Sveučilište u Zagrebu
Grafički fakultet

Strategy of Scientific Research
University of Zagreb
Faculty of Graphic Arts
2021 - 2028

The document entitled "Strategy of Scientific Research of the Faculty of Graphic Arts, University of Zagreb from 2021 to 2028" was prepared by the Committee appointed at the 4th extraordinary electronic session of the Council of the Faculty of Graphic Arts in the academic year 2022/2023, Ref. No: 602-04/23-04/1, Reg. No.: 251-80-06-23-04, on 16th January 2023, composed of teachers of the Faculty of Graphic Arts as follows:

1. Asst. Prof. Marina Vukoje, PhD - Vice Dean for Science and International Cooperation, chairwoman
2. Assoc. Prof. Miroslav Mikota, PhD - Vice Dean for Education and Student Affairs, member
3. Full Prof. Ivana Bolanča Mirković, PhD - chairwoman of the Committee for Doctoral Studies and Science, member
4. Assoc. Prof. Suzana Pasanec Preprotić, PhD - chairwoman of the Quality Management Committee, member
5. Full Prof. Branka Lozo, PhD - member
6. Full Prof. Mirela Rožić, PhD - member
7. Assoc. Prof. Tomislav Cigula, PhD - member

The Strategy was adopted at the 9th regular session of the Faculty Council held on 26th June 2023 (Ref. No: 640-03/23-01/20; Reg. No: 251-80-06-23-3).

The document was proofread and translated into English by Prof. Ana Nemec.

The Scientific Research Strategy of the Faculty of Graphic Arts for the period from 2021 to 2028 is one of the fundamental development documents of the Faculty in the field of scientific research for the purpose of integrating the Faculty into the European Research Area and the field of higher education, turning it into a strong support for the development of the economy and the entire social community in the Republic of Croatia. This document builds on the previous Strategy of Scientific Research of the University of Zagreb Faculty of Graphic Arts, for the period from 2014 to 2020.

The strategic document presented here aims to improve the domestic and international recognition of the Faculty of Graphic Arts in the area of engineering sciences and in the field of graphic technology, so that the Faculty of Graphic Arts from the University of Zagreb can maintain its position as the leading scientific research institution in the Republic of Croatia in its domain, and further develop in the field of innovations in graphic technology.

In order to achieve these goals, the Faculty not only strongly encourages cooperation with similar scientific institutions in the country, in Europe and in the world, but it also promotes cooperation with scientists from other scientific fields and disciplines by intensifying project cooperation and increasing multilateral and horizontal mobility of scientists.

In the end, this document seeks to improve the transfer of knowledge and achievements in research into the industrial sector on the one hand, and to integrate new knowledge into the development of the curriculum on the other hand, thus promoting scientific activity.

Content

1. Introduction

Faculty of Graphic Arts (further: the Faculty) is a constituent unit of the University of Zagreb, Croatia, in the area of engineering sciences, in the field of graphic technology, educating university bachelors, university masters and doctors of science in that field. Faculty of Graphic Arts builds its recognition on more than sixty years of scientific research and education in the field of graphic technology and design of graphic products, having immeasurably contributed to the development of graphic industry in general.

Faculty history dates back to 1959, when the Graduate School of Graphic Arts was founded. In the 1970s, ambitions to provide higher education in the field of graphic technology intensified, and the demanding project of establishing the Faculty of Graphic Arts began. The realization of this far-reaching vision took place in several stages, one of the most significant being the incorporation of the Graduate School of Graphic Arts as a constituent unit into the University of Zagreb in 1979.

The next step followed in 1983 with the establishment of the Scientific Research Centre (ZIC) with the Ministry of Education, employing eight scientists, doctors of science and teachers at the Graduate School of Graphic Arts, who formed the scientific core of the future university study. The next stage in the development of the Faculty was the establishment of the so-called Joint Study of Graphic Technology in the same year, initially as a part-time study programme, and from 1986 as a full-time study programme. The joint study programme of graphic technology was the first graduate study programme in the field of graphic technology, the literal predecessor of the Faculty of Graphic Arts. Besides the Graduate School of Graphic Arts, several other constituent units of the University of Zagreb participated in the realisation of the joint study programme of graphic technology: Faculty of Economics and Business, Faculty of Mechanical Engineering and Naval Architecture, Faculty of Science, Faculty of Chemical Engineering and Technology, as well as two printing houses. The final step followed upon joining graphic engineering and chemical engineering within the Scientific Field Committee in 1989: assignment of scientific field for the appointment of scientists. This fulfilled all the prerequisites for registering the Faculty of Graphic Arts as a constituent unit of the University of Zagreb in 1990.

