FACULTY OF ENGINEERING AND ARCHITECTURE

EDUCATION QUALITY AUDIT

Self-Evaluation Report

15 November 2021

PART A

Accreditation of Flemish Engineering Programmes by the Commission des Titres d'Ingénieur

GHENT UNIVERSITY

Ghent University
Faculty of Engineering and Architecture

Education Quality Audit
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List of acronyms

AAS .... Assistant Academic Staff (*Assisterend Academisch Personeel - AAP*)
ACGP...Accreditation Criteria, Guidelines and Procedures
Agoria ....Belgian federation of companies in the technology industry
AIG .... Alumni association of engineers graduated in Ghent
ASAR ....Academic Strategic Advisory Board (*Academische Strategische Adviesraad*)
ASO .... General Secondary Education (*Algemeen Secundair Onderwijs*)
Athena .... University-wide electronic applications platform
ATS.....................................Administrative and Technical Staff (*Administratief en Technisch Personeel*)

BEST ....Board of European Students of Technology
BOF .... Special Research Fund (*Bijzonder Onderzoeksfonds*)
BSO .... Vocational Secondary Education (*Beroepssecundair Onderwijs*)

CA .... Cooperation Agreement
CEFR...... Common European Framework of Reference for Languages: Learning, Teaching, Assessment
CESAER............... Conference of European Schools for Advanced Engineering Education and Research
CHO..Commission for Higher Education (*Commissie Hoger Onderwijs*)
CTI...Commission des Titres d'Ingénieur
CurCom ....Curriculum Committee (*Curriculumcommissie*)

DICT ....Department of Information and Communication Technology
DLK...Student organisation - architecture (*De Loeiende Koe*)
DoS ....Director of Studies (*Onderwijsdirecteur*)
DOWA................................... Department of Educational Policy (*Directie Onderwijsaangelegenheden*)

EAIE.. European Association of International Education
EC...Educational Council of UGent (*Onderwijsraad*)
ECTS ....European Credit Transfer and Accumulation System
EEDC ....European Engineering Deans Council
EQAR.. European Quality Assurance Register for Higher Education
EQB .... Education Quality Board (*Onderwijskwaliteitsbureau*)
EQCU...................................... Educational Quality Control Unit (*Commissie Kwaliteitszorg Onderwijs*)
ERC.. European Research Council
ESG..European Standards and Guidelines
EUR-ACE...European quality label for engineering degree programmes

FC...Faculty Council (*Faculteitsraad*)
FCI.................. Faculty Committee for Internationalisation (*Facultaire Commissie Internationalisering*)
FEA....... Faculty of Engineering and Architecture (*Faculteit Ingenieurswetenschappen en Architectuur*)
FES ....Faculty Education Services (*Facultaire Dienst Onderwijsondersteuning*)
FIRO .... Faculty International Relations Office
FMT.. Faculty Management Team
FRiS ....Faculty Council of Engineering Students (*Facultaire Raad Ingenieursstudenten*)
FTC..Faculty Evaluation Committee (*Facultaire Toetscommissie*)
FWO.........Scientific Research Foundation Flanders (*Fonds Wetenschappelijk Onderzoek - Vlaanderen*)

GB ....Generic Bachelor Competence (*generieke opleidingscompetentie voor de bachelor*)
GM ....Generic Master Competence (*generieke opleidingscompetentie voor de master*)

HEI .... Higher Education Institution

IAESTE .... International Association for the Exchange of Students for Technical Experience
IAP .... Interuniversity Attraction Poles Programme
ie-net .... Flemish Engineering Association, non profit organisation
IOF .... Industrial Research Fund (*Industrieel Onderzoeksfonds*)
IPPI .... Integrated Policy Plan for Internationalisation (*Geïntegreerd Beleidsplan Internationalisering*)
IPR .... Intellectual Property Management
IRO .... UGent International Relation Office
ISAR .... Industrial Strategic Advisory Board (Industriële *Strategische Adviesraad*)

KSO .... Art Secondary Education (*Kunst Secundair Onderwijs*)

MoU .... Memoranda of Understanding

NVAO .... Accreditation Organisation of the Netherlands and Flanders
OAS .... Other Academic Staff (*Overig Academisch Personeel - OAP*)
OASIS .... University-wide administrative system
OER .... Education and Examination Code (*Onderwijs- en Examenreglement*)

PAC .... Previously Acquired Competencies/Skills (*Eerder Verworven Competentie - EVC*)
PAQ .... Previously Acquired Qualifications (*Eerder Verworven Kwalificatie - EVK*)
Plato .... Administrative environment of the faculty, supplementary to Ufora
PS .... Professorial Staff (*Zelfstandig Academisch Personeel - ZAP*)

RS .... Research Staff (*Wetenschappelijk Personeel - WP*)

SER .... Self-Evaluation Report
SID-Ins .... Study Information Days
SOC .... Strategic Research Centres (*Strategisch Onderzoekscentrum*)
SPC .... Study Programme Committee (*Opleidingscommissie*)
STEM .... Science, Technology, Engineering and Maths
SWOC/SWOT .... Analysis of Strengths, Weaknesses, Opportunities, Challenges/Threats

TSO .... Technical Secondary Education (*Technisch Secundair Onderwijs*)
TT .... TechTransfer UGent

UCT .... University Language Centre (*Universitair Centrum voor Talenonderwijs*)
Ufora .... University-wide electronic learning environment
UGain .... UGent Academy for Engineers (*UGent Academie voor ingenieurs*)
UGent .... Ghent University (*Universiteit Gent*)

VLAIO .... Flanders Innovation & Entrepreneurship *(Vlaams Agentschap Innoveren & Ondernemen*)
VLIR .... Flemish Interuniversity Council (*Vlaamse Interuniversitaire Raad*)
VLUHR .... Flemish Universities and Colleges Council (*Vlaamse Universiteiten en Hogescholen Raad*)
VTK .... Student organisation - engineering (*Vlaamse Technische Kring*)

Abstract (in English)

On a regular basis, the Faculty of Engineering and Architecture [FEA] takes the time necessary to compose a critical self-reflection, in view of the accreditation of its programmes by the Commission des titres d'ingénieur [CTI]. This accreditation also serves as an external view on the education offered by the faculty, as required by the central administration of Ghent University. This reflection is an excellent tool to identify strengths and weaknesses, as well as to propose actions both on a strategic and operational level. The report is aligned according to the template and criteria suggested in the "Accreditation Criteria, Guidelines and Procedures" published by the CTI, thereby offering a global picture of the faculty.

The FEA is committed to educate excellent engineers and engineer-architects, that can successfully apply their acquired knowledge and competences in their professional (potentially international) practice, pursuing creative and innovative solutions. Therefore, the education offered by the FEA is thoroughly founded on a (very) strong scientific and technological base, with room for research orientation in the curricula. In addition to this scientific/technological foundation, programmes also present a strong offer on societal themes and soft skills. Graduates should be in a very good position to assess the impact of their technical solutions on society, and should also conceive these solutions taking this perspective into account. The FEA is very well integrated in Ghent University and is often referred for best practice in education and research.

The faculty is very proud of the level of the graduates, as is reflected by the strong appreciation of the alumni by the professional field. This appreciation is apparent in the employer survey, as well as in the strong industrial demand for alumni from our faculty. More than 95% of our young graduates find a first position (almost) immediately after completing their studies. To guarantee the quality and the relevance of the programmes, all stakeholders are consulted. In addition to external partners – mainly from industry – particular attention is paid to the input of students, who are acting in a partnership with the faculty to keep education standards high.

For the sake of clarity, this report consists of two parts, each accompanied by their own annexes. Part A discusses all faculty topics, as indicated in the CTI-guidelines (cf. CTI's Accreditation Criteria, Guidelines and Procedures), while part B provides more details on each specific programme.

Samenvatting (in Dutch)

Op geregelde tijden neemt de faculteit Ingenieurswetenschappen en Architectuur [FEA] de tijd om tot een kritische zelfreflectie te komen, met het oog op de accreditering van haar opleidingen door de Commission des titres d'ingénieur [CTI], die meteen de door het universiteitsbestuur vereiste externe blik biedt op het onderwijs van de faculteit. Het rapport is een hulpmiddel om sterktes en werkpunten te identificeren, en om ook op strategisch en operationeel niveau acties te identificeren. Het rapport werd opgebouwd volgens de opmaak en criteria gesuggereerd in "Accreditation Guidelines and Procedures" van de CTI, waarmee een totaalbeeld van de faculteit geboden wordt.

De FEA engageert zich om uitstekende ingenieurs en ingenieur-architecten te vormen, die met succes en enthousiasme hun kennis en vaardigheden creatief en innovatief toepassen binnen hun beroepspraktijk, ook in een internationale context. Hiertoe organiseert ze haar onderwijs gebaseerd op een (zeer) sterke wetenschappelijke en technologische basis, waar ook onderzoek in diverse vormen aan bod komt. De opleidingen bieden naast deze wetenschappelijke/technologische fundering ook een gedegen vorming aan rond maatschappelijke thema's en soft skills, zodat afgestudeerden de impact van technologische oplossingen op sociaal en maatschappelijk vlak kunnen inschatten en deze oplossingen vanuit dit perspectief kunnen mee concipiëren. De faculteit is bijzonder goed geïntegreerd in de Universiteit Gent, en fungeert dikwijls als voorbeeld van best practice voor onderwijs en onderzoek.

De faculteit is bijzonder trots op het niveau van haar afgestudeerden, dat zich ook weerspiegeld ziet in de appreciatie van haar alumni door het werkveld. Dit blijkt o.m. uit de resultaten van de werkveldenquête en de grote vraag naar alumni vanuit de industrie. Meer dan 95% van de alumni vindt een eerste baan (quasi) onmiddellijk aansluitend op het afstuderen. Om de kwaliteit en relevantie van haar opleidingen te borgen, wordt met alle stakeholders intens overlegd. Naast de inbreng van externe partijen (vooral vanuit industrie), heeft ze bijzondere aandacht voor de inbreng van de studenten, die hierin als partner van de faculteit ageren.

Omwille van de duidelijkheid, is dit SER opgesplitst in twee delen, telkens met eigen annexen. Deel A bespreekt alle facultaire topics zoals aangebracht in de CTI-richtlijnen (cfr. CTI's Accreditation Criteria, Guidelines and Procedures), en deel B omvat de gedetailleerde beschrijving van de aparte opleidingen.

Résumé (in French)

À intervalles réguliers, la faculté des Sciences de l'ingénieur et d'Architecture [FEA] s'offre le temps d'une autoréflexion critique, en vue de l'accréditation de ses formations par la Commission des titres d'ingénieur [CTI]. Elle s'autorise ainsi un regard critique externe sur son enseignement comme exigé par l'administration centrale de l'université. Le rendu de cette réflexion constitue une aide à l'identification des points forts et moins forts, ainsi que des actions à prévoir au niveau opérationnel stratégique. Le présent rapport est structuré suivant les critères des "Accreditation Criteria, Guidelines and Procedures" [ACGP] établis par la CTI afin de produire un aperçu global de la faculté.

La FEA s'engage à former d'excellents ingénieurs et ingénieurs-architectes qui, professionnellement parlant et dans un contexte international, sont capables d'appliquer avec succès et enthousiasme leurs savoirs et savoir-faire créatifs et innovants. À cette fin, la faculté organise son enseignement sur une solide base scientifique et technologique s'appuyant sur la recherche sous diverses formes. À part cette base scientifique et technologique, les différentes formations offrent également des programmes de qualité sur des thèmes sociétaux afin de développer les compétences personnelles des étudiants. Ceci afin de permettre aux diplômés d'évaluer l'impact d'options technologiques au niveau social et sociétal et, à partir de ces points de vue, de concevoir des solutions. La faculté est très bien intégrée au sein de l'université et sert d'exemple de bonnes pratiques en matière d'enseignement et de recherche.

La faculté se réjouit en particulier du très bon niveau de ses diplômés, d'ailleurs confirmé par l'appréciation générale dont bénéficient ses anciens élèves au sein du milieu professionnel. C'est ce que nous montrent les résultats de l'enquête établie auprès du milieu professionnel et l'énorme demande de nos anciens dans le monde industriel. Plus de 95% des anciens élèves trouve un premier emploi quasiment à l'instant après le diplôme. Dans l'intention d'assurer la qualité et le bien-fondé de ses formations, la faculté organise par ailleurs des consultations intensives avec toutes les parties prenantes. Excepté l'apport des parties externes, en particulier de l'industrie, elle accorde une attention particulière à l'apport des étudiants, considérés comme des partenaires privilégiés de la faculté.

Pour des raisons de clarté, le présent rapport d'auto-évaluation [SER] est divisé en deux parties, chacune avec des annexes. Dans la partie A sont discutés les sujets facultaire tels que prévus par les ACGP de la CTI alors que la partie B contient la description détaillée des formations.

Chapter 1 Mission and Organisation of the Faculty

1.1 Engineering education mission, policy and objectives

1.1.1 Context

Ghent University [UGent], founded in 1817 by King William I of Orange, is one of the major universities in Belgium, offering high-quality courses to close to 50.000 students in 11 faculties (covering the full spectrum of academic disciplines including, amongst others, linguistics, social sciences, economic sciences, medical studies, engineering). The Faculty of Engineering and Architecture [FEA] of UGent finds its roots in the 'Corps des Ponts et Chaussées', founded in 1804 by Napoleontic decree, and was integrated into UGent in 1890. The range of engineering specialisations has gradually expanded to match the needs in industry and society. Faithful to its origin as an engineering school, the FEA offers a comprehensive engineering curriculum of five years. In accordance with the framework of the European Higher Education Area, this curriculum is now composed of a three-year bachelor's programme and a two-year master's programme. The faculty currently offers two bachelor's programmes and sixteen master's programmes leading to the degrees of Bachelor of Science in Engineering and Master of Science in Engineering, and is also involved in the Advanced Master programme Nuclear Engineering. In addition, the faculty also organises other programmes which are not included in the CTI visitation, these are the Engineering Technology programmes (1 Bachelor, 9 Master programmes), and the Master of Science in Urbanism and Spatial Planning.

The language of instruction was French until 1930, when UGent switched to Dutch. In 2012, the language regulations in Flemish higher education became less restrictive, facilitating the use of English in master's programmes. Since the academic year 2013–2014, all master's programmes in Engineering (with the exception of architecture) are taught in English.

1.1.2 Strategy and mission

In its mission statement[1], UGent positions itself as a social and pluralistic university, adopting an international perspective, and offering high-quality research-based education to its students. The university actively encourages students and staff to adopt a constructive critical approach to both education and research activities.

The educational concept of UGent can be summarised as 'Creative Knowledge Development', and is based on the following principles:

- ► Creativity builds on knowledge;
- ► Creative thinking is a competence best acquired by using activating teaching methods;
- ► Creativity requires lifelong learning and a critical attitude towards knowledge in general and one's own knowledge in particular;
- ► Communication and cooperation are essential in knowledge development;
- ► Diversity advances creativity.

As UGent opts for a dynamic and decentralised organisational model, faculties are given substantial freedom to implement this concept and develop their own vision and mission using these guidelines. This gives the FEA the necessary autonomy to define its own mission taking into account the specific needs of an engineering education. The educational mission of the faculty (see Annex A.1) focuses on the following principles:

> 'The faculty of Engineering and Architecture is committed to training excellent engineers and architects, who are able to apply their technical and applied scientific skills and knowledge in any professional context, both in Belgium and abroad. It seeks to do so by providing all of its students with a high-quality and state-of-the-art research-based education. Our engineering, engineering technology, and architecture programmes meet international standards and fulfil the requirements of the work field and industry. Our skilled graduates are able to adapt

rapidly to global technological and economic changes, and contribute substantially to the socio-economic development.'

1.1.3 Engineering education policy and objectives

Because of the broad spectrum of employment opportunities and needs for engineers, the engineering education teaches knowledge, skills and attitudes applicable in all engineering disciplines. Specialisation is offered in selected domains to acquire the necessary insights and knowledge in the latest developments in science and technology.

All programmes offered by the faculty are characterised by

1. A solid foundation in basic sciences (mathematics, chemistry, physics) to develop analytical skills and to provide a scientific basis for technology.
2. A multi-disciplinary introduction to major engineering disciplines (informatics, material sciences, fluid dynamics, system and signal theory, electrical networks).
3. A thorough training in a specific engineering discipline (Mechanical Engineering, Electrical Engineering, Engineering Physics,…).
4. A strong focus on problem solving and innovative thinking during the full programme, culminating in the embedding in research groups during the master's dissertation.
5. Project-oriented learning, starting early on (first term of the first year), in order to train and develop problem-solving and design skills.
6. Development of soft skills (presentation, communication, efficient and fair collaboration, project management) as an integral part of the project-oriented activities in the curriculum.

In addition, the programmes offer

1. The opportunity to stimulate entrepreneurship and business skills through an 'entrepreneurial track' open to all students.
2. The opportunity to take internships to learn the profession hands-on.
3. The opportunity to gain international experience through collaboration in various international programmes and/or the possibility to spend a term or a year abroad.

To realise its mission of training critical engineers able to tackle technological and societal challenges efficiently, the faculty offers a rich mix of educational tools, shifting the focus from more traditional ex-cathedra teaching methods to formats where students are more actively challenged. A university-wide initiative on activating learning methods has been initiated in 2018 (See section 3.4.2). Programmes therefore offer lab sessions, exercises and projects complementing the ex-cathedra sessions, roughly on a 50%-50% basis. Some of the positive experiences with online learning during the coronavirus lockdown will be continued in future teaching and learning approaches. Project-oriented learning has proven to be an excellent approach to motivate students as well as to develop design and soft skills, and therefore has a prominent place in all curricula. Most notably in specialised courses, students are typically coached by PhD and post-doctoral researchers, bringing master's students in close contact with state-of-the-art research practice and results.

1.1.4 Contact with stakeholders

Consultation with all stakeholders is a crucial step in the process of updating and/or creating new engineering programmes. Consultation with the industry takes two forms: (i) in all Study Programme Committees [SPC] an industrial advisory group is regularly invited to reflect on the programme, (ii) the faculty has an Industrial Strategic Advisory Board [ISAR[2]]. The advisory groups are kept up to date on major programme changes, gather feedback on existing curricula and capture new industrial needs. The faculty management keeps the members of the Industrial Strategic Advisory Board up to date on all major strategic changes.

The alumni of the faculty are kept involved through the 'Alumnivereniging van Ingenieurs afgestudeerd aan de Universiteit Gent' [AIG[3]], the alumni association that organises networking events and cultural and/or professional activities for all graduated engineers. AIG acts as a link between the faculty and the Flemish 'ie-net ingenieursvereniging' [ie-net[4]].

Amongst others, AIG sets up informal events (in close collaboration with the faculty) for engineers graduated from the faculty, while at the same time targeting a larger audience. To give a few examples: in 'TechBoost[5]', an expert presents a selected topic based on recent research and in 'Update@Campus[6]' refresher courses on management, engineering or soft skills are given. In addition to conveying the latest results, these events are excellent forums for networking with other faculty alumni.

