (e.g. individual and group projects, collaborative learning, problem-based learning, field work, and other interactive methods) are used.
The process of teaching and the teaching methods are continually evaluated and adapted.
The teaching methods are tailored to a diverse student population (non-traditional student population, part-time students, mature students, students from under-represented and vulnerable groups, etc.)
The Faculty ensures the use of advanced technologies to modernize teaching.
Accessible and committed teachers contribute to the motivation of the students and their engagement.
The Faculty encourages students' independence and responsibility.

In order to achieve the expected learning outcomes at the levels of study programs and subjects, courses are conducted as lectures, seminars, exercises, e-learning, project and independent assignments, field work, professional practice, workshops, consultations, or through learning assistance and mentorship. In order for students to acquire the necessary knowledge and skills, i.e. to achieve the expected learning outcomes, verbal, visual and operational teaching methods are applied and combined.

According to the Rulebook and the Quality Manual, the forms of teaching and the teaching methods are continually evaluated through student evaluations of the teaching process and the teachers, conducted as a single university survey and individual surveys of the Faculty, as well as through teacher self-evaluation by a special form. On the basis of the results, the teachers adjust their teaching and teaching methods if needed.

The teachers adapt their teaching and requirements for their subjects for students with disabilities, students with children, students with certain health problems (e.g. exemption from exercises for individual courses), part-time students (e.g., the course schedule for students of the vocational study program in Founding) students belonging to the Roma national minority and other non-traditional student populations. For such students, additional help in studying is provided by the heads of study year, the Student Coordinator for Support, the Coordinator for Disabled Students and tutors (teachers and students).

Desktop and laptop computers, projectors, interactive boards and a number of contemporary specialized software packages (e.g. Autodesk AutoCAD, Autodesk Simulation Mechanical, Solidworks, ProCAST, ThermoCalc, PowerCorr, PowerSuite, ZSimpWin) are used in classes at the Faculty of Metallurgy in order to achieve the expected learning outcomes at the levels of individual study programs and subjects. Additionally, students have access to a computer classroom with a large number of computers. The student room is also equipped with computers. The Merlin eLearning system is a significant part of the teaching process.

For each subject the consultation hours have been set and posted on the website of the Faculty of Metallurgy. Since the number of students is small, the teachers of the Faculty of Metallurgy are also available to them at other times (the mentoring system). The teachers of the Faculty of Metallurgy motivate and encourage students to take part in a range of additional activities. The tutoring system allows for greater contact between teachers and students of the first and second year of undergraduate study and increases their motivation and engagement. Students participate in exercises as student assistants, in collaboration with their teachers they write scientific and professional papers for publication in journals and for international and domestic scientific and professional conferences (the student section at the International Foundrymen Conference), they

participate in professional seminars organized by the Faculty of Metallurgy, in workshops and lectures held at the Faculty of Metallurgy by distinguished guest teachers and experts, they participate in the scientific and the sports part of the science and sports competition "Tehnologijada", they participate in the promotion of the Faculty of Metallurgy, students of senior years can be tutors to students of the first and second year, etc.

The majority of subjects in the study programs contain elements that require students to work independently and responsibly, such as writing and presenting seminar papers, project assignments, laboratory exercises, etc. All the information that students need for their studies is available on the Faculty of Metallurgy website and through the eLearning Merlin system, which contributes to student autonomy over the course of their studies. The teachers of the Faculty of Metallurgy encourage students to participate in writing and presenting scientific and professional papers at international scientific conferences, to take part in the science and sports competition "Tehnologijada", the ARCA International Innovation Exhibition, to write papers for the Rector's Award, etc.

All of these student activities ultimately lead to the completing and defending of final papers. In this last student work, students can rely on unselfish support and assistance from their mentors – from defining the area for the paper, the topics, finding an economic entity in which to complete the experimental part of the paper and appointing an expert leader, learning the proper use and citation of literature, writing the paper, image and other graphics processing and in the end receiving guidelines for the presentation for public defence. The student is not alone in this process, the student is not just a statistic. He or she is being treated extremely responsibly and openly, just as at all other times, from his or her first freshman lecture up to the final paper.

3.4. The Faculty provides adequate support to its students

The Faculty provides its students with counselling about the study program and career opportunities (e.g. tutors, mentors, and other counsellors help students in their learning and progress).
The Faculty has established functional procedures for student orientation, psychological counselling, legal counselling, support for students with disabilities, support for inclusion in outgoing and incoming mobility programs, and library and student services at the university or faculty level.
The students are familiar with the support services.
Student support is tailored to a diverse student population (part-time students, mature students, foreign students, students from under-represented and vulnerable groups, students with learning disabilities, etc.).
The Faculty employs an adequate number of qualified and committed professional, administrative and technical staff.

The Faculty of Metallurgy offers the possibility of counselling and presenting information (all relevant information is available on the Faculty web site) about studying at the Faculty, employment opportunities after the completion of certain levels (study programs) and employment at the Faculty (teaching assistants, professional associates). Students who enrol in the Faculty of Metallurgy are assigned a tutor according to the Rulebook on the Tutoring System (Pravilnik o tutorskom sustavu). The assignment of tutors refers to the students of the first and second years of undergraduate university study. The notice of the assigned tutors is posted publicly on the Faculty website. The students are also publicly informed about the tutors assigned to them and of their obligations related to the tutoring system when they receive their indexes. Student managers are appointed for individual years of study (undergraduate, graduate, postgraduate) to help students study and progress through the study program.

The University of Zagreb and the Faculty of Metallurgy provide support to students. The University has a Student Office (page 93) and an Office for Disabled Students. The Student Coordinator for Support and the Coordinator for Disabled Students and Students with Special Needs of the Faculty of Metallurgy are involved in activities or services for students having to do with psychological counselling, academic development and career development. The Faculty of Metallurgy has signed agreements on student and teacher mobility (Erasmus and Erasmus+). The Preparatory Semester Workshop is aimed at new students in order to help them master selected parts of the curriculum and prepare them, so they can follow the lectures during the first year of their studies. For foreign students classes in English have been prepared.

All library-related information is available on the Faculty website. The Student Office of the Faculty of Metallurgy is available to all students and provides counselling and support to students. On the Faculty web pages, information on the enrolment, paying tuition and attending the study program and decisions related to the different study programs is available. Students are provided with the following administrative services: copying, scanning and printing services, information services, teaching support, Library and Student Office services. Administrative and technical personnel keep up with the latest trends and attend workshops and seminars related to their field of work. The employees of the Student Office attend workshops and seminars related to training in the ISVU, OBAD and ARHINET systems. The library staff attends seminars and workshops related to the Integrated Librarian System of ALEPH and the Digital Academic Archives and Repository (DABAR). An integral part of the internal evaluation of the quality assurance system includes surveys on student satisfaction with the work of the Faculty's administrative and professional services (the average rating is very good).

3.5. The Faculty provides support to students from vulnerable and under-represented groups

The Faculty School monitors the different needs of students from vulnerable and under-represented groups.
The Faculty encourages interest of vulnerable and under-represented groups in studying.
The teaching process is tailored to the individual needs of students from vulnerable and under-represented groups.
The Faculty is investing money in the support for students from vulnerable and under-represented groups.

At the Faculty of Metallurgy, a support service for people from vulnerable and under-represented groups has been established, namely: the Student Coordinator for Support and the Coordinator for Students with Disabilities. Data on students from vulnerable and under-represented groups using the support are managed in accordance with the Personal Data Protection Act. According to the information catalogue, the right of access to the information held and controlled by the Faculty of Metallurgy of the University of Zagreb is regulated by the Access to Information Act. The Faculty of Metallurgy keeps a complete student database solely for the purpose of exercising their rights and obligations (consent to release personal information). The Rulebook on Studying at the Faculty of Metallurgy is tailored to such groups of students. The employees of the Faculty of Metallurgy direct such students to the competition for targeted scholarships.

The popularization of the Faculty of Metallurgy by visiting secondary schools enables future students to get acquainted with the Faculty's study programs and employment opportunities after the completion of their studies. The information about the enrolment, and the application and enrolment procedures have been adapted for people from vulnerable and under-represented groups – they are posted on the web and the bulletin board, and the information can also be obtained in the Student Office. All students have to apply through the Central Registration Office and they are admitted based on the ranking list, we do not discriminate on any criteria. We have a good practice of integrating vulnerable and under-represented students into our academic community.

Students enrolling at the Faculty of Metallurgy have to bring certificates or state that they belong to a group of vulnerable or under-represented students. Based on the submitted certificates, the teaching process and the exams can be adapted to students from vulnerable and under-represented groups. Tailoring the teaching process to the students' individual needs enables them to take exams in their courses, which can be checked by obtaining a transcription of their marks from the ISVU system. For example, a student with a high degree of disability was not able to write or draw using his own hands, but he passed the "Technical Drawing and Computer Graphics" exam as follows: for several types of tasks (orthogonal projection and isometric projection), the teacher prepared six different solutions, only one of which was correct. The student was required to choose the correct projection, and for each incorrect one explain orally what was wrong with it. Other students have to draw the correct projection themselves. The personal assistant to the student with disabilities and a professional associate in the higher education system were present at the examination.

In the academic years 2014/2015 and 2015/2016 the Faculty of Metallurgy had a student with a high degree of disability for the first time and since the building of the Faculty of Metallurgy did not have access for disabled people, it was necessary to do something about that problem. The issue of accessibility for disabled students was addressed by the purchase of a wheelchair stair climber, thus making every room available to the student (relevant proof can be found in the student's personal file).

3.6. The Faculty enables students to gain international experience

The students are informed about the possibilities of attending a part of their studies abroad.
The Faculty provides support to students when applying for and taking part in exchange programs.
The Faculty ensures the recognition of ECTS credits acquired at a foreign university.
The Faculty collects student satisfaction data on the quality of support of the Faculty in practical student mobility issues.
The students acquire the competences needed to work in an international environment.