Due to the commitment of prominent professors of the Faculty of Graphic Arts and upon positive evaluation of the National Council for Higher Education and recommendation of the Senate of the University of Zagreb, the Postgraduate Study of Graphic Engineering was initiated in 2000.

Ever since the beginnings of the Graduate School of Graphic Arts, The Faculty has been located in the Getaldićeva street 2, which limited the possibilities of its spatial development, as the existing building does not meet the needs, regardless of the undertaken modifications and the subsequent upgrade of the sixth floor. The Faculty has been striving to invest into the acquisition of new scientific research equipment and devices in order to keep pace with new technologies and expand the areas of scientific research. Allocations for this purpose come partly from own funds and partly from project funds.

At present time, scientific research is carried out primarily in the framework of projects at the national and international level in which Faculty employees, in both scientific and teaching positions, successfully participate as project leaders or members of research teams. Systematic guest visits abroad are also frequent, as well as the hosting of foreign scientists. Numerous

activities in the field of mobility of students and Faculty staff ensure continuous scientific and expert training, especially in the case of younger teachers and research fellows. Special attention is also paid to ensuring excellence criteria when employing new teachers and future scientists. Confirmation of the success of such practice can be found in numerous scientific publications and registered patents in the field of graphic design, as well as in awards for creativity and innovation awarded to researchers of the Faculty.

The Faculty publishes an international scientific journal entitled "Acta Graphica", organizes the annual international conference "Blaž Baromić" and the symposium "Printing and Design", and participates as a co-organizer in other scientific and expert gatherings. The Faculty continually invests into trainings and education of staff in specialized areas, into the development of scientific research activities and international cooperation, applying a multidisciplinary approach in accordance with the development of new technologies. However, it does not neglect the teaching process: Based on new scientific insights in the fields of graphic engineering, graphic design and multimedia, the Faculty modifies study programs, updating them to meet the most recent learning outcomes of courses and programmes.

The Faculty cooperates with entrepreneurs in the field of graphic technology primarily by encouraging the Alumni Association "AMAC GRF", further on by organizing scientific meetings and workshops, doctoral studies, and finally by coordinating programmes of student placement with the ultimate aim of transferring scientific insights for the benefit of graphic industry.

This document represents the strategic framework for the development of scientific research and innovation of the Faculty of Graphic Arts from 2021 to 2028, considering good policy documents, as well as strategic documents of superior institutions, the Agency for Science and Higher Education, the University of Zagreb, the Republic of Croatia, and the European Union.

2. Mission

The mission of the Faculty of Graphic Arts includes:

- ensuring and improving the quality of education and training in the field of graphic technology, packaging, multimedia, and visual communication; preparing students for creative, innovative, and successful careers in these fields at the level of undergraduate, graduate and doctoral studies;
- encouraging scientific and teaching staff to join interdisciplinary groups in order to find optimal solutions for the challenges of modern society and climate change, within the domain of graphic technologies, materials and processes;
- improving the economy by transferring research results, joint projects, and innovative solutions;
- working with students and business entities to contribute to the development and engagement of society on globally important issues in the domain of graphic technology;

- improving the work of the institution by implementing high academic values and ethical criteria, providing workplaces for critical thinking, and promoting the equality of all its members.

3. Vision

The vision of the Faculty of Graphic Arts is to position the institution as a significant stakeholder in the European Research Space by encouraging scientific research and employment od competent staff, so that graphic engineering and visual communications are in line with sustainable development, ready to respond to the needs of society as a whole. Additionally, an interdisciplinary approach in research and education will encourage the development of an innovative, entrepreneurial, but also inclusive and climate-responsible society.

4. Current indicators of scientific recognition of the Faculty of Graphic Arts, University of Zagreb (2016 – 2022)

Scientific research at the Faculty of Graphic Arts is carried out in several important forms of activities that are intertwined and mutually connected, such as the postgraduate study programme and the participation of researchers in various projects financed by the European Union, the Croatian Science Foundation, the Ministry of Science and Education, and the University of Zagreb. Furthermore, the Faculty actively promotes participation in international scientific conferences, publishing of scientific papers in scientific journals indexed in relevant scientific databases, and mobility of teaching staff at partner universities in Europe and the world.

4.1. Research capacities

The Faculty's scientific research capacities are viewed from two aspects: human resources and scientific research equipment.

The Faculty currently employs 45 employees in scientific and teaching positions, three of which are part-time employees, 12 employees in associate positions, two employees in teaching positions, and 17 employees in administration. The structure of employees who, according to current regulations, are obliged to participate in scientific research work is shown in Table 1.

The presented structure of employees shows a relative disproportion in the number of researchers in scientific-teaching positions compared to those in associate positions. In particular, the distribution of researchers in associate titles by departments is noticeable in such a way that there are no researchers employed in associate titles at all in two departments, but at the same time a total of seven are employed in the departments in the domain of visual communications and multimedia, which underlines the aim of the Faculty's direction to further develop these areas.