The faculty closely collaborates with industry in various frameworks: EU-research programmes, regional/national research programmes and Flemish strategic research centres. Through these projects, results in various research domains are disseminated to the industry. Furthermore, various start-up companies build upon scientific results. The Industrial Research Fund [IOF[7]] of Ghent University manages the funding for valorisation-oriented research at Ghent University, together with TechTransfer [TT[8]]. The faculty strongly participates in IOF programmes (see Chapter 2).

The Faculty of Engineering and Architecture and the Faculty of Bioscience Engineering have originally founded the UGent Academy for Engineers [UGain][9] and in the near future this collaboration will be expanded to include the Faculty of Sciences. UGain offers a wide variety of courses to inform graduated engineers currently active in industry or research institutes on selected specialised topics. In 2020 several courses were organised (Black Belt in Lean, Big Data, Offshore Wind Energy,…) with a total of 241 participants (see Annex A.2).

So far, we have not mentioned the students themselves as very important stakeholders of the faculty. We will not go into detail here, but in the following sections it will become clear that students are represented in each committee of the faculty and in the Faculty Council [FC]. The Faculty Council of Engineering Students [FRiS] delegates students to the committees (also at university level) and closely collaborates with the 'Vlaamse Technische Kring' [VTK[10]] and De Loeiende Koe [DLK[11]], the student organisations that play important roles in the faculty, as described in Section 3.7.

1.1.5 Promotion of the engineering programme

The intake of students is crucial for the success of the faculty. Considerable efforts are made to inform secondary school students about engineering studies and to motivate them to choose STEM programmes.

Children and youngsters are targeted through a number of activities that are organised by the faculty or that the faculty takes part in, amongst others

- 'Kinderuniversiteit[12]' (Children's University), aimed at eight- to twelve-year-olds;
- 'Dag van de Wetenschap[13]' (Science Day), about science and technology;
- 'Boetiek Techniek[14]' (Boutique Technique), an energetic fair about technology;
- 'WeGoSTEM[15]', hands-on workshops about robotics and AI, organised by Dwengo;
- Robot competitions, organised by WELEK[16], a non-profit organisation, highlighting technology and engineering education;
- 'Flemish Programming Contest[17]', featuring a special category for secondary school students;
- visits to secondary schools (workshops) to inform and promote engineering studies[18].

Prospective students are informed through initiatives such as

- 'Study Information Days' [SID-Ins[19]], bringing the faculty closer to final-year secondary school students;
- information days targeting secondary school teachers[20] (mathematics and sciences);
- faculty information days[21] for prospective students organised each year in March (> 500 attendants);
- 'Open Lectures' and 'Try-outs' during secondary school holidays (November, February and April);
- leaflets and brochures made available to prospective students;
- information made available on the faculty's website.

Prospective students are required to test their mathematical knowledge in a so-called 'positioning test'[22], a compulsory test organised twice per academic year, giving them insight in the expected level

of mathematics (and giving them the opportunity to consider additional preparation if needed). This test is a collaborative initiative of UGent, KU Leuven and VUB (see Section 4.1.1).

1.1.6 Broadening the specialisation

By monitoring social, industrial and scientific evolutions, the faculty identifies possibilities for offering new courses or new master's programmes. One such major evolution was the introduction of the entrepreneurial track in the curriculum for students interested both in technology and entrepreneurship. Similarly, inspired by the growing need for engineering solutions in a medical context, the faculty introduced a new bachelor main subject in biomedical engineering.

The continuous effort to translate research excellence into master's curricula is another strategy for identifying new opportunities to attract the attention of potential students. This is of course often an implicit process, but the faculty also makes this research excellence explicitly visible in newly emerging engineering fields by introducing specialised and focused master's programmes (e.g. Master of Science in Photonics Engineering, Master of Science in Biomedical Engineering, Master of Science in Fire Safety Engineering, Master of Science in Bio-Informatics).

Furthermore a continuous effort is ongoing to strengthen the track on sustainability in the faculty's programmes, as well as to increase attention for ethical issues.

1.1.7 International dimension

The faculty has a long-standing tradition in the Erasmus student exchange framework, with bilateral collaborations with a large number of international partners (more details in Section 3.5). Furthermore, starting from the academic year 2013–2014, all masters in Engineering are taught in English. This underlines the international dimension of the faculty and facilitates the exchange of students beyond the Dutch-speaking part of Europe. In the Master of Science in Engineering: Architecture the language of instruction is Dutch but the programme offers an English track (per term) targeting international students.

The faculty has been an active partner in a number of international programmes, most of which originated from the Erasmus Mundus framework. In these international programmes, international students are hosted at the faculty: International Master of Science in Fire Safety Engineering, International Master of Science in Textile Engineering and the European Master of Science in Nuclear Fusion and Engineering Physics.

Complementary to the ongoing Erasmus efforts, a number of agreements have been set up resulting in foreign students entering the programme in a structured way.

1.1.8 Diversity

Recent numbers on student intake and study progress of students from disadvantaged and underrepresented groups (April 2021), has indicated that the FEA student population predominantly exists of male students (80.8% versus 19.2%) and that our faculty scores below average at Ghent University in attracting students with a migration background. Compared to other faculties, FEA also attracts mainly students of which the parents have higher education diplomas (indication of strong socio-economic background). The faculty has recently installed a new Committee for Diversity and Inclusion, under the guidance of the faculty's diversity coordinator, to devise strategies that aim to attract a student population which better represents the demographic dynamics in society at large (see Section 4.2).

1.2 Organisation and management structure

1.2.1 Management structure

Figure 1 presents the overall management structure of Ghent University. The Faculty of Engineering and Architecture is one of its 11 faculties. Figure 2 shows the organisational chart of the FEA.

The FEA is headed and managed by the Dean. The Dean chairs the Faculty Management Team [FMT], consisting of the Dean, the Vice Dean of Education ('Director of Studies') and the Vice Dean of Research ('Academic Secretary'). The faculty's representative in the University Board of Governors and the Policy

Officers of Human Resource and Education are advisory members of the Faculty Management Team. The Dean and Vice Deans are elected by the Faculty Council amongst its full professors for a term of four years, which can be renewed. The members of the Faculty Council are elected for the same term amongst the academic, technical and administrative staff of the faculty and the students. In accordance with UGent regulations, members are elected with particular attention to gender balance. The Faculty Council meets once a month to discuss and approve proposals by the Faculty Management Team and the various permanent and ad hoc committees advising the Dean.
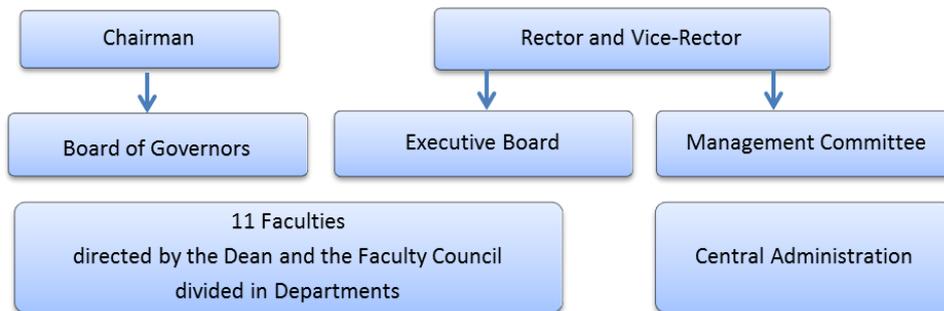

Figure 1: Organogram of Ghent University
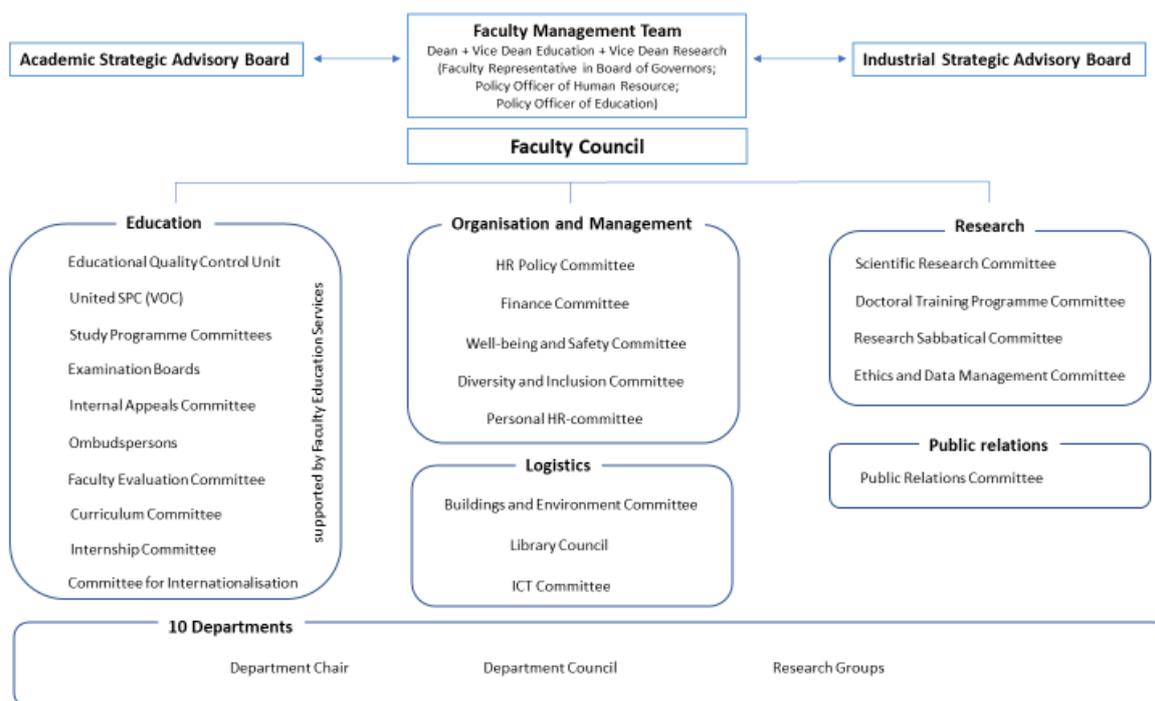
Figure 2: Organogram of the Faculty of Engineering and Architecture

The Industrial Strategic Advisory Board[23] [ISAR] advises the Dean and the faculty on its overall strategy regarding education, research, cooperation with industry and internationalisation. The members of this board have a leading role in industry, large research institutes or governmental organisations. The Academic Strategic Advisory Board[24] [ASAR], composed of the chairmen of faculty (advisory) committees and the faculty's representatives in the University Board committees acts as a think tank and advises the Dean and the faculty on its overall strategy regarding education, research, service to society, internationalisation, logistics, ….

The FEA has 10 departments[25]. Through their teaching staff (see Section 1.3.1) departments take responsibility for the education in the bachelor's and master's programmes and to a growing extent in Life-Long Learning programs. Through their research groups, departments are directly responsible for the research in the FEA.

The following part provides more detailed information on how the management of the educational process is organised at the faculty (leftmost part of Figure 2). Other organisational aspects are discussed in later sections of this report.

The overall responsibility for the education and engineering programmes lies with the Vice Dean of Education (Director of Studies), who heads the Educational Quality Control Unit [EQCU]. This committee is responsible for the quality assurance of the structure and content of the bachelor's and master's programmes and for the regular course evaluation of the responsible teaching staff. The Vice Dean of Education is supported by the administrative staff of the Faculty Education Services [FES].

The EQCU is advised by 26 Study Programme Committees [SPC]. Each bachelor's and master's programme is steered by a dedicated SPC. These committees consist of representatives of the teaching staff, the students and the industry. The industry members are invited on a regular basis to discuss curriculum changes and updates.

The responsibility for programme changes in a particular bachelor or master lies with the SPCs, supported by the EQCU. Programme changes with a major overall impact, for instance introducing an overall project line or entrepreneurship courses, are initiated by the Faculty Management Team and are thoroughly discussed in an ad hoc committee. Programme changes are always advised by the EQCU before being presented to the Faculty Council.

The Curriculum Committee [CurCom] is responsible for the approval of the curricula of the students, (elective courses, intake from other universities,...). This committee is advised by all SPCs and also takes the final decision on individual study tracks.

Each year, the Faculty Council appoints three ombudspersons[26] (2 effective and 1 back-up) proposed by the student members of the FC. The ombudspersons have a mediating task between students and teaching staff. They provide information when students file complaints or guide them to the most appropriate service to solve a particular problem. If deemed appropriate or necessary, students can also appeal to the institutional ombudsperson of UGent.

Every student has the opportunity to take an internship in the industry for a total of 3 or 6 credits (this is discussed in more detail in Section 3.6). The faculty's Internship Committee has the organisational responsibility and marks the internship reports.

The many aspects of internationalisation (both incoming and outgoing students) are taken care of by the International Relations Committee.

The Examination Boards deliberate three times per academic year, after each examination period (February, July and September). All lecturers-in-charge are members of the Examination Boards, chaired by the Vice Dean of Education.

1.2.2 Implementation of the management processes

All key administrative processes, e.g. enrolment and curriculum administration, are supported by university-wide IT infrastructure and software support. The university-wide administrative system 'OASIS[27]' administers all courses and programmes taught at Ghent University, as well as the study curricula of enrolled students. The actual enrolment is taken care of by the central university administration but the administration and approval of the individual curriculum of each student rests with the faculty's Curriculum Committee, underlining the autonomy of the faculties. 'Plato[28]' is the dedicated administrative environment of the FEA, supplementary to Oasis. It allows teaching staff members to easily manage master's dissertation work, internships, PhD students,...

'Ufora[29]' is the official electronic learning environment of Ghent University. Through Ufora, the teaching staff communicates with students and vice versa on a per course basis.

Ghent University was amongst the first universities in Europe to successfully apply for an ECTS label in 2004. The European Credit Transfer and Accumulation System[30] [ECTS] was developed by the European Commission to provide common procedures for guaranteeing academic recognition of studies abroad. ECTS is a student-centred system based on the student workload required to achieve the objectives of a programme, in which the objectives are specified preferably in terms of the learning outcomes and competences to be acquired. All courses taught at Ghent University are described in detailed course

descriptions, based on the ECTS requirements. The course descriptions are updated annually and published in Ghent University's online study guide.

1.3 Human, physical and financial resources

1.3.1 Human resources

The engineering programmes are predominantly taught by personnel of the Faculty of Engineering and Architecture. The different types of employees are

1. The Professorial Staff [PS], who take full responsibility for the quality and content of the courses (including teaching, lab sessions, course material). Post-docs may occasionally take this role.
2. Assisting Academic Staff [AAS] and Other Academic Staff [OAS], who hold an academic master's degree and typically pursue a PhD degree. They take care of lab sessions, exercise sessions and projects organised in the context of a course. While AAS is directly paid from UGent's educational budget, this is not the case with OAS (more details in Section 1.3.3).
3. Administrative and Technical Staff [ATS] and Other Administrative and Technical Staff [OATS]: the technical staff members are responsible for the maintenance of infrastructure, the installation of new equipment and the technical support of projects and master's dissertation work. The administrative staff supports the teaching staff, the researchers and the students. A new category of ATS has been created in July 2015 with mainly teaching assisting tasks. Contrary to AAS these are tenured staff members. ATS is directly paid from the university's educational budget (ATS in Table 1), this is not the case for OATS.

Human resources are allocated to the departments of the faculty, based on indicators reflecting educational duties, scholarly and research activities and output and involvement in internal and external services. The needs of the faculty's departments are discussed in the HR Policy Committee (in which all Department chairs or their representatives are present) (see Figure 2). This committee meets on a regular basis to advise the faculty. Once a year, a human resources plan consistent with the long-term strategy of the faculty and detailing the PS, AAS and ATS positions for the next academic year is presented for approval to the Faculty Council, and to the Board of Governors.

For every new PS position an ad hoc committee is assigned to screen and interview the candidates and to propose one or more candidates to the FC. The decision of the FC is then presented to the Board of Directors for final approval. All staff members (PS, AAS and ATS) have their own dedicated evaluation procedures. As such, these procedures are university-wide but dedicated faculty sub-committees report to the Dean and the FC.

Since 2019, each permanent staff member has a personal HR-committee for career guidance. At several key moments in their careers (start of new professors, promotion opportunities,...) the committee convenes and provides feedback to the staff members. In general, the HR procedures are based on a culture of trust and responsibility, rather than internal competition.

In addition to the staff directly funded by the university's educational budget (covering the PS, AAS and part of the ATS), the success of the engineering programmes builds on the efforts of the research staff [RS], funded through various other (competitive) sources as explained in Section 1.3.3.

It is the faculty's policy to explicitly involve this research staff in education, because (i) this increases the human resources that can be relied on for the successful organisation of courses, projects and master's dissertation work by an order of magnitude and (ii) this ensures the early introduction of research results into the engineering programmes.

The numbers in Table 1 give an overall picture of the size of the staff, the teaching load and the student/staff ratios.

Students	
Number of degree students	
Engineering programmes	2592
Engineering Technology programmes	1935
Guest and exchange students	149
Total number of students	4676
Human resources (in full time equivalents [FTE])	
FTE PS	191,65
FTE AAS	150,20
FTE OAS	942,58
FTE ATS	133,80
FTE OATS	66,52
Staff/student ratios	
Number of FTE PS / 100 students	4,10
Number of FTE (AAS+OAS) / 100 students	23,36
Ratio AAS / PS	0,78
Ratio OAS / PS	4,92
Ratio (AAS+OAS) / PS	5,70
Ratio ATS / PS	0,70
Ratio OATS / PS	0,35
Ratio (ATS+OATS) / PS	1,05

Table 1: Number of students versus human resources for the FEA. Note: the numbers apply to the faculty as a whole also including staff and students of programmes not included in the CTI visitation (data from 2020).

The teaching load assignment per PS (per head count) is detailed in Table 2. The leftmost part of the table indicates the number of courses taught per PS, while the rightmost part gives the distribution of the number of credits per course. About 85% of the professorial staff teaches four courses at the most, a higher teaching load mainly occurs for the lecturers from the Engineering Technology programmes. Note that the majority of courses is assigned 3 or 6 credits, a higher number of credits (9+) are typically assigned to project and atelier courses, often organised during two consecutive semesters.

Number of PS (head count)	288				
Total number of courses	804				
Number of PS with # courses			**Number of credits per course**		
# courses	# PS	% of total PS	# of credits per course	number of courses	% of total courses
1	87	30,2	3	291	36,2
2	74	25,7	4	67	8,3
3	48	16,7	5	34	4,2
4	36	12,5	6	387	48,1
5	18	6,3	7	2	0,2
6	9	3,1	8	1	0,1
7	6	2,0	9	7	0,9
8	4	1,4	10	8	1,0
9+	6	2,0	12	5	0,6
			15	2	0,2

Table 2: Teaching load Note: the numbers apply to the faculty as a whole also including staff and courses of programmes not included in the CTI visitation.

Because of the broad range of engineering specialisations, the faculty also takes advantage of external expertise through the involvement of visiting professors (see Annex A.3) and guest lecturers. The total number of visiting professors is 60 (total FTE: 11,8). Note that visiting professors typically only teach one or two courses, which has to be taken into account when interpreting the number of courses per PS member in the table above. The master's dissertation work is not included in the table and counts for 24 credits.