The students are informed about the possibilities of attending a part of their studies abroad, as all the information related to student mobility is available on the website of the Faculty of Metallurgy and the University. Through student exchanges, students can attend part of their study program or do student internship abroad.

Students of the Faculty of Metallurgy, who have taken part in the Erasmus exchange program, present their experiences to new students during the introductory lecture at the beginning of the first year of studies. Students can be informed about the possibilities of attending a part of their studies abroad by professors as well. The Faculty of Metallurgy also has international students who attend courses with domestic students and thus motivate them to apply for future competitions for student mobility.

At the Faculty of Metallurgy, two people are responsible for providing support to students when they apply for and take part in exchange programs: the Coordinator for International Cooperation and the ECTS Coordinator, as well as their deputies (Proof 3.5). The Coordinator for International Cooperation handles bilateral agreements, Erasmus charters and nominated institutions for international exchange, while the ECTS Coordinator advises the student which courses offered by the foreign institution would be best for the candidate to take.

The students of the Faculty of Metallurgy returning from international exchange at other Universities are ensured to have their ECTS credits recognized. The ECTS Coordinator conducts an analysis to recognize the student's acquired ECTS credits (Proof 3.6).

The Faculty of Metallurgy does not collect student satisfaction data on the quality of support in practical student mobility issues, but students are encouraged to share their experiences with younger generations. Students who are interested in international exchange are referred to the Coordinator for International Cooperation and are also informed about the Erasmus Student Network (ESN), which offers interesting promotional video clips on student exchange. A foreign student who came to the Faculty of Metallurgy using the Erasmus student mobility program for the second year in a row was interviewed (Proof 3.7).

Students acquire the competences needed to work in an international environment. Any course they complete that has not been recognized at the Faculty of Metallurgy is added as a supplement to their diploma (see section 3.9).

3.7. The Faculty provides favourable conditions for studying to foreign students

For foreign students, the information on enrolment and study opportunities is available in a foreign language.
The Faculty provides support to foreign students when applying for and studying at the Faculty.
The Faculty obtains feedback on the satisfaction and needs of foreign students.
Foreign students have the opportunity to attend classes in a foreign language (English).
Croatian lessons for foreign students are available at the level of the University.

Each year, three foreign nationals (from non-EU countries) can enrol in the undergraduate and graduate programs of the Faculty of Metallurgy within the regular enrolment quota. The information on the study programs is available to foreign nationals in a foreign language. The Faculty of Metallurgy participates in the student exchange within the Erasmus+ international exchange program. On the basis of the information available in a foreign language, Erasmus students choose courses that they will take as part of the Erasmus exchange at the Faculty of Metallurgy. Part of the study program can be performed in a foreign language if needed.

There were no foreign students taking their entire studies at the Faculty of Metallurgy in recent years (since the Croatian Homeland War, 1991–1995). Incoming mobility within the international exchange of Erasmus+ programs at the Faculty of Metallurgy is active. Bilateral agreements and the Erasmus charter enable incoming student mobility. Examples of incoming mobility implementation are as follows: in the academic year 2016/2017 two students from Poland and two students from Montenegro (Proof 3.8) and in the academic year 2017/2018 two students from Ukraine and two students from Montenegro (Proof 3.9). The Vice Dean of Academic Affairs and the ECTS Coordinator help incoming students fill in the application forms, while other employees help them fulfil their obligations with the city institutions. A major problem of studying in Sisak is the accommodation of incoming Erasmus students. The employees of the Faculty of Metallurgy help the incoming students find adequate accommodation.

Since the Faculty of Metallurgy has only had incoming student mobility for the last two academic years, the process of obtaining feedback on the satisfaction and needs of foreign students is still being implemented. Namely, incoming students complete a survey that can only be seen at the end of the project after a report has been made at the University level (email sent to the University - Proof 3.10). There is a possibility that a survey could be conducted by the University next academic year, and we will be notified about its results.

Foreign students have the opportunity to attend classes in a foreign language (mostly English). There are incoming students who want to attend classes in Croatian. Croatian language lessons for foreign students are available at the level of the University. The Faculty of Humanities and Social Sciences at the University of Zagreb teaches Croatian language courses for foreign students who study at Croatian universities at its CROATICUM Centre.

3.8. The Faculty ensures objective and consistent evaluation and grading of students' achievements

The criteria and methods of evaluation and grading are clear and published before the individual subjects start.
The criteria and methods of evaluation and grading are aligned with the teaching methods applied.
The Faculty provides support in developing skills related to testing and examination methods for anyone who is to grade students.
If possible, the Faculty conducts evaluations of the grading process.
The evaluation procedures take into account the special circumstances for particular groups of students (adapting the test technology, for example for students with disabilities), while ensuring that the expected learned outcomes are achieved.
The students receive feedback on the results of the evaluation and, where appropriate, learning tips based on them.

The criteria and methods of evaluation and grading are clearly defined and published before the individual subjects start and are presented in the Quality Manual (page 23). In the syllabus for each subject, it is clear which share of ECTS credits pertain to the oral exams, written exams, program assignments and the like (undergraduate, graduate, professional study programs). The teaching programs are also approved by the Faculty Council, as well as by reviewers appointed by the University of Zagreb. The teachers also explain the evaluation methods for a particular course in its introductory lesson.

The Faculty of Metallurgy accepts all the activities of the Centre for the Promotion of Teaching Competences (CeZaN). However, the Centre offers few workshops (Proof 3.11), so the ways in which to improve our teaching competencies are reduced to learning from our mentors and through our own teaching practice.

In June 2016, a workshop for 30 participants under the title "Material Engineering – the Foundation of Innovative Economy" was held at the Faculty of Mechanical Engineering and Naval Architecture in Zagreb with the aim of improving teaching competences. Several teachers from the Faculty of Metallurgy attended this workshop (Proof 3.12). The teachers of the Faculty of Metallurgy attend mentoring workshops (Proof 3.13). The teachers of the Faculty of Metallurgy attend the "Learning Outcomes" workshop on a competency approach to planning study programs and enhancing the actual competences of students designed for university teachers (Proof 3.14). Annual university surveys also help in developing various skills. We have a Student Coordinator for Support at the Faculty of Metallurgy, who coordinates the organization of student workshops organized by the Student Counselling and Support Centre (Centar za savjetovanje i podršku studentima, CSPS) (Proof 3.15).

The Faculty of Metallurgy regularly submits a report on the implementation of internal evaluation (IPUP) at a session of the Faculty Council every year. This document contains the following elements related to this item: the examination of the exam pass rate and the student evaluation of the process of teaching and the teaching staff. If the analysis of the results of the evaluation of the teachers and associates and the process of teaching by the students through the university student survey proves to be unsatisfactory, the Rules of Procedure according to the Conducted Evaluation of the Teachers and Associates are applied. The Dean and one of his associates have access to the university surveys, where they can find student commentaries and feedback from the students about the teachers' objectivity and consistent implementation of the evaluation and grading process. The students have access to the survey results at the Faculty level through the student representatives at the Faculty Council.

If a student retakes his or her exam in a particular course at the Faculty of Metallurgy for the third time (fourth time total in one year, or eight time total the following year), the exam is conducted before a commission. The student can lodge a complaint (The Rulebook on Studying, Article 56) within 24 hours if he or she is not satisfied with the grade. The Dean then forms a three-member examination commission which will repeat the exam within 48 hours. The appeal procedure at the Faculty of Metallurgy has not been initiated in the last 15 years.

In the academic years 2014/2015 and 2015/2016, the Faculty of Metallurgy had a disability student with the diagnosis of Duchenne muscular dystrophy who used a wheelchair. The then Dean managed to procure a wheelchair stair climber, a device for the transport of wheelchairs through staircases, which allowed the student to attend his courses. Unfortunately, in his second year of studies, the student died due to his illness. From his grade print out from the ISVU system, it is evident that, despite his illness, the student passed numerous subjects where the teachers had to adapt the test technology for the exam. The student could not write using his own hands, but he explained the solutions of the problems orally. During his studies he had several personal assistants. His last personal assistant is currently a second-year student at the Faculty of Metallurgy.

The aforementioned student with a high degree of disability was not able to write or draw using his hands, but he passed the "Technical Drawing and Computer Graphics" exam as follows: for several types of tasks (orthogonal projection and isometric projection), the teacher prepared six different solutions, only one of which was correct. The student was required to choose the correct projection, and for each incorrect one explain orally what was wrong with it. Other students have to draw the correct projection themselves. The personal assistant to the student with disabilities and a professional associate in the higher education system were present at the examination.

The students of the Faculty of Metallurgy receive feedback on the results of the evaluation (example: the results of the colloquies are published on the MERLIN system) and, where appropriate, learning tips based on them. Students get an insight into their corrected tasks and, depending on the questions, they get answers to them. Furthermore, every teacher of the Faculty of Metallurgy has his or her office hours posted on the web, where they are available for consultations.

3.9. The Faculty guarantees the issuance of diploma supplements and appropriate information on qualifications

By completing the studies, students are issued appropriate documents (diplomas and supplementary study program documents) describing the qualifications, the achieved learning outcomes and the level, content and status of the study program.
Diplomas and supplementary study program documents are issued in accordance with the relevant regulations.

Pursuant to the Law on Scientific Activity and Higher Education, the Rulebook on the Contents of Diplomas and Supplementary Study Program Documents and the Rulebook on Attending the Undergraduate Study programs and the Graduate Study Program of the Faculty of Metallurgy, upon the completion of the programs, students receive a diploma or certificate (vocational study program in Founding) and a supplementary study program document about the study level to provide insight into the level and the content of the study program and the system and rules of study at the Faculty of Metallurgy. The diploma or the certificate confirms that a student has completed a particular degree and has acquired the right to a particular academic or professional title (Proof 3.16, Proof 3.17, Proof 3.18).