Table 1. Structure of employees in scientific and research work by department, in parentheses the equivalent of work in science in the standard distribution of working hours (Collective Agreement for Science and Higher Education, Official Gazette 9/2019-204)

Title	Department of Fundamental and general knowledge	Department of graphic design and imaging	Department of Computer Graphics and multimedia systems	Department of printing processes	Department of bookbinding and packaging	Department of graphic materials and printing forms	TOTAL
tenured full professor	1 (0.45)	1 (0.45)	1 (0.45)	1 (0.45)	1 (0.45)	1 (0.45)	6 (2.70)
full professor	2 (0.90)	3 (1.35)	1 (0.45)	2 (0.90)	0	1 (0.45)	9 (4.05)
associate professor	1 (0.45)	2 (0.90)	1 (0.45)	2 (0.90)	3 (1.35)	3 (1.35)	12 (5.40)
assistant professor	3 (1,35)	5.1 (2.295)	3 (1.35)	1.59 (0.7155)	1 (0.45)	2 (0.90)	15.69 (7.0605)
senior research assistant	0	2 (1.124)	2 (1.124)	1 (0.562)	1 (0.562)	0	6 (3.372)
Research assistant	0	2 (1.35)	1 (0.675)	1 (0.675)	1 (0.675)	0	5 (3.375)
TOTAL	7 (3.15)	15.1 (7.469)	9 (4.499)	8.59 (4.2025)	7 (3.487)	7 (3.15)	53.69 (25.9575)

4.2. Scientific equipment

Table 2 lists the capital scientific and research equipment installed at the Faculty and the year of acquisition.

Table 2. Scientific and research equipment

(source: https://www.croris.hr/oprema/oprema?USTANOVA=88)

Type of Equipment	Year of purchase
Technidyne Color Touch 2 spectrophotometer	2006
Dataphysics OCA 20 Goniometer – a device for measuring the contact angle	2006
Shimadzu AIM–8800 IR Microscope	2011
Shimadzu IRAffinity-1 FTI spectrophotometer	2010
Prufbau Multipurpose system for Laboratory test printing	2012
Roland VersaUV–LEC 30 printer/cutter	2009
Minolta AccurioPrint C3070L printing machine	2020

It is evident from Table 2 that the Faculty owns a relatively small quantity of capital scientific and research equipment, most of which is quite old, with the exception of the Minolta AccurioPrint C3070L printing machine.

4.3. Overview of scientific research

The results of scientific research are presented in scientific publications. As a rule, the scientists from the Faculty of Graphic Arts publish the results of their research in international scientific journals and in the proceedings of scientific conferences.

Faculty management is particularly committed to increasing scientific productivity, among other things, through an established system of rewarding scientific production.

Table 3 shows scientific productivity of scientists by category of publications (data as of April 15, 2023). It is evident that in 2022, only one paper in the A category was published per scientist, while the lowest number of published papers falls into the B category. Moreover, the increase in participation in international conferences after the COVID pandemic is visible, and with 1.43 papers per scientist, the Faculty surpasses all participation in international conferences from 2017 onwards.

Table 3. Structure of publications by category (Regulations for appointment to academic positions and titles, Official Gazette 28/2017-652)

	Year							
Category	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**Total**
A cat.	21 (0.79)	20 (0.75)	13 (0.49)	17 (0.64)	20 (0.75)	18 (0.68)	26 (0.98)	**135**
B cat.	9 (0.34)	15 (0.56)	14 (0.53)	7 (0.26)	4 (0.15)	11 (0.41)	10 (0.38)	**70**
C cat.	58 (2.18)	27 (1.01)	29 (1.09)	31 (1.16)	29 (1.09)	37 (1.39)	38 (1.43)	**249**
Total	88 (3.30)	62 (2.33)	56 (2.10)	55 (2.06)	53 (1.99)	66 (2.48)	74 (2.78)	**454**

***In parentheses is the average per equivalent of working time dedicated to scientific work*

Table 4 shows the representation of publications in relevant scientific databases.