1.3.2 Physical resources and facilities

The FEA uses a number of buildings located at various places in town (see Annex A.4). The two main locations are: the Sint-Pietersnieuwstraat area in the city centre, with the Plateau-building at Campus Boekentoren (nr. 4 on map 1 in annex) and the Technicum at Campus UFO (nr. 3 on the maps), and Campus Ardoyen (nr. 16 on the map) located in Zwijnaarde, about 5 km from the city centre.

The FEA has the intention to move most of its research activities to campus Ardoyen and this process is speeding up since the last 5 years. The FEA also intends to build a new lecture hall complex on this campus. This should allow all students to move to the campus, except for the students and researchers in the architecture programme, for whom one of the Technicum buildings in the city centre will be completely renovated in 2025. The FEA is currently working on a master plan to further align these plans for the future and is already actively working together with the city, the Flemish government and the administrations for roads and public transport to improve the mobility to the campus Ardoyen. A bicycle bridge will be built to cross the waterway and the freeway towards the campus in the coming years and public transport will bring researchers and students from the city centre and the train station directly to the heart of campus Ardoyen as of next year.

The total floor space occupied by FEA is 75.322 m² (including the campuses Schoonmeersen and Kortrijk with mainly facilities for Engineering technology programmes). Of this total floor area, 9.0% is used as auditoria/lecture rooms, 2.9% for PC-rooms, 8.5% for practicals (inc. architecture design studios), 1.4% for libraries, 37.1% for laboratory and research facilities, 30.6% for offices and 10.5% for storage and technical rooms. Of the total floor area occupied by FEA, 53% is located at campus Ardoyen, 24% in the city centre (Plateau- and Technicum buildings), 12% at campus Schoonmeersen, 6% at campus Kortrijk, and 4% at campus Oostende with specialised research infrastructure. For more details we again refer to Annex A.4.

Lecture rooms

The classes take place on a number of locations, but courses are mainly taught in the Plateau and Technicum buildings (mainly bachelor's programmes) and the Ardoyen Technology campus in Zwijnaarde (mainly master's programmes). The lecture rooms at these locations are well-equipped with the standard teaching infrastructure (data-projector, internet and wireless connections, audio/video equipment, black board/white board). At each location, technical support is available to ensure the proper functioning and maintenance of the equipment, and to assist with occasional troubleshooting. Many lecture rooms have been equipped with special broadcasting (streaming) infrastructure to facilitate hybrid teaching. However, a considerable fraction of the teaching facilities is located in historic/old buildings, that don't comply to the current building comfort standards, and are in need of renovation. For instance, (mechanical) ventilation is typically only present in larger or more recently constructed auditoria.

Laboratories

The different departments of the faculty have access to state-of-the-art research facilities that are also used intensively for educational purposes. Most of the practical labs for engineering students take place in the laboratories on campus Ardoyen. For a list of the main laboratories we refer to the faculty's website[31]. In addition to the resources spent by the various departments, the faculty provides supplementary financial impulses to innovate the infrastructure and stimulate innovative educational approaches. For more details see Section 3.4.2. on Information technology and teaching methodology.

Workspaces

We have been witnessing a growing importance of collaborative project work, but also of exercises and lab sessions in small groups of students. To accommodate these activating collaborative teaching methods, flexible workspaces (flexibility with respect to group sizes, equipment to be used, …) are desperately needed. Currently, the faculty has only limited access to such workspaces, and is therefore a strong advocate to invest in such spaces (especially when considering the new educational infrastructure to be constructed on campus Ardoyen).

Libraries

Standard reference works and research papers are essential in engineering education both in hard copy and electronic format. Scientific literature can be consulted by students and researchers in

- the university's library[32] (including electronic access to many journals and the Web of Science);
- the faculty's library[33];
- the departmental libraries (offering a rich collection in specialised engineering topics).

Personal study facilities

Since several years students have the need to study in groups when preparing for the exams and to prepare courses between lectures. Ghent University and the faculty provide various lecture rooms and study rooms that students can use to prepare for their exams (most notably the reading room at the university's library, the student house 'Therminal', the reading room at the faculty's library, and the study landscape at the iGent building on campus Ardoyen). However, often supply is less than demand, and more study facilities with flexible access are needed.

ICT infrastructure

Lecturers have access to all the university's computer rooms, but mainly use six computer rooms (125 PCs in total) and four laptop rooms (124 workplaces) to support courses relying on computer exercises, including the use of simulation software, mathematical symbolic/numerical software, programming and software engineering,...

The university's Department of Information and Communication Technology [DICT] has decided to replace fixed PC classes (phase out) with laptop rooms, taking into consideration that it is becoming more difficult to keep the PCs up to date for all students (including special requirements in some faculties).

The faculty asks first-year students to purchase their own laptop and is also increasingly using laptop rooms, in line with DICT's decision. At the moment, students make exercises on their own laptop in the designated workspaces, but they can still use fixed PCs if needed. Students for whom the cost of purchasing a laptop (or study material in general) is prohibitive, can apply for financial support at the University's Social Service Office.

Considerable efforts have been made to increase Wi-Fi capacity in the auditoria, in addition to the laptop room facilities.

The computer and laptop classrooms are accessible to students when not reserved for exercise sessions. A number of applications and software tools are available through the university-wide software application platform Athena[34].

1.3.3 Financial resources

The budget for the education and research activities of the FEA originates – according to the overall Flanders and hence, Ghent University, model – from four different sources:

- source 1: the government budget allocated to the university to mainly support its educational mission. This budget is used to pay wages of the PS, the AAS and the ATS, as defined in Section 1.3.1 Human resources. It is also used for new building projects, building maintenance and renovation, energy cost, telecom cost, etc. Part of this budget is divided over the faculties to cover remaining operating costs using a rule based on many parameters, amongst which number of students, number of bachelor's and master's degrees, research output, etc. Table 3 shows the amounts allocated to the FEA for 2018, 2019 and 2020.

- source 2: government budget directly allocated to the universities to support research, divided over the Special Research Fund [BOF], the Industrial Research Fund [IOF], the Fund for Scientific Research Foundation Flanders [FWO], the strategic doctoral research grants of the Flanders Innovation & Entrepreneurship [VLAIO] and the Interuniversity Attraction Poles Programme [IAP].
- source 3: contracts (mostly for research but in some cases also for education) from public funding sources, subdivided over the Flemish Community, Belgian federal bodies, EU and other international bodies.
- source 4: research contracts with industry, including the VLAIO-supported contracts with industry.

As an additional source, a government tax reduction on wages for researchers has to be mentioned. The total sum for sources 2, 3 and 4 is also given in Table 3. The table shows that the financial resources acquired from competitive sources 2, 3 and 4 are significantly larger than the source 1 government budget. This clearly reflects the research-driven potential of the FEA, resulting, as discussed in Section 1.3.1, in the large number of Other Academic Staff mentioned in Table 1 of Section 1.3.1 and its beneficial impact on the FEA programmes.

	Calendar year 2018	Calendar year 2019	Calendar year 2020
Source 1	36.4 (40.87%)	37.4 (36.89%)	39.0 (32.20%)
Sources 2, 3 and 4	52.6 (59.13%)	63.9 (63.11%)	82.3 (67.80%)
Total	**89.0 (100%)**	**101.3 (100%)**	**121.3 (100%)**

Table 3: Financial resources allocated to FEA for education and research activities (both in million euro and in percentages)

1.4 The faculty in 2021

In this section, the main evolutions at faculty level are sketched, in order to summarize the changes that have been implemented since the last CTI accreditation visit. This section only presents a birds eye view on these evolutions and more details are available in dedicated chapters and sections in this report.

1.4.1 University Wide Policy Options

The management of Ghent University has put in place 6 strategic goals, to be pursued by its faculties and administration. Faculties and administration have to identify their priorities w.r.t these strategic options, and their funding is made dependent on reaching set-out targets. This approach streamlines efforts of faculties and administration to reach common goals through a shared strategy. The faculty of Engineering and Architecture has chosen to commit to following options:
- Active learning strategies and online learning
- Sustainability as a backbone for all programmes
- Talent management: a faculty excellence programme

In various chapters of this SER, initiatives in the context of these policy choices are described.

1.4.2 Faculty organisation and management

The former faculty management model has been strengthened by the installation of a Faculty Management Team, consisting of the Faculty Dean, the Vice-Dean for Education, the Vice-Dean for Research, the faculty representative at the UGent Board of Governors, and the Policy Officers of Human Resource and Educational Administration. This management team acts as the daily faculty management, and the strengthening of the government model (as hinted at in the CTI evaluation report) results in a more coherent operation of the faculty as a whole. To support the Faculty Management Team in strategic decision taking, an academic advisory board, consisting of the committee chairman of the faculty was formed. This Academic Strategic Advisory Board is complementary to the Industrial Strategic Advisory Board (already existing board) that gives advice on strategic issues from an industrial viewpoint.

A committee consisting of all SPC-chairman, the "VOC" ("Verenigde OpleidingsCommissies") has been put in place. This forum meets on a 2-monthly basis, where faculty-wide educational topics are discussed and best practices are shared (this was also recommended by the CTI at the occasion of the previous accreditation phase).

To increase the critical mass of departments and exploit synergies, some of the faculty departments have merged resulting in 10 departments (instead of 14 in 2015).

1.4.3 Education

A new quality assurance system has been put into place on a University-wide scale. This system is an implementation of the PDCA-cycle, and a new tool (Educational Monitoring tool) has been implemented where data-drive actions (both strategic and short term) have to be identified to improve on areas with potential problems.

On the faculty level, the Bachelor of Science in Engineering has been reformed, such that the former situation of 6 bachelors has now been changed into a single bachelor with a number of main subjects. At this occasion the first bachelor year has been reformed, implementing a.o. a new project course focusing on societal issues (Sustainability, Entrepreneurship and Ethics). A dedicated project week (similar to the Joker-week as organised in the BSc in Engineering: Architecture) has been organised. "Biomedical Engineering" has been introduced as a main subject for the bachelor. This new programme attracts a relatively large number of students (typically 40-50 students subscribe to this main subject).

1.4.4 Faculty campus

Since 2015, it has become increasingly clear that the spreading of the faculty over different campuses is not ideal, nor for students or for staff members. Therefore, the faculty developed the vision to move all activities to its Ardoyen Technology campus (with only a few exceptions, most notably the Architecture department for which embedding in the historic city centre is an important aspect in view of its study domain). Realising this vision is under way, but moving to Ardoyen requires substantial budgets. The faculty continues to lobby at various levels to secure these funds, in view of the important opportunities enabled by this move.

Chapter 2 External Links and Partnerships

2.1 Industry links

As highlighted in Chapter 1 of this report, and discussed in more detail in Section 3.1.1, the faculty actively seeks advice and support from industry in the conception and in the delivery of its programmes. This is implemented through

- ▶ the involvement of the Industrial Strategic Advisory Board at the faculty level, and the incorporation of advisors from industry in the SPCs;
- ▶ the incorporation of industrial experience in the programme through 60 visiting professors (most with their main occupation in industry);
- ▶ the strong encouragement to take one or more industrial internships during the engineering education;
- ▶ the inclusion of industrially oriented cases in many courses of the programmes;
- ▶ the possibility for master's dissertations to be defined and carried out in cooperation with industry.

The faculty puts a strong focus on project-driven education, where (simplified) industrial design problems are tackled by groups of students (also see Section 3.4).

2.2 Research and innovation links

In this section, a general overview of the research and innovation links at the faculty level is presented, in four, logically grouped, clusters of master's programmes and the main departments involved. Detailed information per research cluster can be found on the faculty's webpages:

Cluster I: (CTI cluster 3) covering the master's programmes Master of Science in Engineering: Architecture, Master of Science in Civil Engineering, Master of Science in Fire Safety Engineering and the International Master of Science in Fire Safety Engineering [web link cluster I[35]] (Department of Architecture and Urban Planning, Department of Structural Engineering and Building Materials, Department of Civil Engineering).

Cluster II: (CTI clusters 4 and 6) covering the master's programmes Master of Science in Biomedical Engineering, Master of Science in Bioinformatics (main subject Engineering), Master of Science in Computer Science Engineering, Master of Science in Electrical Engineering, Master of Science in Engineering Physics, Master of Science in Photonics Engineering, European Master of Science in Nuclear Fusion and Engineering Physics, [web link cluster II[36]]. We treat the CTI clusters 4 and 6 together because the bulk of the teaching and research related to both clusters is situated in the same departments (Department of Information Technology, Department of Electronics and Information Systems, Department of Telecommunications and Information Processing, Department of Applied Physics).

Cluster III: (CTI cluster 5) covering the master's programmes Master of Science in Electromechanical Engineering and Master of Science in Industrial Engineering and Operations Research [web link cluster III[37]] (Department of Electromechanical, Systems and Metal Engineering and the Department of Industrial Systems Engineering and Product Design).

Cluster IV: (CTI cluster 7) covering the master's programmes Master of Science in Chemical Engineering, Master of Science in Sustainable Materials Engineering and International Master of Science in Textile Engineering [web link cluster IV[38]]. (Department of Materials, Textiles and Chemical Engineering).

Please note that CTI clusters 1 and 2 relate to the bachelor's programmes and are as such not mentioned separately. The webpages give the following information per cluster:

- • departments and research groups involved in the cluster (with link to the relevant websites);
- • human resources (PS, AAS, OAS, ATS/OATS);
- • research output: link to academic bibliography of the involved professorial staff members;
- • main academic contacts and research partners;
- • main industrial contacts and research partners;

- spin-offs;
- important research infrastructures.

2.2.1 Research links

The research staff of the faculty comprises about 1350 researchers, either working towards a PhD and/or active in one of the many research projects of the departments of the faculty. Only a relatively small fraction (about 16%) of these researchers is directly funded by the university's educational budget (see Section 1.3.1). Supplementary funding for about 1100 researchers is gathered through the successful submission of competitive research projects and scholarship proposals. As explained in Section 1.3.1, the entire research staff is involved in education, reflecting a strong research focus specifically in the different master's programmes.

Funding channels differ in their strategic orientation, varying in their nature from basic research to close-to-market industrial research. Maintaining a balanced research portfolio, covering the full spectrum between basic research and industry driven research, is of crucial importance in the field of engineering. All funding mechanisms share their highly competitive nature, and a severe selection process to arrive at funded high-quality projects. The most important funding mechanisms are highlighted in the four categories below, which roughly represent an equal share of the global research budget of the faculty:

I. Basic research (no direct relation with industry)
- FWO-Vlaanderen[39] (Research Foundation Flanders, scholarships and research projects);
- BOF[40] (Special Research Fund, UGent, scholarships and research projects);
- ERC[41] (European Research Council, grants);
- Methusalem[42] (Flemish government, long-term structural funding for top researchers);
- EOS programme (funding for joint research projects in basic research between researchers in the Flemish and French-speaking community, based on scientific excellence, EOS: excellence of science);
- FWO research infrastructure (Flemish funding for medium- and large-scale research infrastructures);
- Odysseus programme[43] (support of outstanding researchers who have built up a career outside Flanders and want to continue their research in Flanders).

II. Research with industrial/societal support (valorisation is an important selection criterion, but there is no financial support from industry)
- FWO-SBO (SBO projects and SB PhD fellowships, SBO: strategic basic research).

III. Funded research in collaboration with industry (matching funds from industry to complement the research efforts from the university)
- European research projects (FP7[44], H2020[45]);
- ICON[46] (ICON: demand-driven, cooperative research projects co-funded by the Strategic Research Centres [SOCs] and spearhead clusters of the Flemish Region, see also below, with support of VLAIO: Flanders Innovation & Entrepreneurship);
- VLAIO Baekeland mandates: for PhD research in close collaboration with an enterprise.

IV. Research with strong valorisation focus
- VLAIO innovation mandates: for postdoctoral researchers who intend to commercialise their research findings through valorisation agreements with industry or through the creation of a spin-off company;
- UGent-IOF innovation projects (IOF[47] or Industrial Research Fund: for more details, see below under Innovation Links);
- Bilateral research contracts with industry (including the industrial projects that are funded by the Flemish Government through the VLAIO-agency, and in which the faculty participates);
- Consulting.

The faculty is especially proud to count 10 ERC[48] grantees (4 advanced, 3 consolidator and 3 starting grants), 9 ERC Proof of Concept projects, 2 Odysseus and 2 Methusalem grantees amongst its

permanent staff members (see Annex A.5). For comparison, at UGent, 31 permanent staff members hold a starting ERC grant, 19 hold a consolidator ERC grant and 12 permanent staff members hold an advanced ERC grant.

Collaboration with other research groups and industrial partners is essential to set up research projects. Consequently, during their career (starting at the level of PhD student) all permanent staff members build and continuously expand their research network at the regional, national and international level. Of specific importance is the involvement in the Strategic Research Centres and spearhead clusters of the Flemish Region. The role of these centres is:

- ▶ to stimulate and execute research with high industrial relevance and innovation potential;
- ▶ to coordinate research activities to improve research impact sharing a common research strategy;
- ▶ to act as an interface with industry at local and international level;
- ▶ to bridge the gap between fundamental and applied research.

The faculty is involved in:

- Imec[49] (Flanders' world-leading strategic research centre in nano-electronics and digital technologies);
- Flanders Make[50] (strategic research centre for the manufacturing industry in Flanders);
- VITO (research centre with focus on the development of sustainable technologies);
- VIB (research institute that conducts strategic basic research in life sciences);
- Materials Research Cluster (MRC)[51] (multidisciplinary offer to customers in the field of materials science to speed their time-to-market for new products and technologies in Flanders and beyond);
- SIM[52] (strategic Initiative Materials to strengthen the competitive position of the materials industry in Flanders);
- VIL (spearhead cluster for logistics and transport);
- Catalisti (spearhead cluster for the chemical and plastics industry in Flanders);
- Flux50 (spearhead Flemish Energy Cluster, for projects related to Smart energy region);
- Blauwe cluster (Blue Cluster, spearhead cluster for the blue economy, i.e., seas and ocean's related technology).

The faculty has put in place an impressive research infrastructure to accommodate these projects. A non-exhaustive overview of this infrastructure in various research domains of the faculty is listed in the cluster webpages (see introduction in Section 2.2). This research infrastructure is available to students in the context of (typically master's) courses, projects and master's dissertation work. In this way, the investments in research are leveraged to keep the programme up to date, and to stimulate students through their involvement in state-of-the-art research infrastructure.

2.2.2 Innovation links

The transfer of knowledge from academia to industry is a key aspect in research projects of categories II-IV. To further stimulate this transfer of knowledge, UGent has created a dedicated funding mechanism, the IOF[53] (Industrial Research Fund), focusing specifically on projects with a strong valorisation drive. Different project types are put into place in order to bridge the gap between academic research and industrial valorisation (see Figure 3). Between 2014 and 2020 FEA staff members were involved in 19 ConcepTT projects, 22 StarTT projects, 12 Advanced projects and 1 Stepstone projects, i.e. 27%, 30%, 30% and 6% respectively of the total of all beta and gamma faculties[i] projects.