3.10. The Faculty carefully considers the employability of its students after their studies

The Faculty analyses the employability of its graduates.
The enrolment quotas are adjusted to meet the needs of the community, the labour market and the resources of the Faculty.
The Faculty informs future students about the possibilities of continuing their education or of employment after graduation.
The Faculty provides support to its students with regard to future career planning.
The Faculty maintains contact with former students.

The Faculty of Metallurgy systematically conducts analyses of the employability of graduates according to the Quality Manual and through the internal evaluation of the Faculty quality assurance system. The analyses are conducted according to the data collected from the ISVU system, based on the knowledge acquired through personal contacts and on the basis of the data of the Croatian Employment Service (see point 2.1 of the Self-Evaluation Report and Proof 2.2.).

There is a justification for the study programs and enrolment quotas at the Faculty of Metallurgy, with regard to market needs, the support of the local community (the joint project – Centre for Founding – SIMET) and the support of economic entities (cooperation with the industry). Namely, the employees of the Faculty of Metallurgy successfully cooperate with almost all metal processing and metallurgical companies in the region and the Republic of Croatia, and without their contribution it would be impossible to expect that the present industrial production could be sustained. The Faculty of Metallurgy with its staffing and infrastructure capacities ensures the high quality of teaching. In order to improve the study programs themselves and the justification of the enrolment quotas, the development of material, human and financial resources have been identified as one of the strategic objectives of the Faculty of Metallurgy, even though the existing number of students and the enrolment rates correspond to the space capacity of the Faculty of Metallurgy. The enrolment quotas at the University are set by the Senate of the University of Zagreb, based on the proposal of individual components, and for the Faculty of Metallurgy this proposal largely depends on the needs of the economy.

The website of the Faculty of Metallurgy continuously publishes useful notices for future students and graduates with job vacancies, where future students can see what their future employment might be, and graduates have the opportunity to apply for job vacancies in a timely manner. The popularization of the Faculty of Metallurgy by visiting high schools enables future students to get acquainted with the Faculty's study programs and employment opportunities after the completion of the study programs (Proof 3.19).

The Student Coordinator for Support at the Faculty of Metallurgy is available to students for any form of assistance in their career planning. The University of Zagreb provides support to both domestic and foreign students through its web site. Foreign students who come to the Faculty of Metallurgy as part of student exchange also participate at the Welcome Day for foreign students of the University of Zagreb, and this helps them in their plans for their further study.

Promotional activities conducted by the Faculty of Metallurgy play a significant role in familiarizing current and future students with opportunities for employment: Open Day, seminars, conferences (opportunity to speak directly with participants and representatives of companies, sponsors), organized visits to economic entities.

Continued contact with former students of the Faculty of Metallurgy can be seen through various activities. Former students, and today's employees of various companies, actively participate in the popularization of the Faculty of Metallurgy by visiting secondary schools in the cities where their companies operate (examples: MIV d.d., Varaždin, Ferro Preis d.o.o., Čakovec). Former students also participate in the activities of the Faculty of Metallurgy, such as the Open Day of the Faculty of Metallurgy (examples: Alas-info d.o.o., Applied Ceramics d.o.o., Almos d.o.o.). Former students also participate in the working groups of the Faculty of Metallurgy for the preparation of reaccreditation, namely in the Working Group for deep analysis and revision of the Undergraduate and Graduate Study Program in Metallurgy (external associate from Ferro Preis d.o.o., Čakovec). In addition to participating in working groups, former students are regular members of the Commission for Quality Management of the Faculty of Metallurgy (external associates from Ferro Preis d.o.o., Čakovec and ABS Sisak d.o.o.). The association Alumni and Friends of the Faculty of Metallurgy in Sisak AMA-MEFS (Udruga bivših studenata i prijatelja Metalurškog fakulteta u Sisku), operates within the Faculty of Metallurgy, and it actively participates in the gathering of former students through participation in various events (Brucošijada [a party for freshmen], dinner for Faculty Day, etc.).

IV
Teaching and Institutional Capacities

IMPORTANT→CLEAR→JUSTIFIED→
APPLICABLE→VERIFIABLE→CONFIRMED

Our employees and our students are our greatest resource. The Faculty of Metallurgy has to become the desired employment and study choice.

Weaknesses ☒ threats

- dislocation
- equipment and human resources
- dependency on budget funds
- lack of teams for funding projects
- joining global ideas
- investing boldly and wisely with the sense of purpose of the investment
- professional ethics

Strengths ☑ possibilities

- availability
- recognisability of the area of interest and easy identification of research and research areas
- a multidisciplinary approach
- loyalty to the profession and professional ethics
- using existing resources in the best possible way
- enthusiasm and desire for education to attract financial resources
- pulling together
- assigning value to professional work and forming expert teams
- lifelong learning projects

4.1. The Faculty provides adequate teaching capacities

The number and qualifications of the teachers are adequate for the realization of the study program and the acquisition of the excepted learning outcomes.
The ratio of students and permanently employed teachers at the Faculty is adequate for a high-quality study process.
The teachers' workload is in line with the applicable legal and subordinate regulations, acts of competent bodies, collective agreements, etc.
The teachers' workload ensures a uniform allocation of teaching responsibilities, scientific work, professional and personal development and administrative responsibilities.

The number and qualifications of the teachers are adequate for the realization of the study programs and the acquisition of the excepted learning outcomes. The Faculty of Metallurgy has 5 full professors (2 of whom are tenured full professors), 11 associate professors, 4 assistant professors and 6 teaching assistants. Of the 20 teachers in teaching and research positions, 18 teachers are in the technical fields (14 teachers in the field of metallurgy, 2 teachers in the field of mechanical engineering, 2 teachers in the field of chemical engineering) and 2 teachers in natural sciences (physics and mathematics).

According to the internal evaluation data, the total number of undergraduate and graduate students in the last five academic years (from 2012/2013 to 2016/2017) was fairly uniform and was 131, 123, 135, 135 and 123 respectively. The number of teachers varied between 26 and 34 and the average student-teacher ratio was 4.3 to 1. At the undergraduate level this ratio was 3.7 to 1, and at the graduate level slightly less than 1 to 1.

The teaching for all study programs of the Faculty of Metallurgy is covered by the Faculty's own staff. The Faculty of Metallurgy hires external associates for two subjects - Physical Education and The English Language. Classes of instruction are available on the Faculty's web site (undergraduate programs, graduate programs, vocational programs).

All teachers of the Faculty of Metallurgy are qualified to teach in all study programs. Employment is carried out in accordance with the needs of the teaching process and the strategic goals, following the discussions in the Departments, the Dean's College and the Faculty Council, in accordance with the prescribed procedure. All competitions, as well as the results of the competition procedures, are published publicly.

Taking into account the curriculum of the undergraduate and graduate study programs, the teachers have enough workload, as provided by the legislation (Proof 4.1).

According to the Rulebook on the Internal Organization and the Organization of Jobs at the Faculty of Metallurgy, the teachers have the following tasks: undergraduate, graduate and postgraduate teaching (lectures, exercises, seminars), tasks considered an integral part of the teaching load (consultations, reviewing and correcting the curriculum, grading seminar papers, mentoring of final and graduate papers, master's and doctoral theses, conducting midterm and final exams, preparing their classes, improving their teaching skills, working at the Faculty Council, working in Faculty commissions), scientific research and scientific development (working on projects, including preparation work for projects, scientific development and publishing scientific papers), scientific and expert work for the market carried out within the Faculty and through the resources of the Faculty, other tasks assigned to them by the Dean, a superior employee or stipulated in the contract of employment.

4.2. The method of hiring teachers is objective, transparent and based on excellence

Teacher recruitment procedures stem from the development goals of the Faculty and are aligned with the legal regulations and internal acts.
When selecting, hiring and evaluating teachers, their professional history (teaching activity, research activity, feedback from students, etc.) is taken into account.
The procedures for the employment of teachers are regulated by the Faculty acts, they are transparent, implemented consistently and within the prescribed deadlines.
The Faculty has the appropriate methods of selecting the best candidates for each job and, in addition to the state prescribed minimum conditions for a particular job, it has stipulated competitive criteria that guarantee excellence.

The initiative to employ a new teacher comes from a particular department, which is in line with the staff policy stated in the Development Strategy, taking into account the overall coefficient of the institution (the Faculty) and the consent of the University and the relevant ministry.

The procedure of election or reelection to titles conducted on the basis of the Rulebook on Election to Titles and the Guidelines for the Initiation of procedure for election/reelection to titles and job position).

Before a teacher is hired, a public tender for the appointment to a particular teaching and research position is announced. Candidates apply and submit the necessary documentation (within 30 days) including their CVs, diplomas, certificates of citizenship, bibliography, data about their scientific, teaching and professional background. In the case of a teacher's promotion, the Faculty of Metallurgy issues a certificate on the institutional assessment of teaching quality based on the results of the University's Teacher Assessment Survey. After the procedure is completed (the Selection committee has to be appointed, they have to prepare a report, the Faculty Council and the Field Council have to reach their decisions), the appointed teacher signs the employment contract with the Faculty and the results of the tendering procedure are published publicly.

Based on the examination and verification of the submitted documentation by the candidates for the competition, the Selection committee appointed by the Faculty Council submits a report and a proposal for the candidate to be appointed to the position in question and for his or her recruitment. If there is more than one candidate, the Selection committee studies and verifies the submitted documentation for each of the candidates individually and submits reports for each candidate to the Faculty Council. The Selection committee, based on the separate reports on candidates who applied to the competition, proposes the best candidate, taking into account his or her scientific, teaching and professional background and additional conditions of the Faculty that are stipulated in the Rulebook on Election to Titles.