Table 4. Total number of papers (in journals and proceedings) in the WOSCC and Scopus databases (2016 - 2022) [1,2]

	Year							**TOTAL**
Database	2016	2017	2018	2019	2020	2021	2022	
WOS	23	21	17	22	23	19	27	**152**
Scopus	19	16	15	24	37	26	60	**197**

[1] Source: WOSCC https://www.webofscience.com/wos/woscc/summary/c8b8f9c0-5f23-46a5-874d-59bd76312082-81f7243b/relevance/1

[2] Source: Scopus https://www-scopus-com.ezproxy.nsk.hr/term/analyzer.uri?sid=23ea1b59da3eddaa0b772b054cbf031f&origin=resultslist&src=s&s=AF-ID%2860103665%29&sort=plf-f&sdt=cl&sot=aff&sl=15&count=197&analyzeResults=Analyze+results&cluster=scopubyr%2c%222022%22%2ct%2c%222021%22%2ct%2c%222020%22%2ct%2c%222019%22%2ct%2c%222018%22%2ct%2c%222017%22%2ct%2c%222016%22%2ct&txGid=2c1881a6a233b4e3fe654116374fc8d2

In the period from 2016 to 2022, out of 152 published papers in the WOSCC database, 135 of them are original scientific papers, while three papers are review papers in scientific journals. The remaining 17 papers are papers published in proceedings of international conferences, while four of them are book chapters.

In the period from 2016 to 2022, out of 197 published papers in the Scopus database, 131 of them are original scientific papers, while four papers are peer-reviewed and published in scientific journals. The remaining 61 papers are papers in proceedings of international conferences, and one paper is a book chapter.

It is evident that the annual average is stable with a significant increase in the number of publications in 2022.

Citations and h-index are used in the scientific community to assess the impact of papers and authors in a certain field, i.e. they are used as indicators of the quality of scientific work.

Tables 5 and 6 show the number of citations and the total h-index for the Faculty according to the data from Table 3. The data for both parameters are relatively stable in the course of years presented in the tables. Considering the time required for published works to be cited, somewhat lower values of citations and h-index in recent years can be accounted for, but based on growth trends from previous years, as well as the increased total number of published works for the mentioned years, an increase in citations and h-index in the future analyses of that period is expected.

Table 5. Total number of citations for the Faculty of Graphic Arts (2016 - 2022) [1,2]

	2016	2017	2018	2019	2020	2021	2022	Total
WOS	86	96	76	55	53	40	20	426
Scopus	107	75	77	86	97	57	46	545

Table 1. h-index of the Faculty of Graphic Arts (2016 - 2022) [1,2]

	2016.	2017.	2018.	2019.	2020.	2021.	2022.
WOS	5	6	5	3	3	4	3
Scopus	6	6	5	5	5	5	4

The distribution of publications per Faculty employee in the period from 2016 to 2022 is displayed in Figure 1. In total, 263 publications for 48 employees are recorded, the reason being co-authorship of the same publication. The disparity in the distribution of the number of publications within the WOSCC database among Faculty employees is noticeable from the comparison of the group of five researchers with the largest number of published works – more than 10, with the group of 24 researchers with the smallest number of published works – less than 5. The first group is attributed a total of 70 records, i.e. 26.6% of publications, while the second is credited with a total of 60 records, i.e. 22.8% of publications. In between these two groups there are 16 employees with the number of publications ranging from five to nine.

Overall, more than half of the Faculty's employees belong to the group with less than five publications in the period from 2016 to 2022.

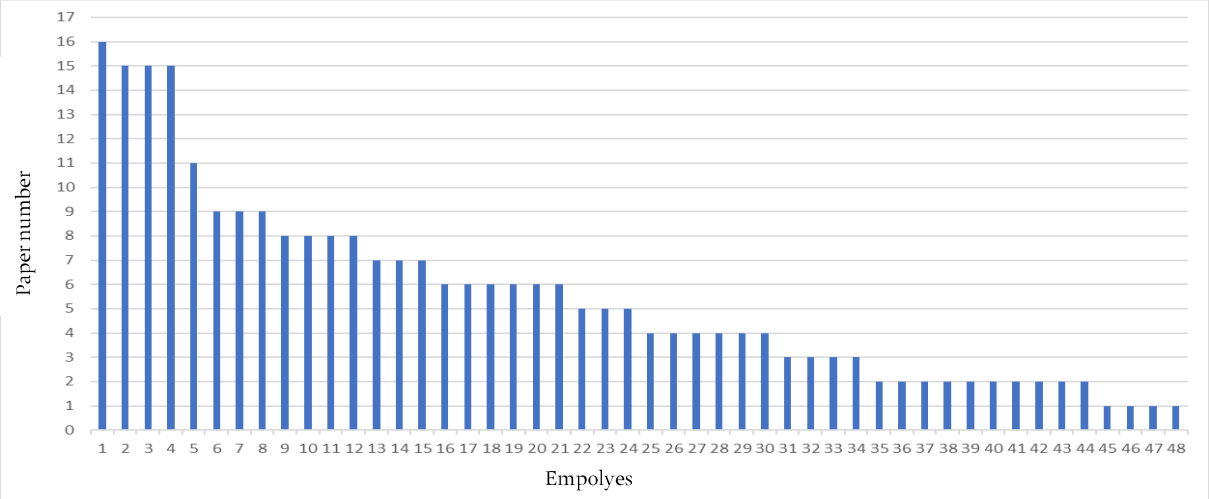

Figure 1. Number of publications per employee of the Faculty of Graphic Arts in the WOSCC database in the period from 2016 to 2022

Figure 2 provides data on journals, i.e., domain and scientific field within which the journal is published, and the frequency of publication of Faculty employees' papers in these journals.