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[i] Beta faculties = Faculty of Sciences, Faculty of Engineering and Architecture, Faculty of Bioscience Engineering
Gamma faculties = Faculty of Medicine and Health Sciences, Faculty of Veterinary Medicine, Faculty of Pharmaceutical Sciences
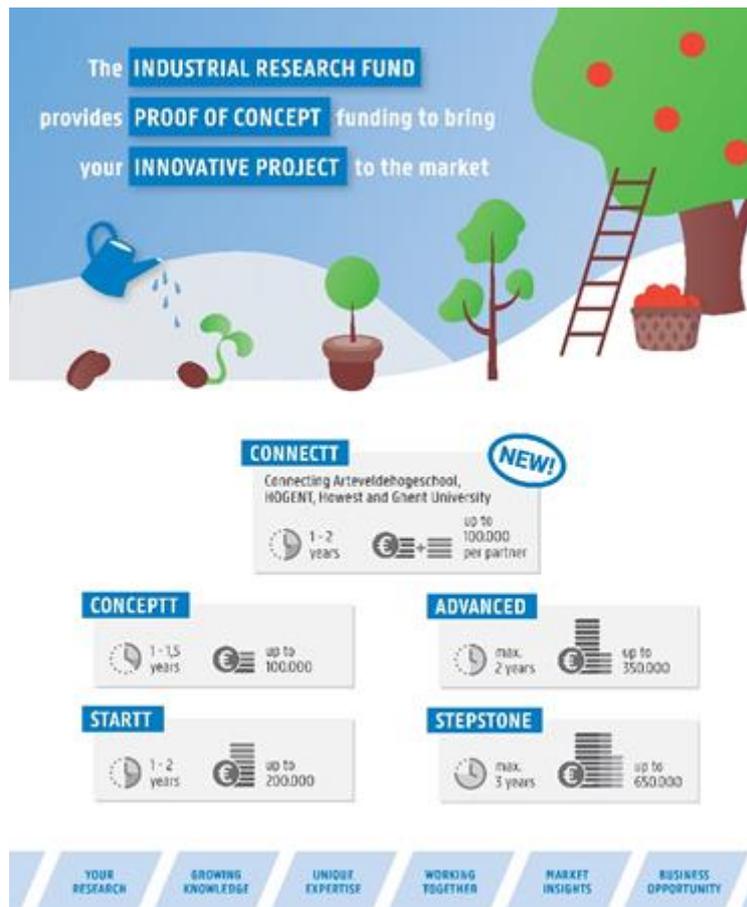
Figure 3: Different IOF projects, from concept to industrial reality

The IOF has created 'business development centres' that group complementary research departments (across faculties) by application area or domain of expertise. A centre is headed by a business development manager who can act as the direct point of contact for industrial partnerships, be it research, services, collaborative research, or IP licensing. These business development managers are embedded in the research entities that contribute to the given application area to make sure that they know the involved researchers very well and can detect opportunities at an early stage. FEA, together with other faculties, is a partner in the following business development centres:

- Biomolecules: Biobased molecules and engineering tools;
- Blue Gent: Aquaculture and Blue Life Sciences;
- ChemTech: valorisation of chemical technology;
- CleanChem: clean technology for durable chemical production;
- Composites: composites;
- DuraBUILDmaterials: valorisation of technologies for durable building materials and techniques;
- End-of-Waste: Creating value out of organic waste and resources;
- EnerGhentIC: Energy Research & Innovation Community;
- e-Poly: valorisation of conformal and polymer based electronic and photonic microsystems;
- HyCT: valorisation of technology in the field of Hybrid Computed Tomography;
- i4S: Smart Solutions for Secure Society;
- i-KNOW: valorisation of intelligent information processing;
- INDATA (IDLab): Internet & Data Lab;
- Machineries & Factories: Machine & factory design and optimisation; industry 4.0;
- MEDTEG: Medical Device Technologies;
- Metals: production, characterisation and application of metals;
- nb-photonics: photonics, components, systems, applications;

- Victoris: Technical optimisation, research and innovation in sport.

UGent's TechTransfer[54] supports research staff in identifying funding mechanisms and business opportunities, and offers legal support (IPR management and patents). A growing number of patent submissions is achieved during the recent years: 18, 19, 21, 21, 23 and 25 for respectively 2015, 2016, 2017, 2018, 2019 and 2020. As to spin-offs, 47% of UGent spin-offs (of a total of 58) originate from the FEA, with an average of four per year over the past six years (2015-2020).

2.3 International links

2.3.1 International strategy

In February 2014 the Board of Governors of UGent approved the Integrated Policy Plan for Internationalisation [IPPI]. The implementation of the IPPI was initiated during the academic year 2014–2015. In 2018 the IPPI was revised, resulting in a new policy plan (IPPI version 2.0[55]) in which 12 strategic lines have been defined. The proposed strategic lines most relevant for the FEA are:
- Line 2: Strengthening institutional partnerships and qualitative partner management
- Line 8: Strengthening the range of international possibilities for students, researchers and staff
- Line 9: Active talent recruitment
- Line 10: Improved reception and support for international staff, researchers and students

Based on the planned scope of the IPPI 2.0, the FEA has already made significant efforts to:
1. monitor incoming degree mobility, by implementing admission criteria based on GRE tests, and offering a preparatory programme taught in English (ref. line 9);
2. ensure a more diligent follow-up and support for international students, with a well-developed buddy system, in collaboration with our local students, and a clearly defined communication flow (ref. line 10);
3. diversify the formats of international mobility beyond the common Erasmus exchange, with which the FEA already has a long experience: these diversified formats include internships abroad, field/lab work abroad, participation in international summer schools, … (ref. line 8);
4. develop a culture of Internationalisation@Home, including specific activities at the faculty (guest lecture series spread over the faculty's campuses, in cooperation with the student organisations) and embedded activities within specific curricula/courses, such as foreign guest lectures, international summer schools, etc. Due to the coronavirus pandemic, online courses and workshops organised by foreign partners have opened up new possibilities, which will be further explored in the future, increasing the opportunities for local students to take part in these I@H activities (ref. line 8);
5. strengthen partnerships with prestigious academic institutions by identifying preferential partners with whom faculty-wide agreements are being negotiated or are already signed (ref. line 2);
6. actively monitor the quality of exchange agreements, by cutting inactive partnerships and reactivating imbalanced partnerships, as to develop a more coherent and dynamic partner portfolio (ref. line 2).

2.3.2 Organisation and internationalisation

The Faculty Committee for Internationalisation [FCI] develops and coordinates the internationalisation policy of the faculty, in line with the strategy articulated in the IPPI 2.0 and in collaboration with the Faculty Management Team. The FCI is composed of staff members acting as the departmental coordinators or International Relations Officers in their respective master's programmes or representing the FEA in different Regional Prospect Platforms focusing on international collaboration with specific areas worldwide. The FCI forms the platform where:
- the guidelines resulting from the implementation of the IPPI 2.0 are communicated;
- actions to be undertaken as a result of the IPPI 2.0 are discussed, such as participation of the faculty in Regional Prospect Platforms, the development of initiatives to stimulate outbound mobility of staff and students and proposals regarding Internationalisation@Home activities;

- requests from specific master's programmes to initiate new partnerships or to organise international activities are assessed;
- strategic choices on the faculty's international policy are being discussed and advised upon;
- best practices are shared regarding internationalisation in the faculty and the university;
- the distribution of budgets allocated to internationalisation are discussed and proposed to the Faculty Council. These budgets relate to outbound teaching staff mobility, prospection travels, Internationalisation@Home activities, as well as a limited number of travel grants for incoming students and staff.

The activities of the FCI are supported by the International Relations Office of the FEA[56] [FEA-IRO] responsible for:

- the administration of inbound and outbound mobility of staff and students;
- the organisation of the welcoming events for international exchange and degree students (each term);
- the follow-up of existing partnerships and setup of new partnerships (in collaboration with the UGent International Relations Office[57] [UGent-IRO];
- the administration of internships abroad, including those organised via the Belgian Branch of the International Association for the Exchange of Students for Technical Experience[58] [IAESTE];
- act as a liaison between student associations and the FCI;
- act as a first point of contact for international staff, students and partners;
- support for visits of foreign university delegations to the FEA.

2.3.3 Partnerships and international networks

Since many years, the FEA is actively involved in research and academic partnerships at an international level. The faculty offers its students opportunities for exchange to partners both inside and outside Europe.

Currently the FEA is running around 110 bilateral Erasmus agreements with several European universities, amongst which the most prestigious engineering programmes in among others France, Germany, Italy, Spain, the Netherlands, Switzerland, Norway and various Eastern European countries. Via the FCI, these agreements are subject to quality assessment and revision, and the various masters are stimulated to strengthen their collaboration with a limited number of preferential, highly ranked foreign partners. New agreements and the prolongation of existing agreements are subject to discussion within and approval of the study program committee and the FCI. This assessment is facilitated by the use of a quality sheet template, providing information on the ranking of the targeted institution/master, on the accreditation, on the content of the curricula, on the services provided, etc. The same approach is followed for the bilateral agreements the FEA has outside of Europe. Currently, the FEA has around 45 Cooperation Agreements [CA] and Memoranda of Understanding [MoU] with institutions outside of Europe. Since the introduction of English-taught master's programmes in 2013–2014, and because of Ghent University's position in international rankings[59], the FEA has become an attractive partner for foreign universities. This has resulted in an increasing number of CA's and MoU's and the FEA is being more and more selective in this respect, targeting collaboration primarily with highly ranked universities. In addition, the FEA also offers integrated study programs offered jointly by an international consortium of universities. Some of them have been awarded the Erasmus Mundus label by the European Commission after a selection based on excellence. Some have been recognised as Erasmus Mundus programmes in the past and are currently continued outside of the EU funding context.

The FEA has also been successful in applying for European funding to set Erasmus Mundus Joint Master Degree programmes via the Erasmus + programme. These master's programmes, developed in close collaboration with foreign partners both inside and outside of Europe are (or have been) running for more than ten years: (1) European Master of Science in Photonics (European funding discontinued after the first phase, reformed to MSc in Photonics Engineering); (2) European Master of Science in Nuclear Fusion and Engineering Physics (European funding continued but now with a partner from France as coordinator); (3) International Master of Science in Fire Safety Engineering (European

funding continued); (4) International Master of Science in Biomedical Engineering (which was not coordinated by UGent and is now, after the EMJMD funding recognised under the EIT Health Label[60] This programme will be terminated, the local MSc in Biomedical Engineering is still offered); (5) International Master of Science in Textile Engineering Advanced Master, was initiated by the former faculty's Department of Textiles and has been running as an international master for over 10 years but has – as of 2021 – received the formal recognition (and funding) as an EMJMD. The experience gained in these international programmes has been very useful for developing FEA's internationalisation policy, particularly in terms of recruitment and assessment of incoming students. The detailed description of these masters and the partnerships involved, can be found in Part B of this SER, except for the MSc in Photonics Engineering which is currently coordinated by VUB and the International MSc in Biomedical Engineering, which is no longer offered at Ghent university (only the regular BSc and MSc in Biomedical Engineering are offered).

The FEA closely follows developments in the domain of International Education by participation of staff members of the International Relations Office in the annual conferences of the European Association of International Education [EAIE]. Moreover, the FEA is very active in the IAESTE-network acting as a host for the Belgian coordinator of the programme. A student delegation of FEA is also part of the Board of European Students of Technology[61] [BEST]. Our faculty has been a life-long member of Conference of European Schools for Advanced Engineering Education and Research (CESAER), of which our Rector has been appointed as President in 2019. As Ghent University, we are involved in numerous institutional networks as well as in the European Universities Initiative 'Enlight'[62].

In the quality assessment of FEA staff members, international collaboration and mobility is viewed as an essential – and necessary – element. While most of the FEA staff members are very mobile in terms of research (participating in conferences, workshops, research consortia), there is still an effort to be made to increase staff mobility for teaching purposes. Similarly, while there are a large number of incoming staff members of partner institutions or foreign researchers visiting the FEA for research purposes, an extra effort should be made to involve them more structurally in teaching, in line with the development of an Internationalisation@Home policy at the faculty level.

In terms of recruiting foreign staff, all job vacancies at Ghent University are announced internationally through the following channels:
- Euraxess European Commission[63];
- Academic Jobs EU.com[64];
- Academic Careers Online[65];
- mailing to a contact list covering all Belgian universities and Dutch universities of technology;
- mailing to a list of ten foreign university departments active in the domain of the vacancy.

This initiative was taken in order to augment the number of professorial staff members of foreign origin. Currently, FEA has 8.5% professors with a non-Belgian nationality, while for all faculties of Ghent university this is 10.0%. For comparison, within FEA 26% of all staff (professors, academic and scientific staff, technical and administrative staff) has a non-Belgian nationality, of which a large majority is scientific staff. This is a larger share compared to all Ghent university staff, where 18% of all staff is non-Belgian.

2.3.4 Joint and double degrees
The faculty's main experience with joint and double degrees with foreign partners stems from the five original international master's programmes offered by FEA (currently reduced to three international masters). As foreign institutes often ask for such joint or double degrees when setting up bilateral agreements, discussions to develop such degree programmes with a selected number of preferential partners are currently being held for specific engineering domains. For joint programmes, the policy is, of course, to opt for a joint degree. However, due to legislation restrictions, this is not possible with every country. In such cases, a double degree solution is chosen.

Within our faculty we currently have a double master degree programme with Université Lille 1, Sciences et Technologies (France) in the field of Electromechanical Engineering. Several other double degree partnerships with a cooperative education scheme (3+2 years) are set up in the field of

Photonics, a.o. with National Sun Yat-sen University (ROC Taiwan), East China University of Science and Technology (China), Dalian University of Technology (China), Huazhong University of Technology (China), Nankai University & Beijing Yiaotong University (China).

The faculty currently offers the following joint degrees:

- European Joint Doctoral Training Programme in High-Temperature Plasma Physics and Thermonuclear Fusion (Czech Technical University of Prague-Czech Republic)
- European Master of Science in Nuclear Fusion and Engineering Physics (Aix-Marseille Université-France, The Complutense University of Madrid-Spain, University Carlos III of Madrid-Spain, Université de Lorraine-France, Institut National des Sciences et Techniques Nucléaires-France, Universität Stuttgart-Germany, Czech Technical University of Prague-Czech Republic)
- International Master of Science in Fire Safety Engineering (Lund University-Sweden, The University of Edinburgh-UK)
- International Master of Science in Textile Engineering (University of West-Attica-Greece, Polytechnic University of Valencia-Spain, University of Haute Alsace-France, University of Borås-Sweden and Kyoto Institute of Technology-Japan)
- Master of Science in Biomedical Engineering (Vrije Universiteit Brussel)
- Master of Science in Nuclear Engineering (Vrije Universiteit Brussel, KU Leuven, Université de Liège, Université Catholique de Louvain, Université Libre de Bruxelles)
- Master of Science in Photonics Engineering (Vrije Universiteit Brussel)

Also for the PhD-programme, the FEA has concluded agreements with international partners, resulting in a double or joint PhD degree (Table 4 shows number of joint PhDs). While there is a growing number of PhDs, the joint PhDs remain relatively stable. For a more extensive overview of completed FEA PhDs we refer to Figure 12 in Section 5.3.

	Total number of PhDs	Number of joint PhDs	Percentage of joint PhDs
2020 – 2021	125	17	13.6
2019 – 2020	139	15	10.8
2018 – 2019	139	16	11.5
2017 – 2018	122	13	10.7
2016 – 2017	109	12	11.0
2015 – 2016	106	15	14.2

Table 4: Number of completed joint PhDs versus total number of completed PhDs

Chapter 3 Educational Process and Programme

3.1 Design and update of the programme

The engineering studies prepare for a wide variety of recruitment profiles, and therefore focus on conveying generic knowledge, methods and attitudes. To ensure immediate employability, graduates need to be aware of the state of the art in the specialisation of their choice. The educational process encourages students to gradually take more responsibility and initiative, making sure that acquiring new knowledge and insights becomes a second nature to the young engineer. This rise in the level of ownership is reflected in all the engineering programmes through the gradual increase in project work. This culminates in the master's dissertation work, where students investigate a topic of their own choice in the context of one of the research groups of the faculty and supervised by experienced researchers.

3.1.1 Communication with stakeholders

As the majority of the graduated engineers are successfully employed in industry, the faculty keeps close contact with the local economic actors to identify opportunities and emerging needs regarding the engineering programmes. The formal mechanisms put into place to organise these contacts (complementary to the many contacts between the academic staff and industry through research and development projects) are:

- The Industrial Strategic Advisory Board[66], composed of 35 members, convenes on a four-monthly basis (three times per year) at the faculty or at the premises of the company or organisation of one of its members. As a result, the following recent fine-tunings to the programmes have been implemented
  - Increased emphasis on soft skills in the curriculum;
  - Introduction of a project line in all programmes;
  - Introduction of entrepreneurial courses.
- All Study Programme Committees regularly invite a number of experts from industry and the society at large to reflect on the current programme contents, to identify new evolutions and trends in the field, and to discuss programme updates.
- The faculty has a long tradition of involving experts from industry and society. This ensures the inclusion of the latest industrial/societal evolutions in the programmes and exposes the students to complementary views on science and technology. This involvement ranges from inviting experts as guest lecturers (typically for 1 or 2 hours), to taking the full responsibility of a course in the programme (the faculty currently counts 60 of such industry-employed professors).

Faculty research staff are also involved in bilateral or externally funded research projects, both on a local and on an international scale. The explicit involvement of research staff in the educational process therefore guarantees that students are confronted with the problems and challenges encountered in the industrial research context typical of the engineering profession.

In addition to identifying needs and trends from the industrial context, the faculty is present in a number of international organisations that focus on the engineering education in particular, including

- The Conference of European Schools for Advanced Engineering Education and Research [CESAER][67];
- The European Engineering Deans Council [EEDC][68];
- The International Association for the Exchange of Students for Technical Experience [IAESTE][69].

3.1.2 Analysis of future needs

The needs as identified by the different stakeholders are analysed at two different levels: (i) the Study Programme Committees focus on evolutions in science and technology in their own specialisation, (ii) the Educational Quality Control Unit [EQCU] focuses on more generic evolutions and needs, spanning multiple programmes and therefore requiring a more structural update of the programmes (e.g.

organising a new master's degree, introducing a new elective social course in all programmes, promoting new teaching methods and approaches, developing overall examination and assessment policies).

It is the explicit task of each Study Programme Committee to reflect critically on the current contents of the study programmes, and to keep students up to date on recent trends in research and technology by introducing new courses or by changing the emphasis and contents of existing ones. These updates and reflections are done on a yearly basis and result in updates to the content of some courses, or in updates to the study programme as a whole. A similar process, but on a more generic level, is conducted by the EQCU.

The continuing efforts of the Study Programme Committees and the EQCU have resulted in several updates to the bachelor's and master's programmes, which are discussed in the detailed description of the specific bachelor's and master's programmes (SER Part B).

The quality assurance of the programmes is a shared responsibility by the SPCs and the EQCU and is monitored in dedicated educational monitors in which the SPC delivers a critical self-evaluation (see Chapter 6).

Before 2016, all bachelor's and master's programmes of the Faculty of Engineering and Architecture were evaluated on a regular basis by the Accreditation Organisation of the Netherlands and Flanders [NVAO]. The recommendations made in the final reports of these assessments were implemented in the programmes.