The report of the Selection committee is based on the overall activity of the applicant in his or her scientific, teaching and professional work. In the analysis, special attention is paid to the candidate's contribution to the development of curricula and study programs, the introduction of new subjects at all levels of study, the opening and organization of new laboratories and practicums, the authorship and co-authorship of university textbooks, compiled lecture notes and teaching materials, the mentoring of final and graduate papers and doctoral theses, reviews of textbooks, etc. The evaluation of the candidate's scientific and research activities is based on the candidate's contribution to the publication of scientific papers in prestigious international and domestic journals, to the presentation of papers at international and domestic conferences, the candidate's citation frequency (international visibility), leading and participating in international and domestic scientific and research projects, invited and/or plenary lectures at international

conferences, membership in program and/or scientific commissions at conferences, etc. In evaluating the professional activity of the applicant, the number of published and presented professional papers, realized professional projects, expert reports, expert evaluations and elaborates, etc. is taken into account. The evaluation of the teacher based on student surveys is also one of the criteria applied.

For positions of assistants, we have the Rulebook on the conditions, criteria and the procedure for the appointment of assistants, i.e. associate positions, whose criteria include the candidate's grade average, the total length of his or her studies, awards and acknowledgments (Rector's Award, Dean's Award, etc.) during the candidate's studies, the area of his or her diploma paper, scholarships, knowledge of another language, published and/or presented papers, etc.

Examples of conducted procedures of employment, election and reelection to titles can be found in:
Proof 4.2. The employment of an assistant
Proof 4.3. The employment of an assistant professor
Proof 4.4. The election to higher title

4.3. The promotions and reappointments of teachers are based on objective and transparent procedures

Objective and transparent procedures are applied for the promotion of teachers.
The procedures for the promotion of teachers are based on evaluating and rewarding excellence.
Additional criteria for the promotion of teachers reflect the strategic goals of the Faculty.
For the promotion of a teacher, important achievements (e.g. contribution to the discipline at the international level, publications in prestigious journals, significant scientific discoveries, successful projects, obtaining additional funds, the mentoring of final and graduate papers, the authorship of lecture notes and textbooks, popular lectures, etc.) are taken into account.
Indicators of excellence include scientific, teaching and professional work and contribution to the development of Faculty.

Every promotion of teachers and scientists at the Faculty of Metallurgy is carried out strictly in accordance with the applicable laws and regulations and is based on objective criteria. Every teacher and scientist is fully acquainted with all the applicable rules in a timely fashion and is able to plan his or her own professional career. The promotion of teachers and scholars is carried out in accordance with the limitations imposed by the Faculty's maximum sum total coefficient and there has never been any objection from any teacher or scientist that he or she was not given a chance to be promoted. This fact points to high-quality planning and the objectivity and transparency of the procedures at the Faculty of Metallurgy. Every year, assessments of possible advancements of teachers and scholars or retirements are made (the teachers state whether they plan to remain in the same position or advance). Based on this information, advancement plans are made.

For the advancement of teachers to senior positions, selection committees are formed in accordance with the applicable laws and regulations, and they evaluate the excellence of candidates who apply for a promotion through a public tender. After a thorough study of all the relevant documents, selection committees make their decisions and send proposals to the Faculty Council of the Faculty of Metallurgy whether or not they recommend a particular teacher for a higher position. So far, the Faculty Council has never ignored a proposal of a selection committee, which attests to the quality of work of the selection committees.

Additional criteria for the advancement of teachers are stipulated by the Rulebook on Election to Titles of the Faculty of Metallurgy, and selection committees check whether or not a particular applicant meets the additional criteria of the Faculty of Metallurgy. If the applicant fails to meet the additional criteria of the Faculty of Metallurgy, he or she cannot be appointed to the position. Strategic goals of the Faculty of Metallurgy were set up by the Development Strategy of the Faculty of Metallurgy 2017-2021, and additional criteria for the advancement of teachers and scientists correspond to strategic goals, because emphasis has been placed on the ability to solve concrete technological problems of the metallurgical industry and the ability to design new technological processes as well as to create technical solutions for concrete problems of the metallurgical industry. The additional criteria of the Faculty of Metallurgy stimulate professional work, and they stimulate the teachers of the Faculty of Metallurgy to patent their inventions.

In the process of advancement of teachers, selection committees are formed for the appointment of teachers and they study the overall career of the candidates thoroughly before reaching their decision. In doing so, they take into account all the important achievements and, on the basis of their expert judgment, they make a proposal to the Faculty Council of the Faculty of Metallurgy.

Special emphasis is placed on the publication of scientific papers in world-renowned journals, which reflects one's contribution to the profession at the international level, on leading or participating in international projects, on lectures at international conferences, as well as on presiding over or working in editorial boards of international journals, etc. Crucial criteria also include designing new curricula for undergraduate, graduate and postgraduate studies, mentoring final and graduate papers and doctoral theses, published textbooks, compiled lecture notes and reviewed teaching materials on the website of the Faculty of Metallurgy. An important criterion is also professional activity with emphasis on published patents, elaborates and expert evaluations.

In their reports to the Faculty Council of the Faculty of Metallurgy, selection committees give a detailed analysis on the scientific, teaching and professional work of candidates in separate chapters. On the basis of thoroughly studied achievements of candidates in their scientific, teaching and professional work, the selection committee makes a final proposal on the selection or non-selection of a candidate. When the conditions achieved by a candidate are compared to the minimum conditions needed for appointment to a particular position, the vast majority of scientists from the Faculty of Metallurgy significantly exceed the minimum conditions.

Proof 4.4. details the process of advancement of an employee from the teaching and research position of an assistant professor to the position of an associate professor.

In accordance with the Quality Assurance Manual, one of the activities for the quality assurance of teachers is public recognition of the contribution to the activities of the Faculty of Metallurgy at a solemn session of the Faculty Council for the Faculty Day, which is one of the performance indicators. At solemn sessions awards are presented after nomination and selection procedures for the awards have been completed. It is also important to point out that the Rulebook on setting the criteria for evaluating the contributions of the employees to the activities of the Faculty of Metallurgy is in development and foreseeably it will be adopted at the Faculty Council in April 2018.

We also have Instructions on employee training (Naputak o usavršavanju zaposlenika) which further enhances excellence at the Faculty of Metallurgy. Another kind of training and specialization are activities within the framework of international mobility, which the teachers prove in their qualification papers when they apply for public tenders for appointment or reappointment to a particular position. Also, the teachers improve their competences by participating in lifelong learning activities (see section 3.8. of the Self-Evaluation Report).

4.4. The Faculty supports its teachers in their professional development

The Faculty provides its teachers the opportunity to enhance their teaching competences at the faculty or university level.
The Faculty promotes the evaluation and improvement of teaching competencies of its teachers based on the recommendations obtained by peer-evaluation of their teaching performance and based on the results of student evaluation.
The teachers participate in international mobility programs, collaborative projects, networks, etc.

The Faculty of Metallurgy offers its teachers the opportunity to improve their competences by organizing seminars, conferences, workshops and panels which the teachers and other Faculty employees attend. Also, the Faculty supports its teachers in their participation in lifelong learning activities that improve teacher competences (see section 3.8. of the Self-Evaluation Report).

The evaluation and improvement of teaching competences is carried out on the basis of the results of student surveys on the work of their teachers, and is regulated by the Rules of Procedure on the results obtained. The teachers are not evaluated by their colleagues, but all the issues related to the implementation of the teaching process (classes, student activity and exam pass rate) are discussed within the relevant department and the Commission for Teaching. In that sense, certain recommendations are given to the Dean and to the Commission for Quality Management.

The teachers are always informed about all domestic and foreign tenders for the allocation of financial resources for scientific research projects. They can count on the support of their colleagues and the Faculty administration for every necessary professional, administrative and technical assistance. Science research groups are allocated financial resources according to their scientific production, within the Financial support for research program, at the proposal of the Commission for Science and Finance and with the final decision of the Faculty Council.

The teachers are also always informed about tenders to which they can apply for mobility and can count on the support of their colleagues and the Faculty administration to help them fulfill their current teaching obligations. All mobility is entered in the International Cooperation Database of the University of Zagreb. An example of mobility can be found in the appendix (Proof 4.5.).

The right to use a sabbatical at the Faculty of Metallurgy has not been used yet due to a small number of teachers and difficulties in covering the classes of a teacher who would go on a sabbatical. However, this possibility exists and is elaborated in the Rulebook on taking a study leave and sabbaticals.

4.5. The facilities, equipment and the whole infrastructure (laboratories, IT service, worksites, etc.) are suitable for the implementation of the study programs and they ensure the achievement of the excepted learning outcomes and the realization of scientific and professional activities

The Faculty plans and improves its infrastructure development in accordance with the strategic goals.
The facilities, equipment and the whole infrastructure (laboratories, IT service, worksites, etc.) are suitable for the implementation of study programs and they ensure the achievement of the expected learning outcomes.
The facilities, equipment and the whole infrastructure (laboratories, IT service, worksites, etc.) are suitable for the realization of scientific and professional activities.

At the Faculty of Metallurgy, a lot of attention is paid to the development of infrastructure. The development of infrastructure is planned within the Faculty's annual and three-year financial plans. During the process of election of the Dean of the Faculty of Metallurgy, each candidate for the position of the Dean of the Faculty of Metallurgy has to present a plan for the development of infrastructure in his proposed work program. The strategic goals defined with the development of material resources are closely related to the planned development of infrastructure. Following a number of successfully completed steps, the project Centre for Founding – SIMET is in the final stage of approval by the European Regional Development Fund. The infrastructure project Centre for Founding, recognized as a priority in the KET research area, is in line with the Research Infrastructure Development Plan of the Republic of Croatia, the Ministry of Science, Education and Sports, 2016 and the Strategic Plan of the Ministry of Economy for the period 2015-2017. Likewise, the project proposal of the Centre for Founding is fully aligned with the Industrial Strategy of the Republic of Croatia 2014-2020 and the Regional Development Strategy of the Republic of Croatia until the end of 2020. The realization of this project will fully contribute to the improvement of the existing infrastructure through the procurement of research equipment unavailable in the Republic of Croatia and its European environment and to the organizational reform of the Faculty. A complete list of the equipment and infrastructure is available in Proof 4.6. This is a clear indicator of the international recognizability of the Faculty of Metallurgy as a scientific and educational institution without which it would be impossible to imagine the development of Croatian metallurgy.