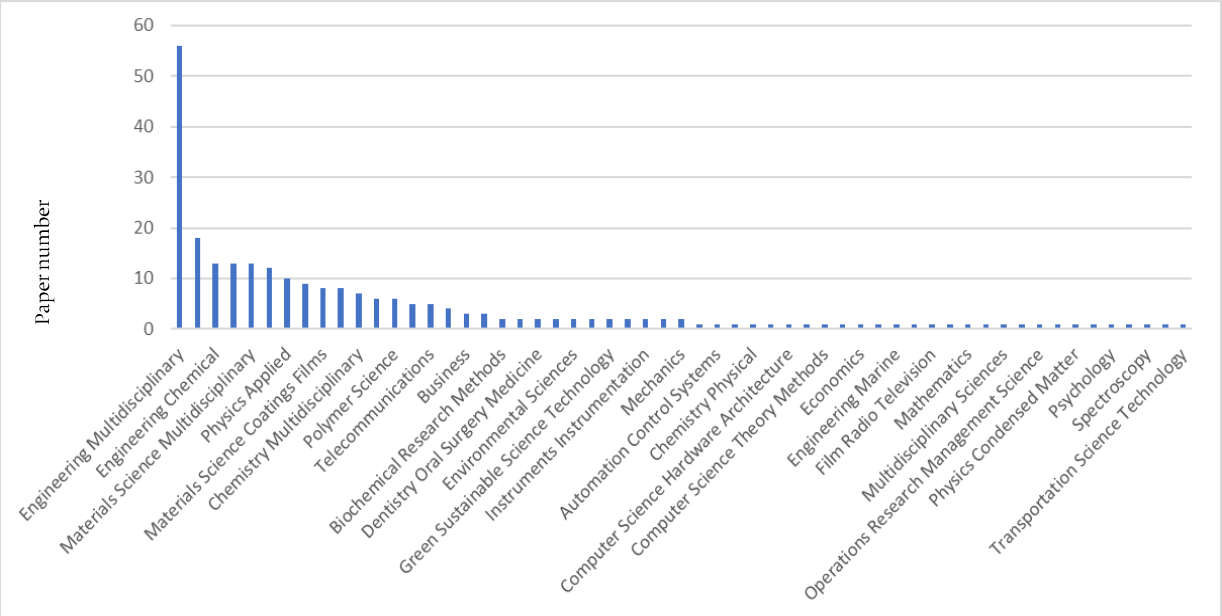

Figure 2. Domains and scientific fields within which scientific papers were published in the period from 2016-2022

It is evident from Figure 2 that in the period from 2016 to 2022, most papers were published in the field of interdisciplinary engineering, followed by areas related to materials research, a total of more than 100 papers (Engineering Chemical, Material Science Multidisciplinary, etc.), whereas 16 papers were published in the field of multimedia (Telecommunications, Computer Science, etc.).

4.4. Scientific projects

1. From 2016 to 2022 scientific research was conducted at the Faculty as part of projects financed by the Croatian Science Foundation (HRZZ), the Ministry of Science, Education and Sports of the Republic of Croatia (MZOS) and European funds, as follows:

2. IRI - Development of software for contextualization of the industrial environment using mixed reality in energy and transport – project leader: full prof. Klaudio Pap, PhD

3. CRO-China project - Research and Application Demonstration on Key Technologies of AR Information Service in Museum Based on 4G/5G – project leader: full prof. Klaudio Pap, PhD

4. HRZZ - UIP-2017-05-2573 Printability, quality and utilization of substrates with non-wood fibres – project leader: Asst. Prof. Irena Bates, PhD, 2018 – 2023, Croatian Science Foundation

5. HRZZ – UIP-2017-05-4081 Development of the model for production efficiency increase and functionality of packaging – project leader: Asst. Prof. Tomislav Cigula, PhD, 2018 – 2023, Croatian Science Foundation

6. HRZZ – DOK-2018-09-7543 Development of the model for production efficiency increase and functionality of packaging – project leader: Assoc. Prof. Ante Poljičak, PhD, 2019 – 2023, Croatian Science Foundation

7. Croatian-Slovenian scientific research project: Increasing the efficiency of production and exploitation of printing forms for offset printing, Croatian partner (project leader): Assoc. Prof. Tomislav Cigula,PhD, 2016-2017, Bilateral project with the Republic of Slovenia, Ministry of Science and Education