In 2018 a new Flemish Decree was adopted in which the Flemish Higher Education Institutions [HEI] received a larger responsibility in the quality assurance system. Programmes are no longer assessed on an individual basis, but the NVAO now reviews the HEI as a whole, including their internal quality assurance processes. As a result of this change a new Quality Assurance Conduct was adopted at UGent in which bachelor and master programmes are required to include an 'external view' in the self-evaluation. For the Engineering programmes of FEA, CTI provides this external view.

3.1.3 Procedure for programme updates

Programme updates are discussed at various levels before their implementation. Yearly updates initiated by the Study Programme Committee go through the following steps:

1. Update proposal finalised in SPC by November 1st;
2. EQCU discussion and advice finalised by December 1st;
3. Faculty Council discussion and approval (end of December);
4. University's Executive Board/Programmes Committee approval (before June).

In principle, programme updates are carried out every academic year (for bachelor's programmes, larger updates are limited to maximally once every three years). Smaller programme updates (e.g. a new focus in the contents of one particular course) do not result in a formal update of the programme and can be completed at the faculty level. Such smaller changes follow steps 1–3 above but with March 1st as a starting date.

3.1.4 Approval of new programmes

The creation of a new programme (resulting in a new bachelor's or master's degree) consists of two phases, an internal phase (Ghent University) and an external one (NVAO and Flemish Government). Most recent examples of the application of this procedure are the MSc in Bioinformatics and the MSc in Fire Safety Engineering.

Internal phase

When an opportunity for a new programme is identified (through one of the mechanisms described above or a combination thereof), an ad hoc group is formed to reflect on the rationale, objectives and focus of the new programme. This task force works out the details of the new programme, before submitting it to the Faculty Council for approval. This work includes, but is not limited to:

- analysing related programmes at Ghent University or other universities;
- formulating the programme objectives and competences;

- formulating the admission requirements for the new programme;
- outlining the structure of the new programme
  - consistent learning paths;
  - balance between different teaching methods;
  - relation to existing degrees;
- defining the course contents;
- analysing the human and material resources needed to implement the new programme.

The task force acts as a de facto SPC. The internal approval phase follows the same steps as the process for programme updates.

External phase

Macro-efficiency check

In Flanders, a macro-efficiency check takes place before the initial accreditation procedure. Institutions that receive public funding need to have a macro-efficiency check performed on each new programme by the Commission for Higher Education [CHO] (established by the Flemish Government). The macro-efficiency check reviews if the proposed new programme can be funded by the national authorities. If the macro-efficiency decision is positive, the application for the initial accreditation can be submitted to NVAO.

Initial accreditation procedure

The NVAO assesses if the new programme meets three generic quality standards:
- intended programme outcome, including the programme-specific learning outcomes;
- teaching and learning process, including the quality and quantity of planned staff;
- evaluation and examination policy (valid, reliable and transparent).

This assessment (including an on-site visit by an external committee) results in an initial accreditation report in which the proposed programme is evaluated. After receiving a positive accreditation report by the NVAO, the Flemish Government can give the final approval for organising the new programme.

3.2 Programme outcomes and learning outcomes (generic)

3.2.1 Learning outcomes approach

Since 2005, UGent has implemented a competence model to guide the design of the bachelor's and master's programmes. This model characterises each programme by a set of objectives (learning outcomes), realised through successfully passing a number of courses in the programme. Each course is therefore in turn characterised by a number of final course competences. For each programme, a matrix -mapping courses to learning outcomes- has been constructed, ensuring that each of the learning outcomes is taught and evaluated, ideally by at least two (compulsory) courses.

The competence model is implemented through a set of competences defined for each bachelor's and master's programme. The faculty's implementation incorporates the specifics of each engineering discipline but at the same time identifies the generic competences across all engineering disciplines. Consequently, a set of 'Generic Bachelor Competences' [GB] (common to all bachelor's degrees offered by the faculty) and a set of 'Generic Master Competences' [GM] (common to all master's degrees offered by the faculty) has been defined. These generic competences are supplemented with competences specific to each engineering discipline, as highlighted in the detailed programme descriptions. The learning outcomes of each programme and each course are also available in the online study guide.

3.2.2 Programme level and graduate level

The generic competence model is constructed in accordance with the guidelines of the EUR-ACE system[70] and, in more general terms, by the Dublin descriptors (the EUR-ACE Learning Outcomes and the Dublin descriptors can be found in Annex A.6).

Inspired by the EUR-ACE Learning Outcomes, the generic competence models of the bachelor's and master's programmes are organised in competence fields. Fields GB2-GB5 and GM2-GM6 are identical for all bachelor's and master's programmes. Competences GB1.1 and GB1.2 are also common to all

bachelor's programmes. The generic competences can be complemented by a number of programme-specific competences. These specific competences are enumerated in Part B of this SER, which is dedicated to the individual programmes. Similarly, competences GM1.1 and GM1.2 are common to all master's programmes but are again complemented by a number of programme-specific competences. Due to their specific nature, the Bachelor and Master of Science in Engineering: Architecture have their own dedicated competence model (although, of course, some competences are similar to the ones enumerated below). The complete description of these competence models can be found in Part B.

Generic bachelor and master competences
(except Architecture)

For a list of the generic competences for the bachelor's and master's programmes of FEA, we refer to Annex A.7. The relationship between the EUR-ACE first cycle Learning Outcomes and the faculty's Generic Competences (both for bachelor and master) is also included in the annex.

Long-term adaptability and analytical capabilities

All engineering programmes have a strong focus on basic sciences and basic engineering disciplines, ensuring an excellent scientific and technological background so that students are capable of effectively absorbing new evolutions in the engineering and management disciplines. This concern is reflected in the competences GB1.1 and GM1.1, and is realised, amongst others, in the courses on basic sciences (Basic Mathematics, Physics, Chemistry: the Structure of Matter, Chemical Thermodynamics, Informatics, Probability and Statistics, …) and basic engineering (Analysis of Systems and Signals, Transport Phenomena, Materials Technology, Mechanics of Materials, …) in the bachelor's programmes. The master's programmes have a sustained emphasis on scientific formation. In view of the rapid changes in all engineering disciplines, students are trained to acquire new knowledge independently. This is realised through the projects, in particular the cross-course projects in the third bachelor year and the master's dissertation work. Openness to new knowledge and methods is reflected in the competences GB3.4, GB3.5, GM3.4 and GM3.5.

Short-term adaptability to professional activity within a branch of engineering

The programmes offered by the FEA aim at providing a balance between analytical scientific/engineering skills and more technological, practically oriented skills. Each course (if applicable) pursues this balance through the combination of the introduction to and in-depth discussion of theoretical concepts with practice-oriented lab work and exercise sessions, where appropriate. Competences GB1.1, GB1.2 and GM1.2 emphasise the ability to apply the acquired knowledge in a concrete context.

To enhance the link with the professional world, the following initiatives are taken:

- student projects and master's dissertation work in collaboration with industry;
- optional internship for 3 or 6 ECTS credits in all programmes;
- elective courses in entrepreneurship available to all students;
- JobFair/Archiefair event by the student organisation VTK/DLK to spot job opportunities;
- guest speakers from industry in various courses;
- the use of cases and industry examples.

Research and innovation

Project work takes a prominent place in the engineering programmes offered by the faculty. As students mature, the project work acquires a more open-ended character, encouraging students to come up with creative ideas and develop them into working prototypes. This process culminates in the master's dissertation work, in which the students are active as junior researchers, analysing a scientific or technological problem, surveying the literature for related work, and finding innovative solutions for the problem at hand. The research attitude is amongst others articulated in the competences GB2.1, GB2.4, GB3.2, GB3.3, GB3.4, GM2.1-GM2.5, GM3.1-3.5.

In Section 5.3 the number of FEA graduates that pursue and finally obtain a PhD is listed (in academic year 2020-2021 a total of 125 PhD diplomas were awarded).

Business culture as well as an economic, social, environmental and ethical awareness
The compulsory bachelor's course 'Sustainable Business Operations' focuses on future engineers that operate within a business management structure, and thus should hold sufficient knowledge, insight and skills in the field of sustainable economic management. In elective follow-up courses, students can specialise in entrepreneurship (taking some or all courses in the course track on entrepreneurship). In 2020 a new compulsory course 'Sustainability, Entrepreneurship and Ethics' has been offered to first-year's students in which the aspects from the course title have to be applied in the context of a specific engineering project.

The competences GB5.X and GM5.X express the awareness of ethical, economic, social and environmental issues in the various engineering programmes. Each student can select a number of elective courses from a list of elective social courses (see Annex A.8) dealing with ethical, social and/or environmental topics.

Communication skills and international awareness
Competences GB4.X and GM4.X relate to communication skills. All masters (except for the Master of Science in Engineering: Architecture) are taught in English. Consequently, students are trained to communicate efficiently both in Dutch and in English (following lectures in English, writing reports in English), and are often involved in project teams with international students. A B2-level in English is required of all students (see Section 3.5.2). Students with a secondary school degree from Flanders are exempted from this language requirement as it is understood that they have acquired English at this level.

Furthermore, students have the opportunity to
- follow part of their master's programme abroad in the context of the Erasmus programme;
- take an international internship;
- follow lectures, organised by international colleagues through Internationalisation@home;
- take an international course during the summer period (e.g. BEST courses[71]).

3.2.3 Consistency of educational objectives

The objectives of the FEA engineering education have been discussed in detail in Section 1.1.3. They explicitly account for the needs of the stakeholders and the mission of the UGent as formulated in Section 1.1.2. The FEA is convinced that its graduates successfully contribute to the needs of society and industry, as they have always done in the past. We refer the reader to Chapter 5 for an in-depth analysis of FEA graduate employment and employer satisfaction. In the employer survey, employers were explicitly asked to score FEA graduates on the points of attention discussed in Section 3.2.2: long and short-term adaptability, research and innovation potential, business culture and economic, social and ethical awareness and communication skills in a national and international context. The results of the surveys conducted among both graduates and employers show a very high degree of satisfaction about the FEA engineering programmes.

3.2.4 Programme outcomes for accreditation

The Master of Science in Engineering programmes of the FEA prepare for a large variety of professional profiles. CTI accreditation documents mention 8 types of professional profiles:
1. Basic and applied research
2. Design, engineering and consulting
3. Production, operation, maintenance, testing, quality, safety
4. Information systems
5. Project management
6. Customer relations (marketing, sales, customer support)
7. Management, human resources
8. Training

To quantify the suitability to prepare our graduates for the profiles mentioned above, Question 9 of the graduate employment survey (see Chapter 5 and its annexes) explicitly asks for the main profile (from the list above) of the present and previous employment, and the one prior to that.

The data in the tables of the annex lead to the following conclusions for alumni graduated in the period 2015-2021:

- categories 'Basic and applied research' and 'Engineering studies, consulting and expertise', again taken together, on average sum to 63%;
- categories 3, 4 and 5 seem to settle around 10% each, while job categories 6, 7 and 8 (being less technical oriented) are almost absent in the survey, which is consistent with the survey conducted in 2015;
- overall, the results indicate that the FEA programmes indeed prepare for the job profiles identified by the CTI.

The emphasis in the FEA engineering programmes on basic sciences, in-depth (mathematics- and physics-based) knowledge of an engineering discipline, and the attention to the development of research skills culminating in a master's dissertation, clearly translate into graduates taking up jobs in categories 1 and 2. The fact that the 'Customer relations' category scores very low, is a consequence of the fact that the FEA does not offer a business engineering programme. At UGent such a programme is offered by the Faculty of Economics and Business Administration. For more details on the survey we refer to Chapter 5.

3.3 Programme content

3.3.1 Generic part of the bachelor's and master's programmes

Coherence with the expected programme outcomes

For this topic, we refer to Section 3.2.1 above as well as the detailed descriptions of the bachelor's and master's programmes (SER Part B).

Curriculum and syllabus content

All FEA's programmes can be consulted in the Ghent University's online study guide. Students and teaching staff can easily access and consult all course descriptions through the online study guide or Ufora. These course descriptions are critically reviewed on a yearly basis, and updates are implemented after advice by the Study Programme Committee and the Educational Quality Control Unit (the latter has received a delegation of power from the Faculty Council for the formal approval of the changes in the course descriptions).

All course descriptions specify the following information:

- Course title
- Course size (number of ECTS credits)
- Course offering and teaching methods (teaching methods/contact hours)
- Lecturer(s) in the current academic year
- Programmes where the course is offered
- Language of instruction
- Keywords
- Position of the course
- Contents
- Initial competences (pre-requisites)
- Final competences
- Conditions to enter the course with a credit contract or an exam contract
- Teaching methods
- Learning material (including price estimate)
- References
- Coaching methods (course content-related study coaching)
- Examination methods and organisation
- Grading policy (calculation of the examination mark)

Common structure of the Bachelor of Science in Engineering programmes

The FEA offers two bachelor's degrees in engineering: the Bachelor of Science in Engineering: Architecture and the Bachelor of Science in Engineering. The latter offers 7 main subjects, that start in the third or fourth term of the bachelor's programme. The first three terms focus on a basic scientific and broad technological formation which is a prerequisite for specialising in an engineering branch. This common three-term programme is further detailed in Annex A.9. The bachelor's degree in Architecture builds on a strong scientific and technological foundation, but a strong focus on design activities is essential early on in the programme. More details on the Architecture programme can be found in Part B of this self-evaluation report.

The Architecture bachelor's programme includes an elective course of 3 credit units, while the bachelor in Engineering (except for 3 ECTS electives in the BSc in Civil Engineering) has no electives. This choice is motivated by the concern to offer a solid and broad scientific and technological formation to all students, moving the specialisation and opportunities for personal learning experiences to the master's programmes. Additionally, the project courses and courses including project components, offer considerable opportunities for students to define or choose projects optimising the match with their personal interests and ambition.

Common structure of the Master of Science in Engineering programmes

Each master's programme has its own engineering specialisation and focuses both on the general master competences and on the discipline-specific competences. Our master's programmes in engineering and architecture comprise 120 credits, with at least 24 credit units for the master's dissertation. This emphasises the importance of individual research, embedded in one of the many research groups of the faculty. Students are given every opportunity to specialise, especially during their master studies. Several master's programmes offer specific specialisation tracks and all programmes give ample opportunities for organising elective courses. The subject of the students' master's dissertation is a personal choice and is also an opportunity to follow their personal research interests. More details on the specific master's programmes can be found in the next sections.

3.3.2 Detailed description of the programmes

In Part B of this self-evaluation report all bachelor's and master's programmes are described separately, in detail.

3.4 Programme delivery

3.4.1 Description of the curriculum

All programmes are published in the online study guide of Ghent University[72]. Each programme has a model track, showing the ideal sequence of courses and the outline of the programme per academic year. Supplementary university and faculty regulations are provided for students that do not follow the model track, typically as a result of not obtaining all credits for one or more courses (Annex A.10). The model track always serves as a guideline, as it takes into account dependencies between courses. All programmes follow a term approach: courses are taught during one term of twelve weeks, followed by an examination period. Some courses are scheduled over the two terms of the academic year, with examinations either after the first or second term, or after both. Such courses include design projects, dissertation projects or cross-course projects in which students integrate and apply the learning outcomes from other courses.

Each course is described in the study guide in the course descriptions, in accordance with the ECTS guidelines. For more details on course description see Section 3.3.1.

3.4.2 Learning process

Delivery modes and practical methods (teaching methods and practical experience)

All programmes are designed to incorporate different teaching methods, optimised for the specific content and learning outcomes of each course.

The Education and Examination Code of Ghent University [OER][73] provides an overview of the teaching methods in the 'Glossary of Teaching and Evaluation Methods'. Teaching methods comprise, but are not limited to, group work, lectures, practicals, projects and seminars.

An overview of the relative importance of the different teaching methods in each bachelor's and master's programme can be found in the annexes of the detailed description of the programmes (Annexes of Part B).

The project line built into each bachelor's and master's programme is specifically designed to develop creativity and design skills, gradually evolving to cases relevant for industrial contexts.

Although internships are not compulsory, 35% of the students follow the recommendation of the faculty to take an internship in industry during their studies. These internships are highly valued by both students and industry supervisors (see Section 3.6 for more details).

Especially for the master's programmes, care is taken that students are brought in direct contact with the industrial context of their specialisation. This is achieved by

- relying on visiting professors for specialised technology courses;
- inviting guest speakers and/or lecturers;
- studying industry related cases and projects;
- including study visits to industry as an integral part of a course (e.g. in the second bachelor year a mandatory study visit is organised in the course Engineering Project II in cooperation with Agoria[74], the Belgian federation of companies in the technology industry);
- initiatives by student organisations.

Students are assisted and guided in their choice for the bachelor's and master's programmes by faculty information sessions, which present the specifics of each programme (contents of the programmes, expectations as well as typical job profiles resulting from these programmes). One of these sessions is organised at the end of the first, i.e. common, bachelor year. A second session, in the second term of the third bachelor year, provides extensive information on all master's programmes.

Study load / workload

The expected study load per course is included in the course description and amounts to between 25 and 30 hours of study per ECTS credit. The study load includes the educational activities, organised in time slots of 1h15. A 6 ECTS credit course usually has two lectures (of 1h15 each) and two practical sessions (lab, exercise, or project sessions) on a weekly basis. A 6 ECTS credit course typically consists of 60 contact hours, leaving 120 hours for evaluation and independent learning and self-study.

The study load as perceived by the students is regularly assessed through surveys (at the university level). This information is used to validate the balance between expected efforts and actually spent efforts, and to fine-tune the programmes where appropriate.

Active teaching methods

Through the 'ACTIVO project', Ghent University is enhancing active learning and active teaching university-wide, starting in the second half of academic year 2018-2019. The aim of the project is to activate students on a behavioural, emotional and cognitive level and to make them an active partner in their learning process. This is achieved by implementing research-based active teaching and assessment methods. The students' own experiences, opinions and preferences are seen as an enrichment of the learning environment.

The project team consists of eleven educational developers, one of which is assigned exclusively to the Faculty of Engineering and Architecture. The goal is to come to an ideal mix of didactic and assessment methods through which the learning outcomes can be optimally attained. The ACTIVO project works according to the principle of constructive alignment. That principle aims to attain and to assess the learning outcomes as efficiently and effectively as possible by aligning the didactic and assessment methods. Constructive alignment is then put into practice by means of active teaching. In the first year, the project focussed explicitly on a selection of bachelor's programmes. As a result of the coronavirus pandemic, the intended and gradual shift to the master's programs is postponed to next academic year, 2021-2022.

Information technology and teaching methodology

Ghent University and the FEA provide appropriate auditoria, laboratories and laptop rooms to accommodate lectures and organise practical sessions for each course. The lecture rooms are equipped and maintained by the central administration, the faculty and the departments.

In addition to the resources spent by the various departments, the faculty provides supplementary financial impulses to renew the infrastructure and stimulate innovative didactic approaches. These impulses are

- A yearly additional budget of € 100.000 for educational infrastructure (see Annex A.11 for an overview of new infrastructure over the past years).
- A yearly additional faculty budget of € 40.000 for innovation projects (a list of projects can be found at the UGent webpage[75]).