At the Faculty of Metallurgy, the facilities, equipment and the whole infrastructure are formally satisfactory for the implementation of study programs. Namely, the equipment and infrastructure are functional but outdated and they do not meet the requirements of positive legislation in the field of energy and ecological efficiency. Likewise, they are not in line with the expected, contemporary, methods of interactive teaching (development of practical, logical, generic, social skills). The implementation of the project Centre for Founding – SIMET will significantly improve the situation at the Faculty of Metallurgy in this segment and will facilitate the planning of new curricula.

The facilities of the Faculty of Metallurgy extend to a total of 3,228 m^2 (34,746 ft^2). Lecture halls take up 339 m^2 (3,649 ft^2) and the laboratories and practicums of the Faculty of Metallurgy take up 1,071 m^2 (11,528 ft^2). The Faculty of Metallurgy has six lecture halls and one computer lecture hall. The lecture halls are in good condition since considerable resources have been invested in their renovation and equipping over the past years. Taking into account the existing number of students and the enrolment quota, the spatial capacities of lecture halls and laboratories are in line with the needs of the Faculty's activities. For students it is convenient that the vast majority of lectures at the Faculty of Metallurgy take place in the morning hours. The Faculty has seven

laboratories, which are used for teaching and for scientific research and professional work of teachers and students. There are no worksites within the Faculty of Metallurgy, and several teachers share individual teacher offices. The computer lecture hall (72 m^2 [775 ft^2]) is constantly being modernized in accordance with the Faculty's financial means.

Research activities at the Faculty of Metallurgy are carried out through the methodology of experimentation and modeling for the purpose of developing materials, products, technology and process optimization. The Catalogue of Equipment and Research (Katalog opreme i istraživanja) at the Faculty of Metallurgy is publicly available. Equipment has not been supplied to the Faculty in the past few years due to the lack of financial resources and the high infrastructure demands required by sophisticated equipment. The maintenance of existing equipment is carried out by taking money from research grants and partly from the means for the overhead; however, these means are very modest.

The students have a newly reconstructed student activity room at their disposal that is used by the Student Club. The students are extremely dissatisfied with the fact that there is no student home in the city of Sisak and even more so with the fact that there is no cafeteria within the building of the Faculty of Metallurgy. Unfortunately, despite all the efforts of all previous administrations of the Faculty of Metallurgy, these two problems have not been solved. Their solution is outside the competence of the Faculty of Metallurgy and the students are aware of this fact.

The students and the employees of the Faculty have access to the internet through the local area network (LAN) and by a wireless connection. Wireless connectivity within the AAI@EduHr system (the so-called EDUROAM) was introduced at the Faculty of Metallurgy in 2010. After being located on SRCE, on December 16th, 2015 the address of the Faculty of Metallurgy was added as the first location of the eduroam probe outside the headquarters of SRCE. The system of eduroam probes is a service designed at SRCE used to test the condition of the service from the perspective of a potential eduroam user at a particular location. After the initial measurements, the eduroam service at the site of the Faculty of Metallurgy was found to meet the system criteria. In the forthcoming period, through the information obtained from the system, possible failures and difficulties in the operation can be detected and, based on the information obtained, improvements can be introduced if they are needed to increase the quality of the service. As part of the e-Infrastructure Day held at SRCE from May 23rd-25th, 2016, the Faculty of Metallurgy received the award for promoting the eduroam service in the category of mid-sized institutions. In the category of large institutions, the award was received by the Faculty of Education and Rehabilitation Sciences, University of Zagreb, and in the category of small institutions by the Clinical Medical Centre Osijek.

In 2011, the Faculty of Metallurgy adopted the Rules for opening, administering and use of user accounts at the server of the Faculty of Metallurgy siscia.simet.hr.

The Faculty of Metallurgy is also the county CARNet hub.

4.6. The Library, its equipment and access to additional features ensure access to scientific literature and library services for the purpose of high-quality study and high-quality scientific and teaching activities

The library, its equipment and additional features provide high-quality study requirements.
The library, its equipment and additional features fulfill the requirements of high-quality scientific and teaching activities.

The library of the Faculty of Metallurgy with its reading room (90 m^2 [969 ft^2] work area and 75 m^2 [807 ft^2] of storage space) is part of the Integrated Library System of the National and University Library in Zagreb and the library from the system of science and higher education, which enables searches in the Aleph system. The online directory is available from our web site, as well as from the other libraries of the Aleph Integrated Library System. In addition to this, the Library of the Faculty of Metallurgy is also searchable in the Joint Catalogue of libraries in the system of science and higher education, which is publicly available (in its test version), and provides information on printed and electronic resources available in more than 45 library catalogues of university, higher education and specialist libraries in the Republic of Croatia (including funds from the National and University Library in Zagreb and the Library of the Faculty of Humanities and Social Sciences, University of Zagreb). It provides users with information about the location of a particular book, as well as the information on its availability and the number of copies available. Based on all of this, it is evident that contemporary literature used in teaching at the Faculty, as well as relevant electronic databases and teaching materials designed for students are available. For most of the courses, the library has a sufficient number of copies of titles selected for required reading, which enables students of the Faculty of Metallurgy to fulfill their obligations on time. Feedback from the students about the possibilities of using the Faculty library can be seen in the Internal Audit Report, where the students gave high grades for all segments of the operation of the Library over the last few years.

Students and teachers also have access to the services of the University Computing Centre (SRCE), which enabled the founding of the Repository of the Faculty of Metallurgy as a part of the Digital Academic Archives and Repositories in 2015, where all graduate papers are regularly stored beginning from its establishment.

The Faculty of Metallurgy has a number of titles needed for teaching and scientific research at its disposal. The library regularly receives new issues of some journals (Metalurgija, Matematičko fizički list, Materiali in Tehnologije, etc.). There is an insufficient number of printed versions of magazines from the metallurgical field. Titles which are not available at the Faculty of Metallurgy are acquired through the interlibrary loan system, primarily in cooperation with other libraries of other faculties in the country, while the borrowing from abroad goes through the National and University Library in Zagreb. Through the portal of electronic sources for the Croatian academic and scientific community, we have access to databases with a national license and databases with a license of the University of Zagreb. In addition to using the interlibrary loan system, the Joint catalogue search as well as the repositories, primarily those used by the University Computing Centre (Ara, Hrčak, Dabar), we also have access to all relevant electronic databases. Despite the small number of journals arriving in printed form, these are available either in electronic form (databases) or via the interlibrary loan system.

A part of Library is Class Material Bookshop (Skriptarnica) where it is possible to obtain various titles published by the Faculty of Metallurgy. In addition to this, the Library also provides an ISBN assignment service. The rules of operation for the Library and the conditions and the manner of use of books and other library materials are regulated by the Rulebook of the Library of the Faculty of Metallurgy.

4.7. The Faculty manages its financial resources rationally

Financial sustainability and efficiency are visible in all aspects of the operation of the Faculty.
The Faculty manages its financial resources transparently, efficiently and appropriately.
Additional funding sources are used for the development and upgrading of the Faculty.
Additional funding sources are provided through domestic and international projects, cooperation with the industry, the local community, etc.

From the structure of its revenue, it is evident that the Faculty of Metallurgy is financially viable with the revenue it receives from the Ministry of Science and Education and the University of Zagreb. The revenue coming from its own activities shows that the Faculty of Metallurgy as an institution has far greater potential in cooperation with economic entities.

Additional sources of funding are secured through scientific research projects funded by the Croatian Science Foundation, research grants funded by the University of Zagreb, cooperation with industry (e.g. Saint Jean Industries, Bentoproduct, Almos Kutina, etc.). The Student Center in Sisak supports student activities and the students' participation at scientific and sports competitions of technology faculties of the Republic of Croatia (Tehnologijada). Through grants for projects funded from the Structural Funds and the EU Cohesion Fund in the period 2007-2013, the Faculty of Metallurgy received funds for the first phase of the Centre for Founding – SIMET project. The Faculty of Metallurgy also obtains additional funds from cooperation with the Faculty of Organization and Informatics (Proof 4.7.).

The Faculty of Metallurgy organizes the International Foundrymen Conference and seminars in the field of founding. Part of the income realized in these organized activities is set aside for the upgrading of the Faculty of Metallurgy. 15% of the income coming from the Faculty's own business activity is set aside (Conference Proof 4.8., income realized in cooperation with the economy, revenue from the programs of lifelong learning). The employees participate in professional seminars, work training, and they increase the knowledge base of the Faculty.

The Faculty of Metallurgy manages its available financial resources very responsibly and sparingly.

Namely, in 2003 the Faculty of Metallurgy adopted a *Special collective agreement on the distribution of revenue and the determination of salaries or other employee benefits from revenues obtained from the market*, which was cancelled on December 22nd, 2009 by the then dean as an anti-recession measure. This decision is still in effect.

The Faculty of Metallurgy has always made sure to implement and introduce energy efficiency measures to reduce energy consumption. This issue is continuously addressed by a specially appointed commission (Proof 4.9.). In 2006 the windows at the Faculty were replaced, a year later the radiators, and in 2012 a new heating system was introduced. Namely, before 2012 the Faculty was heated by the use of its own two boilers with extra light fuel oil, and from the heating season of 2012 it has been using services of hot water pipline company Toplinarstvo. This significantly reduced the cost of heating, as the average spending in Croatian kunas for 2009, 2010 and 2011 was kn283,296.03 and for the heating season of 2016 the costs were kn155,906.21, saving a total of kn127,389.82 (Proof 4.10.).