8. Erasmus plus 2017-1-UK01-KA202-036573 Assistive Technology Work in Europe In Public In Particular - Creative Europe Program of the European Union – partner: Full Prof. Jesenka Pibernik, PhD Full Prof Diana Milčić,PhD Full Prof Lidija Mandić. European Education and Culture Executive Agency

9. Active and intelligent fibre-based packaging – innovation and market introduction, COST Action, 2015 – 2019, Croatian partners: Asst. Prof. Sonja Jamnicki, PhD Full Prof. Branka Lozo, PhD

10. Croatian-Slovenian scientific research project: The use of agro waste anthocyanins with nanocellulose as indicators for pH-controlled smart packaging – project leader: Assoc. Prof. Sanja Mahović Poljaček,PhD 2023 – 2025, Bilateral project with the Republic of Slovenia, Ministry of Science and Education.

4.4.1. Short-term research grants

Since 2013, the University of Zagreb has been granting its constituent units short-term grants for scientific research. Grants are intended to cover additional research costs, including the costs of materials, equipment, travel and participation in conferences, costs of publications and dissemination, and other scientific activities. The University allocates the funds to the constituent *units*, while the constituent units distributes these funds to research groups in accordance with the criteria of excellence in terms of the number and status of previous publications of researchers and grant managers. The number of Faculty research groups that were awarded short-term grants for scientific research is visible in Table 7.

Table 7. Number of research teams in the period from 2016 to 2023 to have received allocations within the framework of short-term grants from the University of Zagreb

Year	Number of research groups
2016	6
2017	6
2018	6
2019	6
2020	8
2021	9
2022	9
2023	9

4.4.2. Scientific cooperation as support for projects

In the above-mentioned period from 2016-2022 the Faculty also ensured scientific cooperation with the company IGT Testing Systems, which produces laboratory equipment to test graphic materials and conducts laboratory tests of printing substrates and printing inks for various printing techniques. The use of IGT laboratory equipment in practical lessons at the Faculty has proven to be of great benefit both for students and for the research activity of teachers and scientists. This entire project strengthened international cooperation, encouraged professional training of employees, and contributed to the modernization of our laboratories.

International scientific cooperation was also achieved with the American corporation Flint Group financing the project " Modelling of the “printing plate-ink-print” response system ", project leader: assoc. prof. Sanja Mahović-Poljaček, PhD.

4.5. Postgraduate study programme of Graphic engineering and Graphic Product Design

The Faculty of Graphic Arts is the leading institution for postgraduate (doctoral) studies in the area of engineering sciences and in the field of graphic technology, providing its students with exceptional education and training in scientific research work, thus preparing them to obtain the academic degree of Doctors of Science.

The syllabus of the postgraduate study programme of Graphic Engineering and Design of Graphic Products was created over the course of many years of hard work, research, and reflection, taking into account similar programmes in Europe and the world, introducing elements of their contents into the syllabus and adapting the study programme to specific needs and requirements of the Croatian society and its labour market. Postgraduate students are actively involved in scientific work, thus developing their abilities as scientists and researchers. The teaching segment of the postgraduate study programme combines traditional lectures and the study of expert literature with scientific research, independently or in team work on projects, i.e., individually in research seminars, in accordance with the guidelines of the Bologna process.

In the period between 2016 and 2022, a total of 35 doctoral theses were defended as part of the postgraduate study programme, four of which in English[3]. Doctoral dissertations mostly focus on graphic materials, graphic design, visual communications, and interactive media.

4.6. Organization of scientific and professional conferences

The Faculty of Graphic Arts has been a long-standing stakeholder in the organization of international conferences in the field of graphic technology, printing and engineering, graphic communication, and design, having hosted a large number of participants and encouraging active participation of students.

Conferences are a way of disseminating research results obtained in the framework of scientific projects or research activities but also a principal contributor to the greater international visibility of our institution. In the period from 2016 to 2022, the Faculty organized one and co-organized three scientific conferences every year:

1. International Conference of Printing, Design and Graphic Communications "Blaž Baromić"[4]
2. Printing and design[5]
3. MATRIB[6]
4. International Symposium on Graphic Engineering and Design (GRID)[7].

[3] https://eprints.grf.unizg.hr/view/type/thesis=5Fphd.date.html#group_2023-01-19
[4] https://pdc.conferenceatnet.com/
[5] https://www.tiskarstvo.net/printing&design2023/
[6] https://hdmt.hr/conferences/
[7] https://www.grid.uns.ac.rs/symposium/zbornik2022.html

The Faculty publishes the proceedings of the "Blaž Baromić" International Conference of Printing, Design and Graphic Communications, an annual publication in printed form.