In the academic year 2020-2021 (and as a direct consequence of the coronavirus pandemic), all lectures were recorded and streamed. To this end, Ghent University has invested in both portable recording and streaming sets for each lecture room, and in professional recording devices (capture agents). Ghent University has also set up two professional recording studios with professional advice and technical support on recording and editing, and offers a wide library of professional recording equipment.

Master's dissertation defences can also be held online, for instance in specific teleclassing rooms.

FEA has two elaborate teleclassing systems and the staff can also use the university teleclassing facilities provided by DICT[76].

Supporting education: Ufora

Since the academic year 2019-2020, Ghent University uses a new online learning environment Ufora. All courses extensively use this platform, that includes the following features:

- the course description;
- announcements (e.g. for announcing any practical course arrangements);
- providing lecture material (course texts, slides, hand-outs, syllabus);
- offering additional sources of information to the student;
- organising virtual classrooms;
- uploading video material, streaming lectures and knowledge clips;
- managing assignments (projects, exercises), including a student drop box (e.g. for handing in assignments);
- different modalities to provide feedback to students;
- assessment by using rubrics;
- online learning paths;
- discussion forums;
- administrating student groups, e.g. in order to facilitate group work.

Ufora is intensively used by all courses, and is the major communication infrastructure between lecturers and students. New features and the implementation of new requirements arising from new teaching approaches are regularly added to the platform.

Lecturers can also be reached through e-mail (e.g. for individual contacts, to make an appointment if additional explanation is needed) or before/after lectures for short clarifications or practical arrangements.

Online teaching and assessment: Bongo, Zoom, MS Teams, gather.town…

The coronavirus pandemic has led to a previously unknown switch to online teaching. Since the second term of the academic year 2019-2020, new tools for online learning are in use. Classes are held online through Bongo (Ufora's virtual classroom, with interaction opportunities through functionalities such as screen sharing, screen control, quickly organising a poll, and chat), Zoom (for video calls with larger groups), Microsoft Teams or gather.town. Assessments and evaluations that could not be held on campus as a result of the coronavirus measures, were also organised through these tools.

Curriculum management: OASIS and Plato

Ghent University has developed its own system for the administration of students and the educational processes, called Oasis[77]. Employees from the central and faculty administration extensively use the back-end of the system, while students and lecturers interact with the front-end through the Oasis-website. Functionalities on the Oasis-website include:

- re-enrolment;
- curriculum management (viewing, editing, submitting (elective) courses, individualised learning path);
- publication of exam results;
- downloading certificates of enrolment, certificates of achievement, certificates for insurance purposes or for public transport.

The Faculty of Engineering and Architecture has developed the additional tool Plato[78], to automate additional administrative processes. Through Plato, the following processes are managed:

- master's dissertation process (selection of research topic, dissertation uploading and archiving, evaluation);
- internships (administration and contract handling, report uploading, evaluation and feedback);
- exemptions (requesting the recognition of previously acquired competencies/skills in the curriculum).

Both tools are intensively used by students and staff, and have resulted in considerable efficiency gains in the educational process.

3.4.3 Training the staff

To further optimise the educational process, and to introduce the teaching staff with new teaching methods and innovative tools, Ghent University offers several types of training[79]. These include, a.o.:

- teacher training for tenure track staff (compulsory for newly appointed staff members, possibility for a follow-up training) and for teaching assistants;
- advanced training on communication, presentation skills, feedback methods, peer assessment…;
- training on blended learning and online education, and the use of didactic tools for online teaching;

There is also a training offer for Study Programme Committees, a.o. on diversity, entrepreneurship, sustainability, internationalisation on the programme level.

In 2019-2020, more than 200 FEA lecturers took one or more training opportunities of offer by Ghent University.

3.4.4 Assessment of learning outcomes

Assessment methods and grading

Each course makes use of appropriate evaluation methods, detailed in the course description. The calculation of the final marks, the terms and conditions to pass the course and the modalities for the second examination period (in case of changes in assessment methods and/or grading policy) are specified. The evaluation methods and grading policy are explicitly communicated to the students at the start of each course. In the course of the educational activities, lecturers use questions and/or exercises that reflect the concrete requirements of the evaluation. The evaluation method (oral/written, open/closed book, open questions/multiple choice…) is reviewed and approved yearly by the responsible Study Programme Committee.

The final examination marks are communicated to the students through Oasis. All students are entitled to get feedback and to peruse their exam copy and any assignments that were submitted as part of continuous assessment. This feedback is primarily aimed at preparing the student for a new exam for the same course, indicating possible shortcomings in insights and performance. In the rare case a disagreement arises on the examination score, the student can seek advice from the (faculty's) ombudspersons. If the problem is not solved at the faculty level, students can file a complaint at the university level, with the institutional ombudsperson of UGent.

Evaluation strategy

Ghent University has developed an overall concept[80] to ensure fair and consistent evaluation throughout the different programmes. This vision is articulated in a framework of 17 principles, and within this framework, the different faculties have defined their specific strategy.

The evaluation strategy for the FEA is more described in detail in Section 6.1.7 (Continuous improvement cycle).

Master's dissertation

All master's degrees comprise a master's dissertation work of at least 24 ECTS credits, as part of the last master year. This is a research project conducted individually or by two students collectively in one of the research groups of the faculty. During this master's dissertation work, the student is guided by the dissertation supervisors. Students are expected to be able to

- identify the proper research questions in the topic at hand;
- conduct a literature study, identifying related work;
- design a proper methodology to tackle the research questions identified;
- organise and conduct the scientific work in a well-organised, considered approach;
- work independently, but seek advice when appropriate;
- communicate on their progress and problems efficiently (both orally and in writing);
- write a comprehensive report (the master's dissertation) on their findings;
- write a short paper on their findings;
- succinctly present their work in public.

Master's dissertation work is evaluated against a fixed set of criteria by the dissertation assessment committee, consisting of one or two supervisors and one to three members of the dissertation reading committee. At least one member of this jury is from another research group or from industry. The criteria can be found on the faculty's website[81].

3.4.5 Student follow-up and tutoring

The transition from secondary school to the university requires a major change in the students' mind-set and attitude. The required level of understanding, the level of abstraction and the less stringent framework guiding their daily occupations have proven a difficult step to take for many students. Therefore, the faculty, supported by Ghent University, has taken a number of initiatives to aid them in taking this step.

Initiatives for first-year students

The Faculty of Engineering and Architecture offers counselling services to bachelor's students in their first year, called the monitoring services[82]. The monitoring service provides study coaching for all first-year courses (except for the architecturally oriented courses where a dedicated tutoring system is put in place). The efforts are complementary to the courses, and target students having problems with one or more courses. Initiatives include

- group sessions to explain specific topics;
- feedback sessions for the intermediate tests;
- exam preparation sessions;
- individual sessions for students requiring specific explanation and further support;
- study groups to coach the students in their learning process.

The architecturally oriented courses have a dedicated tutoring system. All lecturers from the first year are, outside the lectures and exercise classes, weekly available during three additional hours (and more upon request). These extra time slots stimulate students to seek support in case of problems and students are encouraged to take this opportunity to tackle problems as early as possible.

Initiatives in the first year BSc. in Engineering (all programmes except Architecture)

The course 'Basic Mathematics' (3 ECTS credits) aims at aligning all students to the same level regarding mathematical capabilities, by reviewing a number of important topics from secondary school mathematics (complex numbers, mathematical analysis, planar geometry and matrices). This course focuses on problem solving and is organised in the first three weeks of the academic year. The course

is concluded with a test at the end of the third week, on the basis of which students can assess their capabilities and take appropriate action.

All courses in the first year of engineering implement evaluations during the term, allowing students to monitor their mastering of the course content:

- Homework (Physics I, Probability and Statistics, Chemical Thermodynamics)
- Continuous feedback for project courses (Modelling, Making and Measuring; Sustainability, Entrepreneurship and Ethics).
- Open book tests (2 tests are organised per course)

The open book tests check the insight and proper understanding of the course content (rather than focusing on reproduction or on solving advanced problems). Scores on these tests are available one week after taking them, and students are encouraged to take part in feedback sessions or seek advice in case of problems. In this way, students, the monitoring services and the lecturers are able to follow the progress students make and detect problems early on.

Active learning in the first bachelor's year is most explicit in the new 'DOE' course, that focuses on sustainability, entrepreneurship and ethics. The course starts with seven introductory lectures on these themes, both by UGent lecturers and partners from industry. It culminates in a project week during which the students analyse the result of the technical group work they performed in the previous semester. The first four days of this week are reserved exclusively for group work and workshops focussing on the three themes that are highlighted throughout the course. The result of the analysis is presented during an engineering festival on Friday of the reserved week.

Initiatives in the first year BSc. in Engineering: Architecture

The most challenging course in the first year is Architectural Design, as it deals with subject matter, competences and teaching methods for which secondary school offers no preparation. For this reason, students are tutored in one-on-one situations or in small groups. This is made possible by dividing the total group of first-year students in two manageable units (of ca. 60–80 students), each with their own studio professor and team of assistants. Tutoring of the students is strictly organised so that each student knows when a professor or an assistant is available.

In the first term students are given small assignments that allow them to gain self-confidence. The grading of these assignments serves as a basis for feedback but does not contribute directly towards the final grade. The final grade for the year is based on the work of the second term and an overall assessment of the first term.

The studio professors are available before and after studio hours for walk-in consults.

Within the architecture program, the first focus of the ACTIVO project was on the three consecutive architectural design courses in the three years of the bachelor's program. With the lecturing and supervising team from the first-year's course, multiple discussions on the scope of the course and how to attain the necessary competences yielded inspiring views and an exploration of alternative assessment and review formats.

Initiatives for all students (bachelor and master)

Students are entitled to (and encouraged to seek) feedback on the results of all evaluation activities in the context of a course (both continuous assessment e.g. projects, lab sessions, graded exercises, and end-of-term assessment, i.e. exams). For the first-year courses, specific time slots are allocated and students are explicitly invited to take part in feedback. In other courses, feedback can be organised upon request, as walk-in sessions or as a group session, but always as soon as possible after the communication of results. The explicit purpose of feedback is to assist students in preparing for their exams, and to maximise their chances of obtaining a credit for the course.

The Learning Track Counsellors advise the students with their curriculum (choosing elective courses, composing an individualised learning path if one or more credits have not yet been obtained). The advice takes into account (i) the prerequisites for each course and (ii) the study capacity of each student (aiming at a realistic study load and schedule for the student). The counsellor also gives advice when students wish to change to another programme (either offered by the faculty or outside the faculty). Students can also follow individual or group sessions on study planning and study methods.

The Counselling Office provides training on study skills and study efficiency. Student psychologists can be contacted by students experiencing study-related or personal difficulties.

The university offers a mentor programme[83] to assist new students when entering the university. The mentors are students that have successfully completed 60 ECTS credits in the previous academic year. The programme is specifically targeted at foreign students and to students who do not speak Dutch at home (migration background).

Honours programme

The Faculty of Engineering and Architecture is deeply committed to fostering the skills of its many excellent students and to increasing its societal impact. For these two reasons an honours program has been established, which is called Innovation for Society. The program will start for the first time in academic year 2021-2022. Its goal is to offer 15 to 25 excellent students the possibility to participate in a challenging yearlong program offering a substantial intellectual challenge, next to the ordinary curriculum followed by the participating students. Every year, the selected cohort of students will work on a different theme derived from the United Nations Sustainable Development Goals and considered in the local context of Ghent or Belgium (for a description of the programme in Dutch, see annex A.12 and website[84]).

The theme for 2021-2022 is 'Engineers for Fair Institutions' and focusses on the role the engineer of the future may have in different aspects of our legal system and the ethical dilemmas that may arise thereof. The theme for 2022-2023 is 'Coastal island/Multifunctional Island' and will focus on renewable energy on artificial islands.

Finally, the program intends to foster direct collaboration between students in engineering, engineering technology and engineering: architecture, across disciplines and year of study.

Next to this faculty specific honours programme, the faculty will take part in the interfaculty honours programme Education. This interdisciplinary programme offers promising students a two year trajectory into educational competences and innovative educational projects and research. The students get a basic pedagogical training, and gradually develop their educational skills as they are actively involved in the supervision of practicals and exercises. The specific faculty focal points and eligible courses are under consideration. Students will be selected in the spring of 2022, to start this new programme in 2022–2023.

3.4.6 Sustainable development, ethics and professional ethics

The concepts of sustainable development, social responsibility, ethics and professional ethics are part of the generic competences in the bachelor's and master's programmes, in Competence Field 4 ('Competences in cooperation and communication'), in Competence field 5 ('Societal competences') and in Competence field 6 ('Profession-specific competences') (cf. Annex A.7). In all programmes, one or more courses from the core curriculum contribute to these competences, and a large number of elective courses cover such aspects as sustainability, ethics, entrepreneurship or social responsibility. One of the faculty's short- and mid-term goals (and one of the faculty's guiding themes for the following years, in line with Ghent University's policy choices), focusses on sustainability (cf. Annex A.1).

The faculty's study programmes are outlined on a central technical-scientific basis. Sustainability issues are interwoven throughout the courses and are an integral part of the faculty's programmes. To align with the Ghent University policy choice on sustainability, the faculty has decided to implement a clear focus on sustainability in all engineering programmes. This constructive alignment along sustainability has been initiated with the introduction of the course "Sustainability, Entrepreneurship and Ethics" in the first bachelor year of BSc in Engineering. Efforts are ongoing to develop a sustainability learning path, introducing a sustainability focus in existing courses. To fully prepare our future engineers and architects, today's sustainability challenges will be more prominently addressed in all study programmes. Sustainability aspects will be covered in new and existing courses, and sustainability thinking as well as sustainability transitions will be incorporated into various projects.

A similar approach is taken on ethics, where the University recommends introducing an ethics oriented learning path in the curriculum. Implementation of this is ongoing, and has started introducing ethical

issues (plagiarism, experimental code of conduct, data integrity) in the "Modelling, Making and Measuring" course and more explicitly in the new course "Sustainability, Entrepreneurship and Ethics" in the first bachelor year of BSc in Engineering. Ethics issues will be elaborated on in the project line, and this is currently under deployment. In the architectural engineering and civil engineering programmes other courses related to professional ethics and practice, such as Deontology and Construction law, are included in the programmes, typically in the last bachelor or the last master year.

3.4.7 Engineering qualification certificate

After the successful completion of the master's programme in engineering, graduates receive their diploma, which grants them the title of 'Master of Science in Engineering'. The diploma, the official qualification certificate, is supplemented with a diploma supplement based on a model of the European Commission, the Council of Europe and UNESCO/CEPES.

The diploma supplement provides objective information aimed at improving the international transparency and the recognition of diplomas for academic and career purposes. The diploma supplement details the nature, level, context, content and status of the successfully completed studies. The holder of the degree of Master of Science in Engineering is also authorised to bear the title of 'Burgerlijk ingenieur' (professional title in Dutch, established by decree). The holder of the degree Master of Science in Engineering: Architecture is authorised to bear the title of 'Burgerlijk ingenieur-architect' (in Dutch). Before entering the actual architect profession a mandatory two-year architect-traineeship is needed. Application for this professional recognition is arranged via the 'Orde van Architecten – Vlaamse Raad'[85].

3.5 International dimension

3.5.1 Expected outcome

The study programmes at the Faculty of Engineering and Architecture explicitly aim at forming creative and dynamic engineers who will be able to address the challenges of the future in a globalised world. Hence, the international and intercultural skills of our students receive our full attention. Apart from organising several international master's programmes, the faculty also has made the choice to teach its regular master's programmes in Engineering in English (since 2013), in order to prepare the students for an internationally oriented work environment. At the same time, the choice for English as the standard teaching language is a stimulus for student and staff international mobility and also makes inbound mobility possible.

Question 4 ('what is your opinion on the professional communication skills – national and international – and team work skills?') of the employer satisfaction survey discussed in Section 5.3, gives a 77% very good or good score and a 18.4% neutral score. With 71.3% of the respondents coming from a company with more than 20 engineering employees (Question 8), in Flanders, this almost automatically implies that the international dimension is present. This implies that the expected outcome is also, to a large degree, realised.

A recent survey organised by the student representatives also showed that students are overall very satisfied about following their master's programmes in English.

3.5.2 Cultural background and language skills

Since 1930, Dutch has been the language of instruction at UGent. This legal requirement (together with the relatively small extent of the Dutch speaking region in Europe) has had a strong impact on internationalisation at FEA. While FEA has a long tradition of outbound mobility, the Dutch language formed a major obstacle for inbound mobility, notwithstanding the international level of the education and the use of international textbooks and literature as teaching material. Since the transition from Dutch to English as the language of instruction for master's programmes during the academic year 2013–2014 inbound mobility has become possible (see Section 3.5.4). To guarantee the educational quality of the lectures as well as the course material, the Flemish government requires a C1 certificate in English of all staff members teaching in English (and conversely, also a C1 certificate in Dutch for non-native speakers teaching in Dutch).

For foreign students, the language level required to enroll is equivalent to B2 (either Dutch or English depending on the programme). For students holding a diploma from a Flemish secondary school, the B2 level is automatically assumed, and no additional courses or tests are formally required. This is a consequence of the strong focus on the study of foreign languages in primary and secondary school in Flanders, where the study of French already starts in primary school and the study of English at the beginning of secondary school.

Some international master's programmes at FEA have specific language requirements[86], as stipulated in the respective consortium agreements with the international partner institutions. For students (both international and local) having difficulties mastering the English language, the university offers specific courses via the University Language Centre[87] [UCT] as well as guidance on request in reading and writing. In addition, one of the elective courses during the bachelor's programmes is dedicated to the specific use of English in an academic context ('Academic English'). Staff members also have the possibility of following advanced courses in Academic English.

3.5.3 Outbound mobility

The international dimension is one of the six pillars of the vision of Ghent University on a high-quality academic education. Clearly, outbound mobility is part of the DNA of the international master's programmes, while in the other master's programmes it is facilitated and stimulated, but not compulsory. Up to the academic year 2018-2019 FEA was realising a stable outbound mobility of its master's students (around 160 to 170 per academic year), a large part of which via Erasmus exchange, although taking up internships abroad is also gaining in importance; during the last two years however, international mobility was heavily perturbed by the coronavirus pandemic. Currently, the situation is slowly recovering, yet overseas exchanges are still very complicated. However, during the pandemic some opportunities were created by the UGent central administration for implementing "online mobility" and also internationalisation@home received more attention.

Currently, UGent stimulates all faculties to develop flexible study programmes including so-called windows of opportunity, making it easier for students to incorporate also short and online international experiences in their study programmes. The participation of UGent in the ENLIGHT network will also create additional possibilities.

Already now other formats than Erasmus exchanges are actively promoted, such as:

- internships abroad (through IAESTE or similar organisations);
- participation in international workshops, summer schools or winter courses (such as the ones organised by BEST, or offered by foreign institutions the faculty has collaboration agreements with);
- field work in the Global South (with VLIR-UOS travel grants[88]);
- participating in specific grant programmes (BAEF[89], Chinese Scholarship Council,…);
- a research internship in a foreign university/lab.