The Faculty of Metallurgy has two certified energy advisors. Their role is to monitor the consumption of energy (heating, electricity and water), propose measures to reduce energy consumption, produce monthly readouts of energy consumption, make annual calculations and send data to the Energy Management Information System - ISGE (Informacijski sustav gospodarenja energijom, Proof 4.11.). The energy consumption is monitored on an oscillation diagram, so that increased consumption can be checked and measures can be promptly taken.

According to the Energy Efficiency Certificate (Proof 4.12.), the Faculty received an E classification, which means that the Faculty of Metallurgy has to continue to work on reducing energy consumption. In this respect, the responsible person periodically seeks and receives reports from the energy consultants and investigates the possibilities of further action (Proof 4.13.).

The management of financial resources is in line with the adopted financial plan.

During the preparation of the financial plan for the following three-year period, all employees are involved: the heads of the departments submit plans for the said periods to the Vice Dean for Science and Finance, who draws up the financial plan in cooperation with the head of the institution and the Head of Accounting. The final financial plan then has to be adopted by the Faculty Council.

In the periodic and annual reports, the revenues and expenditures of the current year are compared with the previous one and thus the increase in revenues and expenditures compared to the previous year is controlled. All financial reports are available on the website of the Faculty of Metallurgy.

All financial plans and reports are regularly published on the Faculty's website: https://www.simet.unizg.hr/hr/dokumenti/unutarnja-financijska-kontrola.

On December 8th, 2011, the Dean of the Faculty of Metallurgy issued a Decision on the Appointment of a Person in Charge of Irregularities on the basis of the Law on Internal Control Systems in Public Institutions. As can be seen from the Report on Irregularities (Proof 4.14.), the Faculty of Metallurgy has no irregularities.

The operation of the Department of Accounting is transparent and clear: in December 2011, flowcharts were developed which apply for the period of Self-Evaluation (2013-2017), and which are related to the receipt and registration of incoming invoices and the payment and filing of incoming invoices. In November 2016, an addition was made in the flowcharts:

1. Flowchart (supplement) – Payment and filing of incoming invoices
2. Flowchart (supplement) – Receipt and entry of incoming invoices

At least twice a year the employees of the Accounting Office attend professional seminars organized by advisory institutions as part of their training and this increases the knowledge base of the Faculty.

V
Scientific Activity

IMPORTANT→CLEAR→JUSTIFIED

With the synergy of scientists, equipment and networking, scientific research in one's own field of research along with the spreading of interdisciplinary fields is the basis of innovation and progress.

According to the Statute of the Faculty of Metallurgy, scientific and research work of the Faculty has two strategic directions. Strategic directions **Metallurgical Engineering and Industrial Ecology** belong to *Advanced Production Technologies*, an activity verified at the European level, while the strategic direction of **Engineering Metal Materials** of the Faculty of Metallurgy can be included within the European activity of *New Advanced Materials*.

weaknesses ☒ threats

- enrollment
- material, human and financial resources
- the equipment

strengths ☑ possibilities

- understanding and applying the interest of the industry
- scholarship contracts / possibility of experimentation
- the purpose of the doctoral dissertations is to strengthen the economy
- using existing resources in the best possible way
- the applicability of scientific and research work
- participation on the international scientific stage
- recognizability
- supporting innovation
- supporting project proposals
- the consistency of research and the development of the core area with the introduction and application of interdisciplinary areas

IMPORTANT→CLEAR→JUSTIFIED→APPLICABLE

Scientific research connected with the economy is the basis for professional work – providing advice, services and knowledge to economic entities that are looking for it and need it. Scientists have to be able to develop tools and skills in order to apply their knowledge to the conditions of real industry. Professional work has to be revived by connecting and networking at the local and national levels, resulting in personal and professional development of individuals, attracting investments, strengthening and developing research fields, and the emergence of innovations.

Weaknesses ☒ threats

- unrecognizability
- non-integration into national bases (HKO, HZMO)
- lifelong learning programs verified by competent professional organizations
- resources

Strengths ☑ possibilities

- experts who can provide the best solutions possible
- the only national institution in the metallurgy sector
- centres of excellence
- the catalogue of equipment and research
- support in the compilation of expert evaluations, studies, and elaborates
- expert work that meets the needs of the economy and also brings money

5.1. The teachers and associates employed at the Faculty are devoted to achieving high quality and quantity of scientific research

The teachers and associates publish an appropriate number of high quality scientific publications.
The Faculty has effective procedures of encouraging the publication of high quality scientific work.
The Faculty keeps records about the publications.
The scientific activity of the Faculty is visible in doctoral theses.
The teachers and associates of the Faculty actively promote scientific achievements at national and international conferences.

The Strategic Goal of the Faculty of Metallurgy is scientific activity based on fundamental, applied and developmental research, which continually systematizes scientific knowledge and represents scientific achievements. There are two strategic directions of the Faculty's scientific research: **Metallurgy Engineering and Industrial Ecology**, belonging to the European verified activity of *Advanced Production Technologies* and **Engineering Metal Materials** within the European activity *New Advanced Materials* (the Development Strategy of the Faculty of Metallurgy for 2011-2016, pg. 22, the Development Strategy of the Faculty of Metallurgy, 2017-2021, pg. 23, the Scientific Research Strategy of the Faculty of Metallurgy, 2013-2016).

The scientific interest and role of the Faculty of Metallurgy is reflected in the research and development of metal materials production in the Republic of Croatia, both for semi-finished and finished products. Therefore, the research activity of the Faculty of Metallurgy is aimed at improving the situation in metallurgy and metal processing industry, which can be achieved by fulfilling factors such as: improving product quality, increasing production, high energy efficiency, low emissions of pollutants and the introduction new advanced technologies. This implies the imperative of increasing the transfer of technology and research results between scientific and educational institutions, of positioning oneself on the European and world map of scientific excellence, as well as consolidating and developing cooperation with small and medium-sized enterprises.

The strengthening of scientific research activity is based on the implementation of modern strategies and concepts. The validity of scientific research is reflected in targeted research into material development and the transfer of technology to partners from the real sector according to the principle "from an idea to the finished product". There are three main directions of these activities:

1. the design of innovative engineering materials according to specific market requirements and the characterization of the synthesized or innovated material according to the specific improved and/or more demanding final product properties,
2. product development using sophisticated CAD/CAE technology (CAD – Computer Aided Design, computer-aided design of the product development process and the preparation of structures for production, and CAE – Computer Aided Engineering)
3. lifelong learning (L3) – the goal of lifelong learning is to bring sophisticated equipment and research and knowledge based on them to students, experts from the economy and all the interested stakeholders. This will enable the development of engineering skills, innovativeness and inventiveness in project task solving and it will launch experts competent on a global scale into the metal processing industry and metallurgical enterprises.

Teachers and associates disseminate the results of their scientific work in national and international publications. Most of the papers are published in international journals featuring all three branches in the field of metallurgy (processing, mechanical and physical metallurgy), chemical engineering, mechanical engineering, physics and mathematics. In the last five years a total of 99 scientific papers have been published in international and domestic journals. In the journals of the highest category (A1), quoted in tertiary publications/databases, 59 scientific papers have been published, of which 44 are quoted in the Current Contents (CC) database. 34 scientific papers have been published in journals cited in secondary publications/bases (A2). 6 scientific reviews and 7 professional papers have been published in journals cited in secondary publications/databases (A2). 6 scientific papers and 1 professional paper have been published in the C group journals. Thus, in the period between 2013 and 2017, the teachers and associates of the Faculty of Metallurgy published a total of 113 papers in various journals. A significant number of papers (97) were products of collaboration with faculties and scientific organizations in the country and abroad (the Faculty of Chemical Engineering and Technology, University of Zagreb, the Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb, the Faculty of Science, University of Zagreb, Ruđer Bošković Institute in Zagreb, the Faculty of Natural Sciences and Engineering, University of Ljubljana, the Technical Faculty, University of Belgrade, the Faculty of Metallurgy and Materials Science, University of Zenica, etc.). 1 book was published in Croatia, and 3 chapters of a book were published (Proof 5.1., Table 5.1.).

In the last five years, according to the Web of Science Core Collection (WoSCC) database for the total citation of the papers published in the journals cited in that database, excluding self-citation, is 134, total h-index: 15 (Proof 5.2.). According to the Scopus database, total citation for the papers published in the journals cited in that database, the total citation, excluding self-citation, is 111, total h-index: 14 (Proof 5.3.).

All departments of the Faculty of Metallurgy provide support to the teachers and associates in publishing high quality works, especially Accounting Office, the Secretariat, the Dean's Office and the Library. The support is verified by the signature of the Dean on all relevant documents (applications, agreements, contracts, invoices). The Institution provides well-equipped and maintained facilities for conducting scientific research on existing equipment as well as applications for tenders in order to modernize the equipment and the facilities for scientific research and professional work. The Faculty of Metallurgy encourages the reporting and active participation in projects and the procurement of research equipment with the aim of achieving the results needed for the publication of high quality scientific papers and the promotion of the teaching staff. Scientific research is evaluated by internal evaluation, which forms the basis for the allocation of funds appropriated within the Financial Support for Research program. The employees are informed about the possibilities of reporting a project and the ways of leading domestic and international projects and mobility programs, which enable networking and greater scientific respectability while making an unimpeded teaching process possible.