In the mentioned period, the Faculty also co-organized the event called "International Colour Day", which contributed to the popularization of science and the promotion of the Faculty of Graphic Arts.

4.7. Publication of the scientific journal "Acta Graphica"

The Faculty of Graphic Arts is also the publisher of the scientific journal "Acta Graphica" as a quarterly edition with double-blind peer review.

The journal publishes scientific research papers, technical papers, reviews, short and preliminary communications, special bulletins, and other news in the field of graphic technology, printing and engineering, graphic communication, and design, as well as in all basic and applied scientific fields relevant to graphic technology and art.

The main purpose of the magazine is to enable readers, scientists, and teachers, to be up to date with the latest research in the field of graphic technology, graphic design and visual communications.

The journal has an open access policy, all published papers are available in their entirety in the electronic form on the journal's official website.

The journal is indexed in the EBSCO database[8]. "Acta Graphica" is also available on the central HRČAK portal, which brings together Croatian scientific and professional journals.[9]

4.8. Mobility of staff and students

The Faculty strongly encourages the mobility of teachers and students, especially outgoing mobility programmes, with the purpose of exchanging knowledge and experience, developing international cooperation, improving professional skills and competences, and thus positively reflecting on teaching practises and student education in general. The mobility is carried out through ERASMUS+ projects, CEEPUS, and academic mobility programmes on an annual basis. Tables 8 and 9 show a significant reduction in incoming and outgoing mobility in 2020 due to the COVID-19 pandemic. However, 2022 recorded a visible increase in exchange programmes, indicating the recovery of mobility after the pandemic.

In order to maintain an overview of the mobility of university employees, the University encourages them to enter the data on a completed mobility programme of university employees into the university database, i.e., the Record of International Cooperation[10].

[8] https://actagraphica.hr/index.php/actagraphica
[9] https://hrcak.srce.hr/actagraphica
[10] https://www.unizg.hr/ index-aai.php

Table 2. Outgoing staff and student mobility

	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
Staff	35	20	24	1	3	14
Students	13	10	8	8	3	6

Table 3. Incoming staff and student mobility

	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
Staff	10	5	18	1	0	3
Students	13	5	7	10	0	14

5. Strategic goals of scientific development

5.1. Strategic areas of scientific activity of the Faculty

Taking into account the strategic documents within the national and European research space, but also the envisaged development of the Faculty in terms of new curricula, the strategic thematic areas which the Faculty's research activities will be focused on are:

1. Communication channels for an inclusive society
2. Design and security in the digital communication space
3. Advanced materials and processes with a no-waste concept, the so-called "zero waste concept"
4. Packaging with added value

These strategic areas are in accordance with the clusters of the "Horizon Europe" programme (pillar II), as well as with the Smart Specialization Strategy[11] (S3).

In order to strengthen the market competitiveness of the Croatian economy in Europe, primarily in the field of graphic engineering, multimedia and visual communications, the Faculty is fully aware of the need to directly engage both the private and the public sector in scientific and research activities, thus pursuing the role of the initiator of entrepreneurial discoveries.

By promoting the excellence of scientific and research work, it is possible to create cluster associations in which businessmen and scientists will work together to adapt the graphic technology sector to the needs of civil society[12].

5.2. Strategic goals in scientific research

In addition to defining the primary thematic areas of research, it is necessary to create the overall framework of scientific activities, considering the previous activities of the Faculty, as well as the parameters of the national and European research area.

Based on the above, the strategic goals of scientific research are defined as following:

C1. Improving the scientific infrastructure of the Faculty

C2. Increasing excellence in research and recognition of the Faculty in the national, European and world research area

C3. Increasing the transfer of knowledge towards business entities

[11] https://mzo.gov.hr/UserDocsImages/dokumenti/EUfondovi/OPKK_2014-2020/Strategija%20pametne%20specijalizacije%20Republike%20Hrvatske%20za%20razdoblje%20od%202016.%20-%202020.%20godine.pdf

[12] https://www.grf.unizg.hr/wp-content/uploads/2022/10/Brosura-Osam-kljucnih-kompetencija-buducnosti.pdf

Ad C1 Improving the Faculty's scientific infrastructure

In accordance with the defined strategic areas, it is necessary to strengthen the research capacities of the Faculty in general, especially in the field of visual communications and multimedia. This refers primarily to the acquisition of relevant scientific equipment as a prerequisite for conducting successful scientific research.

The upgrade of infrastructure will be ensured by participating in national and international projects, whose funding will enable investment in scientific and research equipment. At the same time, participation in scientific projects enables employment of young scientists, which strengthens human potential in scientific research. Furthermore, intra-institutional and inter-institutional cooperation is encouraged with the aim of contributing to the interdisciplinarity in research and intensifying of the use of the scientific research equipment for the benefit of researchers' training and education.