Early on in the academic year (typically October-November), an event is organised to inform students about the various possibilities to gain international experience as part of their study programme. Students with previous exchange experiences are actively included in these events and in attracting new students, and student organisations organise additional events to trigger the interest in outbound mobility.

	2016–2017	2017–2018	2018–2019	2019–2020	2020–2021
Erasmus+ and Bilateral Agreements	100	116	106	106	25
Internships abroad	23	71	55	61	9

Table 5: Outbound mobility: number of outgoing FEA students

3.5.4 Inbound mobility

Inbound mobility at FEA mainly occurs at master and PhD level: due to the language requirements in Dutch, this is almost not possible in the bachelor programmes. The percentage of foreign students at

FEA currently is 15,8%, the overall rate at UGent being 12,8%, Inbound mobility consists of both incoming exchange students and foreign degree seeking students. Due to the shift to English as a teaching language at master level, as well as Ghent University's position in international rankings, there was an increase in inbound mobility over the last years, with in particular a rise of applications from degree students. In Table 6 and Table 7, we provide the detailed numbers for inbound mobility since the academic year 2016–2017, for both exchange and degree students.

	2016–2017	2017–2018	2018–2019	2019–2020	2020–2021
Erasmus+ and Bilateral Agreements	76	126	119	117	50
Internships	78	84	52	29	20

Table 6: Inbound mobility: number of incoming exchange students

	2016–2017	2017–2018	2018–2019	2019–2020	2020–2021
MSc in Engineering and in Engineering-Architecture programmes	37	31	36	39	35
International MSc in Engineering programmes	29	30	26	31	32

Table 7: Inbound mobility: number of incoming degree students

Before and upon arrival, international students are provided with a wealth of practical information, both by the central IRO and the faculty's IRO. The faculty's IRO staff offers a lot of support to the international students for all aspects of their stay. Both the university and the faculty have put a lot of effort in providing English information, not only on the study programmes, but on all aspects of being a student at Ghent University; also all official communications to students are sent out in Dutch and in English. The faculty's website is structured in such a way that information is now easily accessible for different target groups, while the UGent website offers detailed course descriptions in English for all programmes.

Various student organisations (VTK, BEST, DLK, Poutrix, …) help out during the Welcoming Events organised before the start of each term, ensuring that international students integrate quickly in the students' community. With their help also a buddy programme is offered. For those students eager to learn more about local culture and history, a specific course entitled 'Low Country Studies'[90] is being proposed. However, during the last two years the coronavirus pandemic has made the life of international students very hard. Online alternatives have been established for social contact (e.g. in gather.town) and social and financial support has been offered to those in need of it.

The quality control of incoming students being a point of concern, the faculty has taken some actions. First of all, the performances of exchange students from partner institutions are actively monitored. If incoming students do not perform according to the faculty's standards, or if local support offered to our own outgoing students does not meet our expectations, partnerships are no longer maintained.

For degree seeking students with a foreign degree, the situation is more complicated, since the assessment of an application may only be performed on the basis of the study programme and the credentials of the student's home institution and not on the basis of the candidate's own skills or strengths and weaknesses. Therefore, in order to avoid deceptions (from both sides) we now strongly encourage all applicants to take a GRE-test as a kind of self-assessment and to include their result in their application. Applicants scoring low on this test receive the advice not to enroll, even if they are to be accepted on the basis of their diploma.

Moreover, the faculty's staff will actively participate in international fairs in order to scout talented students all over the world, a strategy which was approved shortly before the coronavirus pandemic, so did not get the chance to be in place yet.

3.6 Industry and internships

All master's programmes offer the possibility to take one or two internships of 3 ECTS credits each (at least 4 weeks of internship), or one internship of 6 ECTS credits (at least 6 weeks of internship). Students may also take up internships without formally including them in their curriculum. The goal of these internships is to bring the student in close contact and interaction with the actual industrial or social environment where the knowledge being acquired will be applied, and to draw the attention to different aspects of the working environment not captured by the traditional educational methods.

The envisioned learning outcomes of the internship are:

- to function as a member of a team in a non-academic, professional environment outside the student's own trusted university;
- to apply the acquired engineering skills to one or more concrete problem statements in an organised, accurate and structured way;
- to operate independently, with a sense of creativity, personal initiative and critical thinking;
- to report, in writing, on a technical and/or scientific subject with attention to lay-out, language and structure of the document as well as to scientific correctness and soundness.

3.6.1 Internship process and assessment

Internships are offered through various channels:

- the student organisation VTK lists internship opportunities on its website, and advertises internships during the job and internship fair;
- IAESTE offers internships abroad;
- some master's programmes (or their student organisations) organise industry-related events with advertisement of job and internship offers;
- students individually get in contact with companies;
- teaching staff often has excellent relations with industry, and this network is often used to help students to find an internship.

Once students have found an internship, they initiate a dedicated procedure, the full details of which can be found at the FEA website[91]. The most important points of the procedure are:

1. approval of the topic by an internship supervisor (teaching staff member).
2. regular contacts with the supervisor to discuss the internship, to ensure that the results are in line with the expectations.
3. submitting a report discussing the industrial context of the internship, the objectives, technical achievements and results and a personal evaluation of the internship.
4. submission of an evaluation by the industry supervisor on the practical aspects of the internship, on the performance of the intern and on his/her skills and attitudes (using fixed set of criteria, available at the Plato website).
5. submission of an evaluation by the internship supervisor on the scientific aspects of the work and the structure, lay-out and correctness of the report (using a fixed set of criteria, available on the Plato website) and grading the internship and the report.
6. feedback and assessment of the internship by the student.

The Internships Committee of the faculty organises a deliberation session with a final opportunity for internship supervisors to align their grades compared with other internship reports.

3.6.2 Internship statistics

A set of data and a detailed discussion can be found in Annex 13. The two main conclusions are:

- about 1/3rd of all students take an internship;
- the internships are very highly appreciated by the industry supervisor.

3.7 Student life

Ghent University takes the welfare, social and physical well-being of its students at heart, and consequently offers a wide variety of services[92], including

- cultural activities;

- housing facilities (university halls);
- student meals (student restaurants);
- sports facilities;
- social welfare and medical services;
- bicycle rentals and repair;
- medical service for students;
- student counselling service (Counselling Office[93], ombudsperson at university level).

FRiS[94] (Faculty Council of Engineering Students) is the student organisation that assembles all student representatives at the faculty. There are around 150 student representatives active in various councils and committees. The most important councils and committees with respect to education are the Faculty Council, the Education Quality Control Committee and the Study Programme Committees. The Faculty Council has 16 student members, the Education Quality Control Committee counts 6 student representatives and each Study Programme Committee typically contains 6 students. Besides coordinating all the student representatives, FRiS provides very valuable information to the faculty about programme content or organisation of the faculty from the point of view of the students. Furthermore, independent surveys are organised about various topics related to education.

VTK[95] ('Vlaamse Technische Kring Gent') is the student organisation of the faculty's engineering students, offering a rich variety of services and activities to the students. These include:
- support for several events organised by the faculty (information day for prospective students, welcome days for new students, …);
- a peer assisted learning program for first-year students;
- magazine for students ('t Civielke, Manna);
- syllabus shop, distributing books and print-outs of course material for students (in cooperation with the staff members);
- many extracurricular activities like the organisation of 'The JobFair' and 'the Internshipfair', but also lectures, sport activities, yearly student gala, yearly show, yearly quiz, skiing trip…
- running their own student bar 'Delta'.

DLK[96] ('De Loeiende Koe') is the student organisation of the architecture students which organises, amongst others:
- support for several events organised by the faculty (information day for prospective students, welcoming of new architecture students, …);
- magazines for students (Koerant);
- organisation of lectures and debates on architecture;
- organisation of architectural student's exhibitions;
- organisation of the 'Jokerweek', in cooperation with the Department of Architecture and Urban Planning;
- 'radio Plato', an online radio station during the coronavirus pandemic.

Moreover, our faculty counts a lot of Engineering Technology students. Regardless of their four-year study programmes, their student organisation, Hermes[97], also provides a large variety of services and activities to the students of our faculty amongst which: Jobfair, welcome days, CV screening, lectures…

Additionally, the faculty has numerous student organisations aimed at students of particular programmes. They organise dedicated events and excursions that are relevant for the student group.
- Ceneka[98] for students in electrical engineering and computer science;
- BEAM[99]; for students in biomedical engineering;
- MaChT[100] for students in chemical engineering and materials science;
- Poutrix[101] for students in civil engineering;
- Orlean[102], for students industrial engineering and operations research;

- Pkarus[103] for students in mechanical engineering;
- IEEE Student Branch Ghent[104], for students in electrical engineering;
- VVN[105] for students in engineering physics;
- Centaura; for students in engineering technology in Courtrai;
- UGent SPIE Student Chapter[106] for students in photonics engineering.

More than 200 students have an active role in these organisations, participating in the organisation and daily activities or organising student events. The faculty highly appreciates this active involvement of its students, as their efforts are crucial to enhance the community and are beneficial to student's mental and social well-being. The faculty thus fully supports VTK's (Vlaamse Technische Kring) plans to build a new student house at the heart of the Ardoyen Technology campus in Zwijnaarde, thus providing a physical meeting place for the faculty's student organisations and student representatives. The student organisations' initiatives and activities also get direct financial support from various companies.

The city of Ghent plays a vital role in student life, offering several facilities (e.g. sport infrastructure), and a rich cultural life in the city. The 'studentenambtenaar'[107], a civil servant specifically for students, coordinates all student's initiatives that are linked to the city. The city of Ghent yearly elects a student of the year[108] and a student entrepreneur of the year[109].

Chapter 4 Student Selection and Admission

4.1 Selection and admission strategy

4.1.1 Bachelor admission

Generally speaking, all students who have successfully completed their secondary education in Belgium have access to Ghent University's bachelor's programmes (with an additional access requirement for Dentistry/Medicine programmes, where students are required to pass an entrance exam). Several other diplomas or certificates are also granted access, with in some cases, specific admission procedures (more information available at website[110]). In addition to these admission requirements, a language certificate of proficiency in Dutch/English (CEFR B2) is required for programmes taught in Dutch/English. For students holding a diploma from a Flemish secondary school, the B2 level is implied as an outcome of the secondary education.

As the studies in engineering heavily build on skills and mathematics acquired during secondary education, recruitment of students focuses on students with this background. Until 2003, engineering studies were limited to students who passed an entrance exam on mathematics. Since 2004, organising an entrance exam is no longer allowed by the Ministry of Education.

At present, in order to stimulate secondary school students to prepare for their engineering studies and to remedy potential shortcomings in their mathematical education, the Flemish universities who offer engineering programmes (VUB, KU Leuven and UGent) jointly organise a positioning test. This test focuses on students who had at least six hours of mathematics per week in secondary school, in the last two years. Students with less mathematical background are also encouraged to participate in the test, as all interested students are allowed to calibrate themselves.

The results of the test have no direct consequences for the enrolment, but are a part of the orientation process. The test provides feedback to the participants, and gives them a clear view of their own skills and knowledge, and of the expected level. This enables them to make an informed choice. If the results of the test fall short, the faculty offers a one-week catch-up summer programme in mathematics (free of charge) and allows students to retake the test afterwards. All participating students may receive feedback on their test and may consult faculty members on their choice of study.

More details on the positioning test (modalities, sample questions, etc.) can be found at the dedicated webpage[111], an example of a previous positioning test (in Dutch) can be found in Annex A.14.

Table 8 lists the numbers of participants. After an initial start-up phase (years 2013-2014 and 2014-2015), a relatively stable number of participants can be seen (representing about 60% of the 1st bachelor year population). As of the year 2018-2019, a sharp increase in participation occurred due to a change in regulation: participation to the positioning test is now a prerequisite for subscription. Note that subscription to the studies is possible after taking the test, irrespective of the result. A detailed analysis of the success rate in the first bachelor year of students who participated in the positioning test as compared to those who did not, can be found in Annex A.15.

	BSc in Engineering	BSc in Engineering: Architecture
2013–2014	214	53
2014–2015	217	63
2015–2016	263	63
2016–2017	265	72
2017–2018	273	71
2018–2019	509	127
2019–2020	461	148
2020–2021	380	136

Table 8: Number of participants in the positioning test

4.1.2 Characteristics of bachelor's students

Figure 4 gives an overview of the number of students enrolled in the Bachelor of Science in engineering and the Bachelor of Science in engineering: architecture in the previous academic years. The results show a relatively stable recruitment of new students.
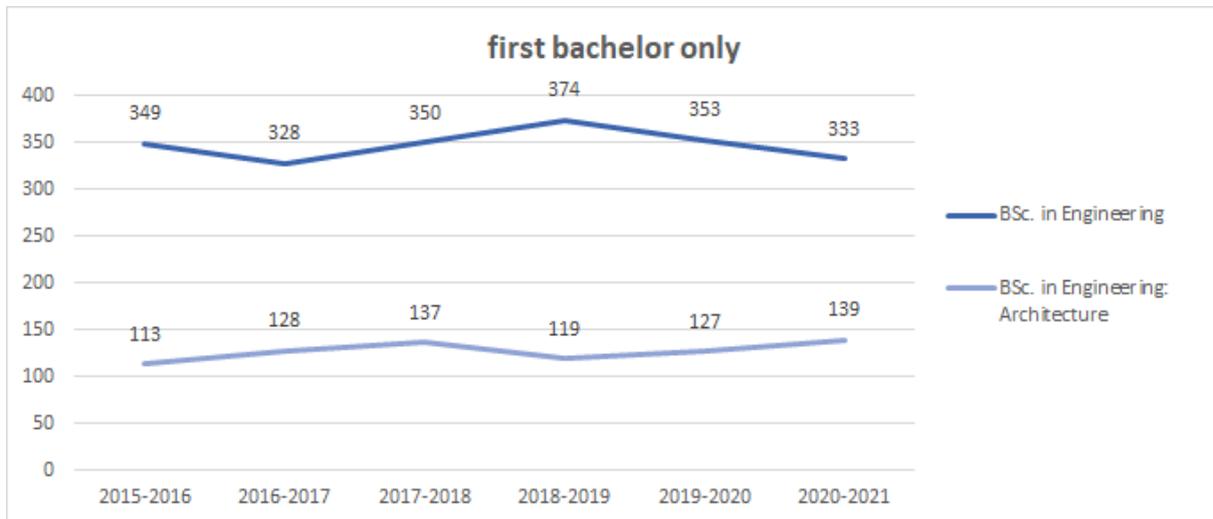

Figure 4: Evolution in number of newly enrolled students (first bachelor year)

Figure 5 shows the percentage of male and female students in engineering and architecture. Over the years, male students constitute a large majority in the Bachelor of Science in Engineering, with limited changes overtime. In contrast, the Bachelor of Science in Engineering: Architecture attracts an almost equal amount of female and male students.
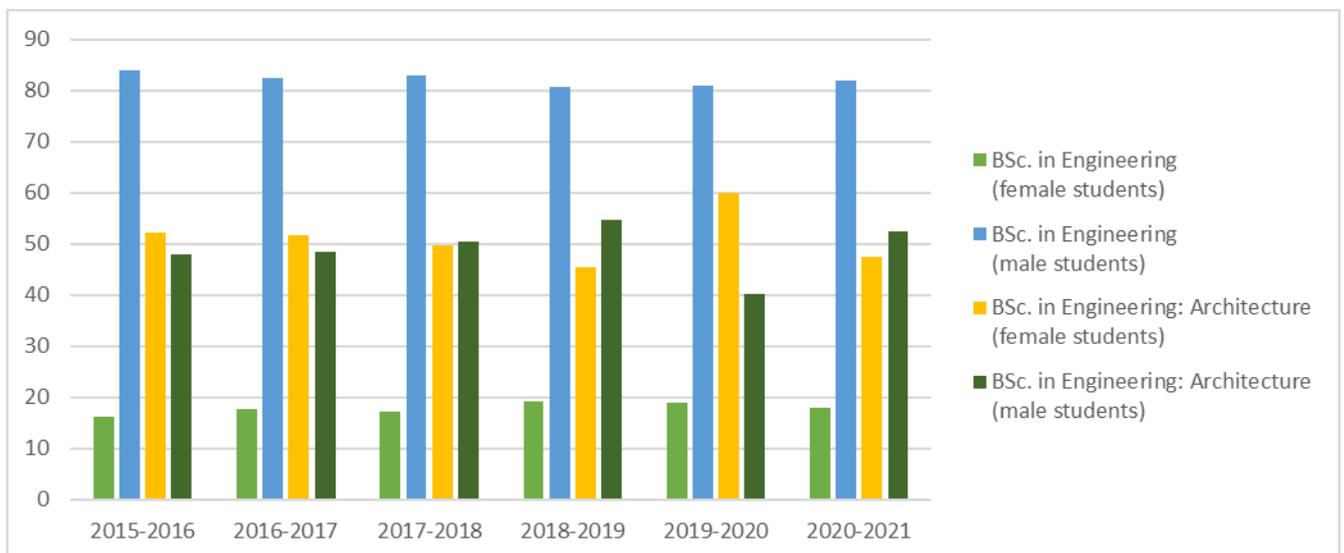
Figure 5: Percentages of male and female first-bachelor students

Figure 6 gives an overview of the background of the faculty's bachelor students. The large majority of engineering students had a previous education in General Secondary Education, few students have a background in Technical Secondary Education. A small percentage of Art Secondary Education students enrol in architecture, but the majority has a more general background.
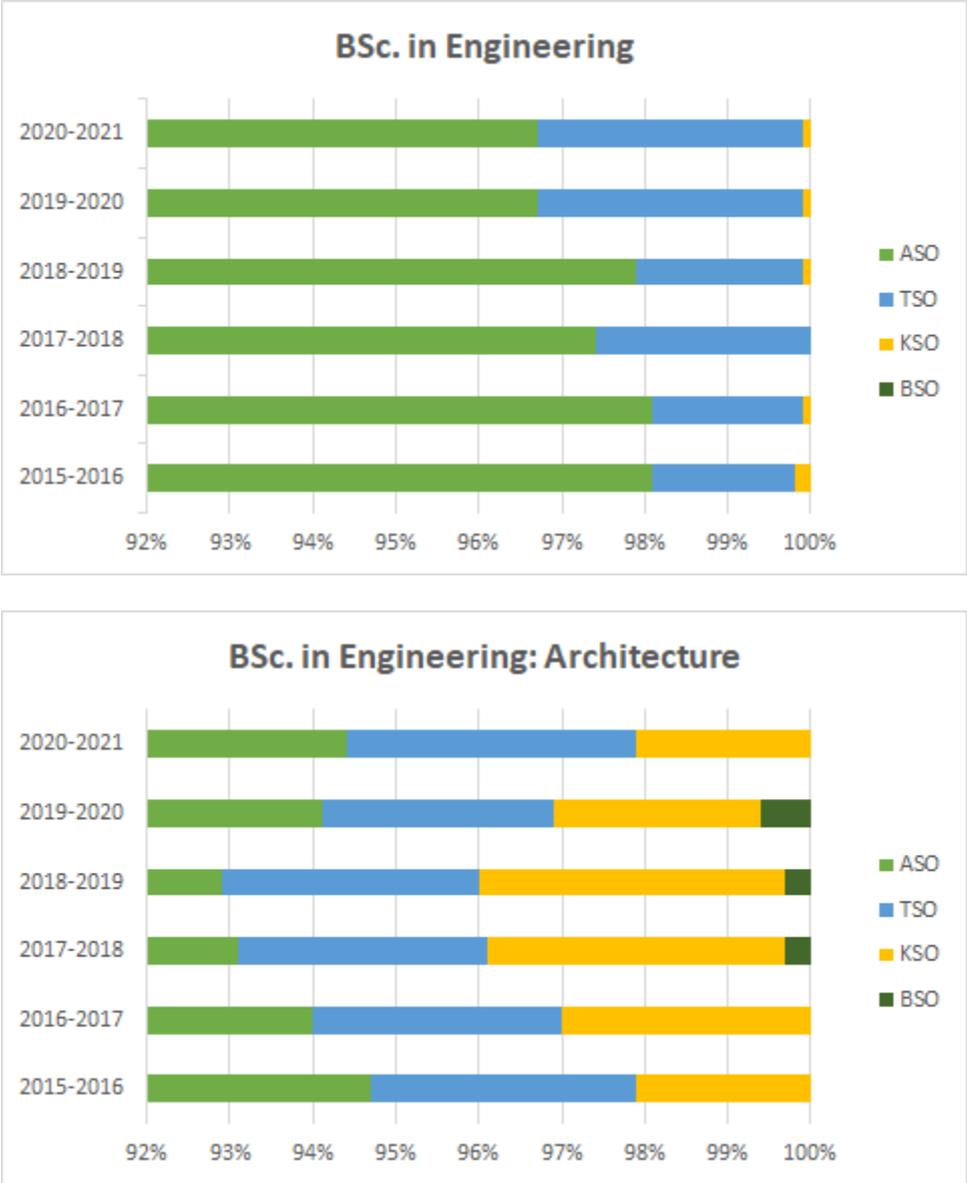