A record of published scientific papers, professional papers, projects, books, monographs and the like is kept and updated annually and published publicly:
https://www.simet.unizg.hr/hr/znanost/statistika-radova-papers-statistics
https://www.simet.unizg.hr/hr/znanost/znanstveno-istrazivacki-projekti
https://bib.irb.hr/lista-radova?sif_ust=124

Writing a doctoral thesis is the foundation of proving one's own scientific competencies. In the period from January 1st, 2013 to December 31st, 2017 two research assistants defended their doctoral theses at the Faculty of Metallurgy, and they are still employees of the institution. In collaboration with their mentors, they have published a number of scientific papers in international journals and in proceedings from international conferences, which stemmed from their doctoral theses (Proof 5.4.).

The teachers and associates of the Faculty of Metallurgy are very active in presenting the results of scientific research work at international and domestic conferences. They participated in scientific and professional conferences with a total of 208 scientific papers, out of which 157 scientific papers were published in various proceedings, and 51 papers were published in proceedings/books of abstracts. A total of 170 scientific papers were results of collaboration with faculties and scientific organizations in the country and abroad. In addition to this, 10 professional papers were published in proceedings and 2 professional papers in books of abstracts. According to this, in the period between 2013 and 2017, the employees of the Faculty of Metallurgy participated at scientific and professional conferences with a total of 220 peer-reviewed papers (Proof 5.5.). Over the past five years, the Faculty of Metallurgy organized four International Foundrymen Conferences and several expert conferences in the form of seminars with the goal of transferring knowledge on achievements in the field of metallurgy (Proof 5.6.) and co-organized 5 international conferences (Table 5.4.).

The exchange of scientific and expert knowledge through the organization of the International Foundrymen Conferences and other scientific and professional conferences confirms the significance of the Faculty of Metallurgy as an institution that brings together scientists and researchers, businessmen and representatives of domestic and international associations of metallurgy and related fields.

5.2. The Faculty proves that its scientific and professional research and the transfer of knowledge are socially relevant

The Faculty monitors the needs of society and the labour market and considers them when planning its research activities.
The Faculty has an effective support system for research and transfer of knowledge and technology.
The teachers and associates of the Faculty participate in the activities of scientific and professional associations.

In the Science Research Strategy for the period between 2013 and 2016, as well as within the framework of the General Strategy for the Development of the Faculty of Metallurgy for the period between 2017 and 2021, and strategies at the state level, chapters related to scientific research have been elaborated and, in accordance with them and the High Quality Policy of the Faculty of Metallurgy, action plans are being implemented in accordance with the needs of society and the labour market:
Strategic Plan for the period 2017-2019 Ministary of science and education (page 77)
Industrial Strategy of Republic of Croatia 2014-2020 (page 214)

The Faculty of Metallurgy is integrated into the economy as well as into the broader and the local community, which enables it to monitor their needs and the needs of the labour market. Over the past five years, cooperation with a number of business entities and institutions has been achieved both in the country and abroad. Cooperation with the companies in the field of metal casting has been especially intensified. The goal of the Faculty to become a reference institution that will carry out scientific, high-technological and laboratory research comparable to the best practices in Europe and the world is reflected through the establishment of the Centre for Founding - SIMET (Proof 5.7.).

As a direct result of the scientific research work at the Faculty of Metallurgy, one patent was submitted (Proof 5.8.). Collaboration with the economy was realized in the form of concrete service and support contracts in the application of new technologies and solving the problems of metallurgical production. In the period between 2013 and 2017 the employees of the Faculty of Metallurgy prepared 63 reports for economic entities (Proof 5.9.), and an example of such report (from the order to the final report) is Proof 5.10.

The Faculty of Metallurgy is very active in the transfer of knowledge and technology to the economy through its professional activity. In addition to expert reports, expertises and professional elaborations, in the period between 2013 and 2017 professional papers were published in periodicals and proceedings from conferences and a number of activities related to the popularization of the profession were carried out. 7 professional papers were published in journals cited in secondary publications/databases (Proof 5.1.). 3 popularization articles (Proof 5.11.) were published, and 2 papers were published in professional journals (Proof 5.12.). In international proceedings, 10 professional papers and 2 abstracts of professional papers were published in the proceedings of international conferences (Proof 5.5.).

From the available data, significant employee engagement is evident in the organization and participation in numerous activities related to the popularization of science and consultations for the public (Open Day of the Faculty of Metallurgy, the Science Festival, Leap into Science, Zagreb University Fair, Sisak MetalFest, Soela, Energy Day in Sisak, etc.) (Proof 5.13.). By organizing workshops and forums and through the system of lifelong education, the Faculty of Metallurgy conducts education of students, its employees and the general public (Proof 5.14.).

In the process of transfer of knowledge and technology, the Faculty of Metallurgy, which has been the core of higher education in the city of Sisak and the whole region since its establishment, has the support of the local community. Apart from active involvement in the organization of scientific and professional conferences, the support comes in the form of valuable donations for the organization of various events and gatherings (Day of the Faculty of Metallurgy, Tehnologijada, expert excursions and the like) (Proof 5.15.).

In addition to their basic tasks in teaching, research and professional activities, the employees contribute to the local and wider community through their involvement in professional and public bodies in the private and public sectors (Proof 5.16.). The representation of the employees is even greater in local, professional and civic associations through which the employees of the Faculty of Metallurgy promote and improve their activities (Proof 5.17.).

5.3. The scientific and professional achievements of the Faculty have been recognized at the national and international level

The teachers, associates and professional staff have won university, national and international awards and acknowledgments for scientific/professional achievements.
The Faculty conducts a number of scientific/professional projects (university, national and international projects).
The teachers, associates and experts frequently participate at national and international conferences as invited speakers.
The teachers and associates are members of scientific/expert conference boards and journal editorial staff.

The teachers of the Faculty of Metallurgy have received 7 awards for scientific and professional achievements over the last 5 years. It should be emphasized that the teachers and associates actively participate in the ARCA International Innovation Exhibitions, where in the last 5 years they won a total of 4 international awards for their achievements and innovations. The teachers, associates and expert staff from the Faculty of Metallurgy actively use the eduroam service and participate in its promotion, and as part of the e-Infrastructure Day, SRCE, the Faculty of Metallurgy received the award for the promotion of the eduroam service in the category of mid-sized institutions (Proof 5.18.).

Scientific research at the Faculty of Metallurgy is carried out through international and domestic projects and under the Financial support for research program. In the period between 2013 and 2017 the Faculty of Metallurgy was the holder of an international project funded by the European Regional Development Fund, a partner in an international project funded by the European Social Fund, the holder of two bilateral projects, the holder of two and a partner in three domestic projects of the Croatian Science Foundation, as well as a partner in the establishment of a scientific centre of excellence. (Proof 5.19., Table 5.3.).

In 2013, the funding of 5 scientific projects was stopped by the Ministry of Science and Education, and from then onwards research has been financed through the financial support of the University of Zagreb. So far there have been 26 such studies. Priority research topics at the Faculty of Metallurgy are in correlation with the strategic research directions in the Republic of Croatia in terms of the development of advanced materials, environmental protection and energy efficiency research.

The teachers of the Faculty of Metallurgy are recognized as well-established experts in metallurgy and industrial ecology, and they held 9 invited lectures at international conferences in Slovenia, Bosnia and Herzegovina and Serbia in the last 5 years (Proof 5.20.).

In the last 5 years, the teachers and associates of the Faculty of Metallurgy were members of scientific/program commissions 76 times at 35 international conferences and were members of organizational commissions 25 times for 13 international conferences (Proof 5.21., Table 5.4.).

In the period from 2013 to 2017, the Faculty of Metallurgy organized the International Foundrymen Conference 4 times. The conference is continually held in cooperation with numerous domestic and international higher education institutions and economic entities from the wider region (Table 5.4.). A large number of teachers and associates from the Faculty of Metallurgy, as well as numerous scientists from other national and intergovernmental institutions, participate in the organization of the conference (as members of the organizational, program and review commissions).

In the same period, the Faculty of Metallurgy co-organized 5 international conferences in the field of materials, ecology and recycling (Table 5.4.).

In the period between 2013 and 2017, the teachers of the Faculty of Metallurgy were members of the editorial boards of 4 journals, for one of these as the editor-in-chief and for 1 journal as a member of the international supervisory board (Proof 5.21., Table 5.5.).

5.4. The scientific activity of the institution of the Faculty is both sustainable and developmental

The development strategy of scientific activity is aligned with the vision of the development of the Faculty.
Scientific activities of the Faculty represent the realization of the strategic program.
The Faculty has appropriate resources for scientific activities.
The Faculty recognizes and rewards scientific achievements of its employees.
The Faculty continually improves its scientific activity by financing, increasing human resources, adapting the facilities and investing in the necessary equipment, obtaining appropriate literature, supporting dissemination of results and drawing up doctoral theses.

The Development Strategy of the Faculty of Metallurgy is aligned with the institution's vision of development, which is evident from the anticipated strategic goals of scientific research, which includes the improvement and upgrading of postgraduate doctoral study programs, scientific research, and advancement and training of the employees.

The Quality Assurance Manual defines the activities, the time of implementation and performance indicators for achieving the strategic goals set by the Strategy, which are in line with the Vision and Mission of the Faculty, for increasing the participation of researchers in competent scientific research projects, and for improving teacher mobility, which will increase the competencies of scientific and teaching personnel in the field of metallurgy and industrial ecology.

The purpose of the Faculty of Metallurgy of the University of Zagreb is to create new knowledge and to educate the Faculty personnel in the area of technical sciences, the field of metallurgy and to transfer technological solutions to economic entities, with the goal of developing the society and boosting the economy. Research carried out within the framework of scientific projects at the Faculty of Metallurgy contributes to the growth of fundamental, applied and developmental knowledge in the field of metallurgy, chemical engineering, mechanical engineering and physics and mathematics. This also contributes to the development of the competences of the teachers of the Faculty of Metallurgy and to the better transfer of knowledge through undergraduate, graduate and postgraduate doctoral studies. The quality of scientific research, international recognition of the Faculty of Metallurgy and the publication of joint research in co-authorship with foreign scientists raise the level of the teachers' mentorship competences and the training of PhD students.