Ad C2 Increasing excellence in research and recognition of the Faculty in the European and global research area

In its first pillar, the "Horizon Europe" programme defines "excellent science". The Faculty will therefore keep encouraging and promoting excellence in research. In order to increase the Faculty's impact and facilitate the participation in international consortia for the implementation of scientific research and projects, it is necessary to increase the Faculty's scientific recognition. Operationally, this refers to publishing papers in journals with a high impact factor and open access, which will result in an increase in the citation of scientific publications. Furthermore, the participation of employees in international conferences and mobility programmes (Erasmus, Ceepus, academic mobility) in a wide range of countries increases international recognition of the Faculty, enabling scientists to expand the network of collaborators in the European and global research area.

Ad C3 Increasing the transfer of knowledge towards business entities

The third pillar of the "Horizon Europe" programme is the so called "Innovative Europe", which promotes development, transfer, and application of all forms of innovation, especially towards micro-, small- and medium-sized enterprises, in order to ensure long-term goals regarding the development of society and climate neutrality of the European economy. It is therefore necessary to encourage the patenting of research knowledge, as well increasing cooperation with business entities via specific scientific and professional projects, thus achieving global goals of an inclusive society and reducing the impact on the environment.

5.3. Activities aimed at achieving strategic goals

Table 10 lists concrete activities for achieving strategic goals and indicators (measures) for monitoring the progress in achieving strategic goals. In addition to defining strategic goals, the key elements for success in achieving these goals are appointment of responsible subjects and individuals and definition of implementation deadlines, as well as regular monitoring of progress and implementation of plans in accordance with environmental changes.

Table 10. Activities aimed at achieving strategic goals and implementation indicators

Goal	Activity	Implementation indicator	Individuals in charge	Outcome and deadline for implementation
C1	Analysis of scientific research equipment	Report on the condition of scientific research equipment	Committee in charge of creating equipment catalogue	Equipment catalogue, September 2023
	Acquisition/upgrade of scientific and research equipment	Report on funds invested in the purchase/upgrade of scientific research equipment	Department chairs, Faculty Administration	Report at the end of each fiscal year
	Increasing the number of enrolled doctoral students and encouraging scientific involvement of enrolled doctoral students	Number of students enrolled in doctoral studies, annual report on the progress of doctoral students	Committee in charge of doctoral studies, teachers	Report at the end of each academic year
	Increasing the number of students engaged in scientific work	Number of scientific papers in co-authorship with students	Teachers	Report at the end of each academic year
	Encouraging proposals and implementation of scientific research projects	Participation in workshops	Teachers, Faculty Administration	Report at the end of each academic year
	Increasing the number of project proposals	Number of project proposals/approved scientific projects	Teachers, Faculty Administration	Report at the end of each academic year
	Intensifying project cooperation with other institutions	Number of project proposals/approved projects in cooperation with other institutions	Teachers, Faculty Administration	Report at the end of each academic year
C2	Implementation of a system of excellence in publishing	Regulation / Decision on Employee Rewards	Faculty Administration	Adopted Regulation / Decision on Employee Rewards September 2023
	Publication of research results in journals with a high	Number of papers published in journals	Employees with the obligation of	Report at the end of each calendar year

	impact factor (WOSCC database)	with a high impact factor	conducting scientific work	
	Participation in international scientific conferences abroad	Number of international scientific conferences abroad	Employees with the obligation of conducting scientific work	Report at the end of each calendar year
	Outgoing mobility at institutions of similar scientific profile	Number of completed outgoing mobility programmes, report on achieved scientific work	Teachers, Faculty Administration	Report at the end of each academic year, report upon completion of outgoing mobility programme
	Proposals for scientific projects with international collaborators	Number of proposals/ approved international projects	Teachers	Report at the end of each academic year
C3	Intensifying collaboration with business entities	Collaboration with business entities	Alumni association, Faculty Administration	Semi-annual/quarterly newsletter
	Presentations of research activities to business entities	Meeting with business entities	Alumni association, Faculty Administration, scientific conference „Blaž Baromić“	Annual meeting
	Increasing project cooperation with business entities	Number of projects carried out in cooperation with business entities	Teachers	Report on cooperation with business entities at the end of each calendar year
	Increase in patent applications	Number of patent applications	Teachers, Faculty Administration	Report on patent applications at the end of each calendar year

By implementing the activities shown in Table 10, by 2028 the Faculty will fulfil the strategic goals of scientific research in the areas defined by this document and ensure international recognition maintaining the reputation of a leading scientific institution in the field of graphic technology, visual and multimedia communications.