The employees' scientific research within projects and support programs (Proof 5.19., Table 5.3.) and their published papers (Proof 5.1.) are in line with the predicted strategic directions and defined areas in the Development Strategy of the Faculty of Metallurgy 2013-2016 and the Development Strategy of the Faculty of Metallurgy 2017-2021. Raising the scientific and teaching competencies of the employees is stimulated by the mobility of employees to international higher education institutions, as foreseen by the Quality Assurance Manual (Priručnik za osiguravanje kvalitete) (pp. 31-32) and by the Rulebook on the Doctoral Study of Mechanical Engineering, Naval Architecture, Aeronautical Engineering and Metallurgical Engineering (page 6).

With the goal of transferring information to teachers and students and encouraging scientific research activities in the direction of research strategic directions, the Dean and the Faculty Council appointed members of the Commission for Science and Finance, coordinators and their deputies for international cooperation and scientific projects, as well as for international mobility,

members of the Commission for the evaluation of student mobility applications received under the Erasmus Program and the ECTS Coordinator and Deputy.

The facilities for scientific research are at the same time used as facilities in which student laboratory exercises within the curriculum are carried out. The Department of Process Metallurgy consists of three laboratories: *The Laboratory for Iron, Steel and Metal Casting, the Laboratory for Chemistry, Hydrometallurgy and Corrosion Testing* and *the Laboratory for Industrial Ecology*. The Department of Physical Metallurgy includes *the Laboratory for Physics and Structural Examinations* and *the Laboratory for the Development and Application of Materials*, while the Department of Mechanical Metallurgy includes *the Laboratory for Processing Metal by Casting* and *the Laboratory for Heat Engineering and Mechanical Engineering*.

The Faculty of Metallurgy has compiled a Catalogue of Equipment and Research conducted at the Faculty of Metallurgy in order to increase the visibility and distinctiveness of competences with the goal of strengthening cooperation with other higher education institutions and economic subjects.

The Faculty has a computer classroom equipped with 25 modern computers that meets all the teaching and research needs of students. The computers contain advanced software packages designed for computer modelling and numerical simulations.

The Library of the Faculty of Metallurgy provides scientific literature, with a rich book and magazine fund. The Library also provides access to online databases for the scientific and teaching staff and students of all levels of study.

Quality Assurance Manual (pages 43, 47) in section 7.3. as part of Activity 8, provides for the recognition of the contribution to the activities of the Faculty of Metallurgy of its employees, students and external stakeholders at a solemn session of the Faculty Council for the Faculty Day. The Commission for Student Papers and Awards and The Commission for the Establishment of Criteria and Evaluating Employee Contributions to the Activities of the Faculty of Metallurgy submits a proposal to the members of the Teaching Commission for consideration, after which the proposal is forwarded to the Faculty Council, which makes the final decision on awarding the prizes. In the academic year 2016/2017 at the solemn session of the Faculty Council for the Faculty Day, 1 doctoral candidate was awarded for her remarkable contribution to the scientific, professional and teaching activities of the Faculty of Metallurgy in the academic year 2015/2016 (Proof 5.22.), while on the same occasion in the academic year 2016/2017, 5 employees of the Faculty of Metallurgy were awarded for their outstanding achievements and contribution of special significance to the development and reputation of the metallurgical profession (Proof 5.23., Proof 5.24., Proof 5.25., Proof 5.26.).

The Faculty is aware that the existing measures for the motivation of employees are insufficient and the regulations on awards are being drafted, which will transparently define the criteria for awards and accolades to employees. In this sense, a Working Group for the elaboration of the Rulebook on the establishment of criteria for evaluating employee contributions to the activities of the Faculty of Metallurgy has been set up.

In the period between 2013 and 2017 at the Faculty of Metallurgy a total of 8 people were employed in new jobs and 1 employee in an existing position of a technical associate. In 2013 1 assistant professor was employed in the area of technical sciences, field of mechanical engineering at the Department of Mechanical Metallurgy. In 2016 by 1 expert associate was employed in the system of science and higher education at the Department for Process Metallurgy and 1 teaching assistant in the area of technical sciences, filed of metallurgy at the Department of Mechanical Metallurgy. In 2017, 3 teaching assistants were employed in the area of technical sciences, 2 teaching assistants in the field of metallurgy and 1 in the field of chemical engineering at the Department of Process Metallurgy. Furthermore, in 2017, 2 assistant professors were employed, 1 in the area of technical sciences, the field of engineering at the Department of Mechanical Metallurgy, and another assistant professor in the area of natural sciences, the field of mathematics at the Department of Physical Metallurgy. A technical associate was employed by the Department for Process Metallurgy in 2017. Presently, the procedures for new 2 jobs are in progress, 1 assistant professor and 1 teaching assistant at the Department for Process Metallurgy and the Department of Mechanical Metallurgy:

https://www.simet.unizg.hr/hr/dokumenti/natjecaji-za-radna-mjesta
https://www.simet.unizg.hr/hr/dokumenti/rezultati-natjecaja-za-radna-mjesta

The financial investment of the Faculty of Metallurgy in the period between 2013 and 2017 in research equipment and computer programs is visible in the financial statements of the Faculty and is presented in chapters 4.5. and 4.7. of this Self-Evaluation Report.

The Library of the Faculty of Metallurgy regularly acquires new books, the computer classroom for students of all levels of study is well equipped and new programs are continuously being acquired in line with the teaching and scientific activity. The dissemination of scientific papers and doctoral theses is ensured by the financial means coming from scientific projects and supports (Proof 5.19., Table 5.3.).

5.5. The scientific and professional activity and the achievements of the Faculty are improving the teaching process

The equipment for scientific research is used in undergraduate, graduate, and postgraduate study programs.
Undergraduate, graduate, and postgraduate students are included in the scientific projects of the Faculty.
The teaching process in the postgraduate university study program and doctoral theses reflect the scientific research and achievements of the Faculty.

The Faculty has seven laboratories whose equipment is used in the laboratory exercises of undergraduate, graduate and doctoral study programs, which is clear from the plans of the undergraduate and graduate programs in Metallurgy. Laboratory equipment is also used for the purpose of producing final and graduate papers as well as doctoral theses.

Within the framework of the course "The Optimization of Casting Designs" a workshop using the ProCast software tool for numerical simulation of casting and rolling of castings is regularly held under the guidance of a renowned foreign expert.

Finally, the Faculty's scientific and teaching staff uses the existing equipment in their scientific work and integrates the results of their research into their teaching.

The teachers introduce the students to scientific research and planning activities, critical analysis of the results and the production and presentation of scientific papers. Already during the undergraduate and graduate study programs, students are actively involved in scientific projects through the production of scientific papers presented at national and international scientific conferences, within student sections (Proof 5.27., Proof 5.28.) and in the scientific part of the international student manifestation of faculties of technology students, Tehnologijada (Proof 5.27.). Furthermore, the best student papers were rewarded with the Rector's Prize (Proof 5.29.).

In the period between 2013 and 2017, the employees of the Faculty of Metallurgy published a total of 28 scientific papers in collaboration with undergraduate and graduate students, of which 1 scientific paper in a journal and 27 scientific papers in the proceedings of international conferences. Scientific papers in co-authorship with students were developed within the subjects of scientific projects and the short-term financial support program of the Faculty (Proof 5.28.).

The students of the postgraduate doctoral study of the Faculty of Metallurgy are involved in active scientific research projects and the short-term financial support from the University of Zagreb program as associates (Proof 5.30.) and in the last 5 years they have published a total of 66 scientific papers, with 3 papers in journals cited in the CC database, 16 scientific papers in other journals, 36 scientific papers in proceedings with an international peer-review, 4 papers in proceedings without reviews, 4 other papers in proceedings, and 4 summaries from an international scientific conference (Proof 5.31.).

The Rulebook on the Doctoral Program in Mechanical Engineering, Naval Architecture, Aeronautical Engineering, Metallurgical Engineering makes the participation of PhD students in scientific research work compulsory, they have to present and publish research results, by which they achieve the required ECTS credits (page 6).

Students of all levels of study also participate in activities undertaken by the Faculty of Metallurgy in order to increase the visibility of the Faculty and the profession itself and to popularize science (Proof 5.32., Proof 5.13.).

In Proof 5.33. examples of the inclusion of undergraduate and graduate students in the research activity of the Faculty of Metallurgy can be found.

The employees of the Faculty of Metallurgy teach in the study program of Metallurgy Engineering, a joint postgraduate doctoral study of the Faculty of Mechanical Engineering and Naval Architecture and the Faculty of Metallurgy Mechanical Engineering, Naval Architecture, Aeronautical Engineering and Metallurgical Engineering, in line with the respective competences and field of their scientific research, as evidenced by the published works in the field relevant to the program course (Proof 5.1.). The Rulebook on the Doctoral Program in Mechanical Engineering, Naval Architecture, Aeronautical Engineering and Metallurgical Engineering, the method of enrolment, selection of courses and selection of the topic of the doctoral thesis with the help of a study advisor is defined. All employees of the Faculty of Metallurgy in scientific and teaching positions can be mentors of doctoral theses, and most of the teachers have already participated in mentoring workshops organized by the University of Zagreb.

In the period from 2013 to 2017, two doctoral theses of the postgraduate doctoral program in Metallurgy were defended at the Faculty of Metallurgy (Proof 5.4.). Students of the joint postgraduate doctoral program Mechanical Engineering, Naval Architecture, Aeronautical Engineering and Metallurgical Engineering will also conduct their scientific research for their doctoral theses in the framework of active projects and the support from the Faculty of Metallurgy (Proof 5.30.), where they are involved as associates.