Figure 6: Background secondary school (percentages) for Engineering (left) and Architecture (right). Starting point of the graph is 92%
ASO = General Secondary Education (*Algemeen Secundair Onderwijs*), TSO = Technical Secondary Education (*Technisch Secundair Onderwijs*), KSO = Art Secondary Education (*Kunstsecundair Onderwijs*), BSO = Vocational Secondary Education (Beroepssecundair Onderwijs)

Figure 7 gives information on the mathematical background of the students in the most recent academic year: 75% had more than 6 hours of math per week while at most 0.5% took 4 hours per week or less. This shows that the FEA attracts students with the suitable mathematical background for engineering studies. The programme of Engineering: Architecture counts a higher share of students with a smaller number of hours of mathematics in secondary school.
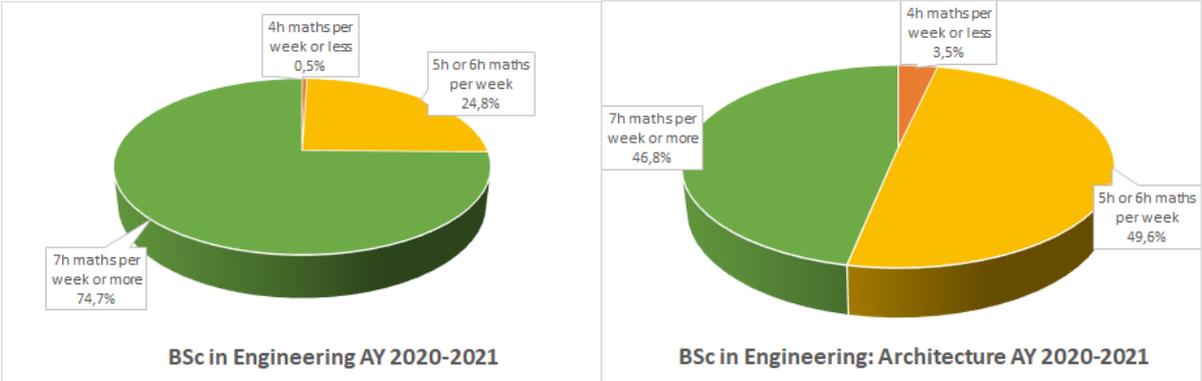

Figure 7: Mathematical background of students in first bachelor year – number of hours per week in mathematics (in secondary school)

Table 9 gives an overview of the nationality of the faculty's students. In the bachelor's programmes, the student population is almost completely Belgian, with limited changes over the years. In the group of Belgian students a share up to 10% (engineering) to 15% (architecture) has an international background, as demonstrated by the language spoken at h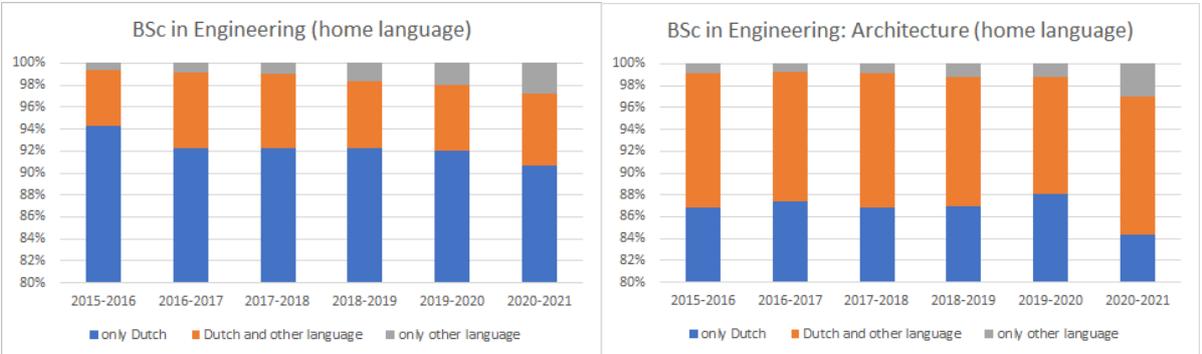ome, or the nationality of the parents (see Figure 8: Language spoken at home (percentages, bachelor's students) - starting point of the graph is 80% and Figure 9: Parents nationality (percentages, bachelor's students) - starting point of the graph is 85%). This share is slowly increasing over the past years.

	BACHELOR OF SCIENCE IN ENGINEERING		BACHELOR OF SCIENCE IN ENGINEERING: ARCHITECTURE	
	Belgian	Other	Belgian	Other
2020 – 2021	98,4%	1,6%	96,9%	3,1%
2019 – 2020	98,5%	1,5%	98,1%	1,9%
2018 – 2019	98,5%	1,5%	97,5%	2,5%
2017 – 2018	98,3%	1,7%	97,7%	2,3%
2016 – 2017	99%	1%	98,1%	1,9%
2015 – 2016	98,6%	1,4%	97,3%	2,7%

Table 9: Nationality of the bachelor's students

Figure 8: Language spoken at home (percentages, bachelor's students) - starting point of the graph is 80%
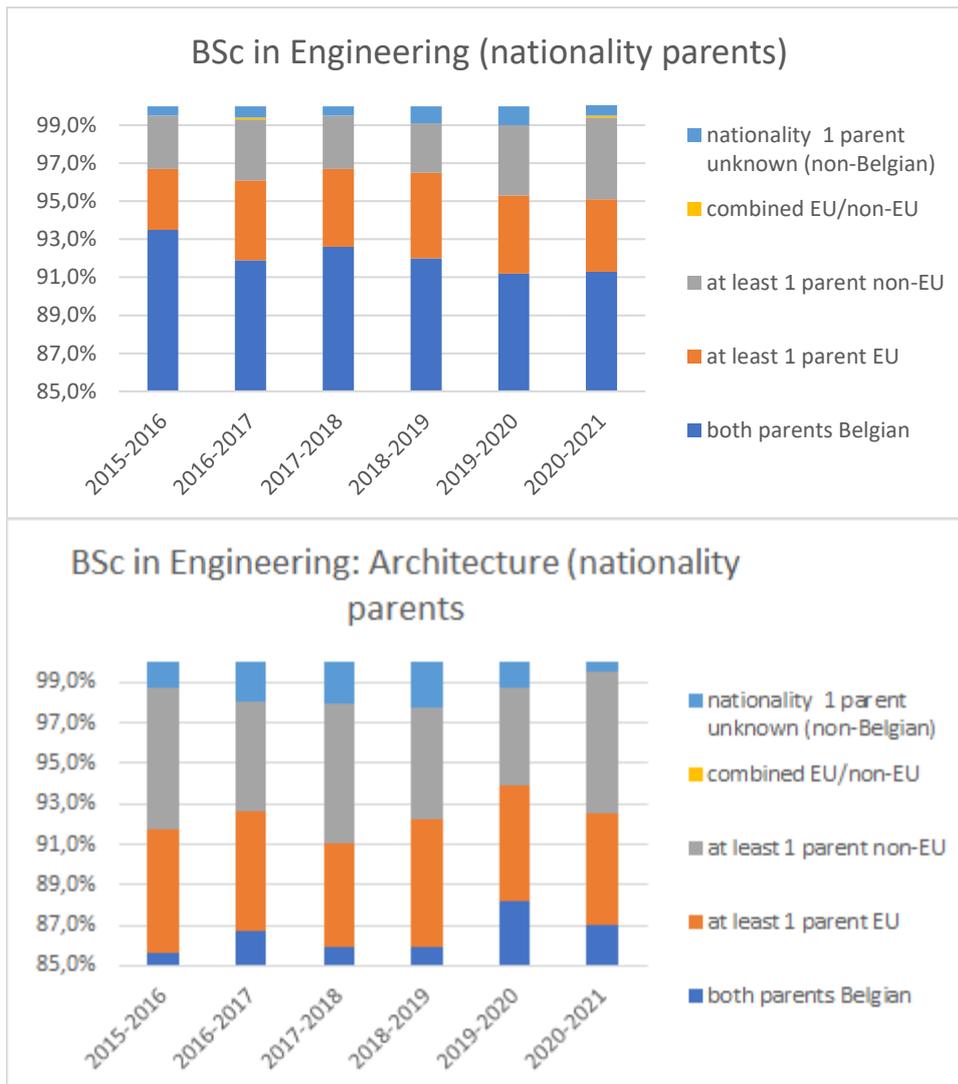
Figure 9: Parents nationality (percentages, bachelor's students) - starting point of the graph is 85%

4.1.3 Master admission

The bachelor's programmes in engineering are meant to be complemented by a subsequent master's programme. Every bachelor's programme has at least one master's programme with direct admission, as is required by decree.

Alternatively, admission is granted to students already holding a master's degree strongly related to the master's programme they want to enter (horizontal intake). Students with bachelor's degrees that have no immediate admission in a master's programme may need to follow a preparatory course programme (up to 120 credits). The preparatory course programmes can be found in the study guide, but the specifics are outlined by the SPCs, based on the previous degree and background of the students. Similar language admission requirements as for the bachelor's programmes apply (i.e. CEFR B2 level for the language of instruction of the programme). Full details about admission can be found at the university's webpages on diploma requirements[112] and language requirements[113].

The faculty offers a number of master's programmes with a broader intake, typically international or jointly organised programmes. These programmes often have specific admittance procedures, the details of which are explained in the specific programme descriptions of Part B.

All master's programmes in engineering can admit international degree seeking students. More information on the procedure for international degree students is explained in Section 3.5.4.

At present, the Faculty of Engineering and Architecture organises both Bachelor and Master of Science in Engineering programmes (3+2 year) and Bachelor and Master of Science in Engineering Technology programmes (3+1 year). Without discussing the details, engineering programmes attach much more importance to underlying fundamental and mathematical principles whereas engineering technology programmes are more focused in direct applicability. Both profiles are well known and respected in industry.

Now and in the past, in the spirit of flexible learning paths, the FEA has chosen to offer graduates of the Engineering Technology programmes the possibility to complement their four-year education with a two-year Master of Science in Engineering. Their specific master's programmes are complemented with a selected set of Bachelor in Engineering courses (replacing a number of electives) intended to provide more fundamentals.

4.1.4 Characteristics of master's students

Figure 10 gives an overview of the number of students enrolled in the master's programmes in engineering and architecture in the previous academic years. Specific numbers for each master's programme can be found in the annexes of the detailed description of the programmes (see Annexes of Part B).
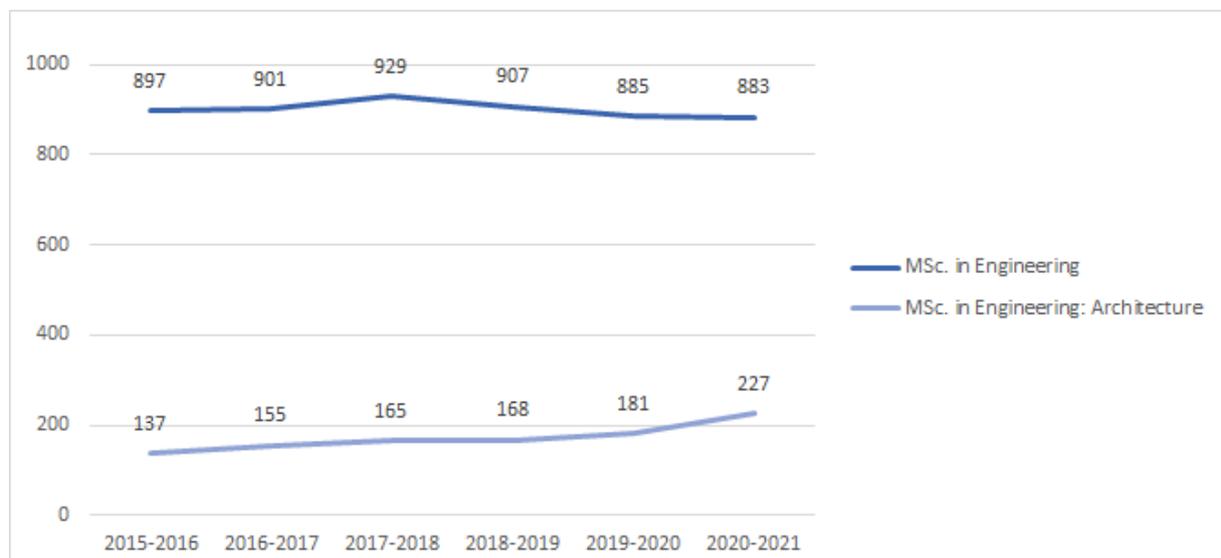

Figure 10: Evolution in number of master's students

Table 10 and Table 11 supply some detailed information about the students that are admitted to the master's programmes. A decrease in the number of students pursuing a Master of Science in Engineering degree via horizontal intake is to be noticed.

	MASTER OF SCIENCE IN ENGINEERING: ARCHITECTURE	
	direct admission	preparatory course programmes
2020 – 2021	223	4
2019 – 2020	178	3
2018 – 2019	164	4
2017 – 2018	159	6
2016 – 2017	149	6
2015 – 2016	134	3

Table 10: Admission (direct admission, horizontal intake) Master of Science in Engineering: Architecture

	MASTERS OF SCIENCE IN ENGINEERING		
	direct admission	horizontal intake	preparatory course programmes
2020 – 2021	737	132	14
2019 – 2020	739	132	14
2018 – 2019	729	160	18
2017 – 2018	754	157	18
2016 – 2017	731	157	13
2015 – 2016	734	152	11

Table 11: Admission (direct admission, horizontal intake, preparatory course programmes) Master of Science in Engineering

Figure 11 gives an overview of the percentages of male and female students in the Masters of Science in Engineering and the Master of Science in Engineering: Architecture. The imbalance between female and male students in the master's programmes of engineering (with the exception of architecture) is an ongoing concern.
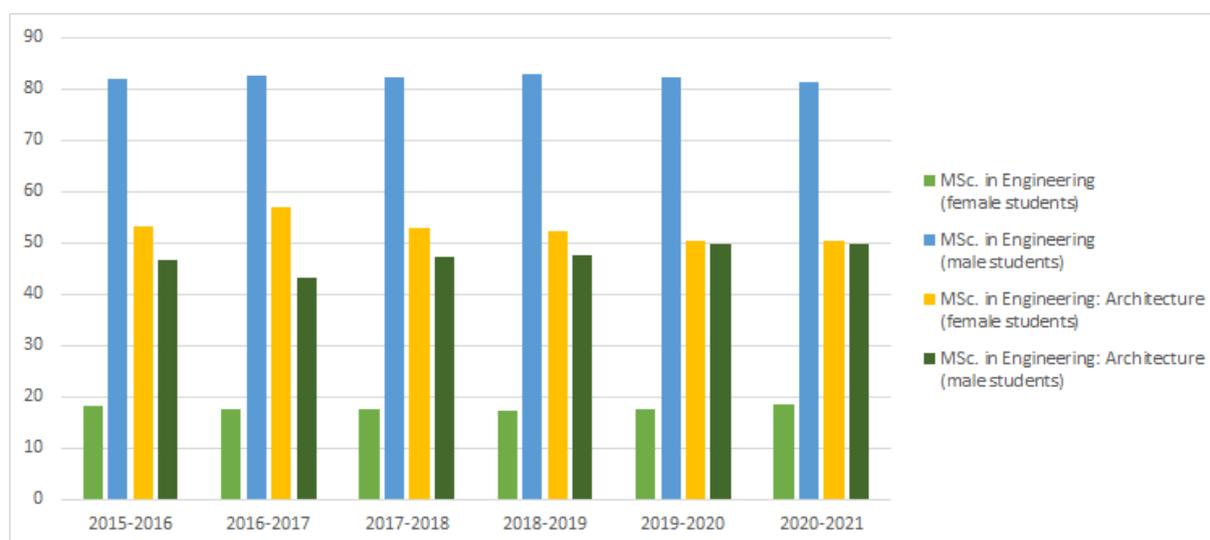

Figure 11: Percentages of male and female master's students

	MASTER OF SCIENCE IN ENGINEERING PROGRAMMES		MASTER OF SCIENCE IN ENGINEERING: ARCHITECTURE		INTERNATIONAL MASTER OF SCIENCE PROGRAMMES	
	Belgian	Other	Belgian	Other	Belgian	Other
2020 – 2021	91,2%	8,8%	99,1%	0,9%	11,6%	88,4%
2019 – 2020	91%	9%	98,3%	1,7%	11%	89%
2018 – 2019	90,9%	9,1%	99,4%	0,6%	14%	86%
2017 – 2018	91,2%	8,8%	97,6%	2,4%	14,3%	85,7%
2016 – 2017	92,7%	7,3%	96,8%	3,2%	14,6%	85,4%
2015 – 2016	93,9%	6,1%	97,1%	2,9%	18,1%	81,9%

Table 12: Nationality of the master's students

4.1.5 Student selection and admission organisation

As explained in the section above, no formal selection rules apply for students holding a Flemish or equivalent degree. Students entering the bachelor's programmes are informed on the expected skills through various initiatives, for instance through the university's website and various promotional materials (brochure, SID-ins, positioning test, …).

Specific regulations on admission with other or foreign study certificates are detailed in the Education and Examination Code of Ghent University and are communicated through the university's website.

International degree-seeking students are subject to an objective assessment based on their obtained degrees, often complemented with an interview. Recently, the Faculty has decided to ask prospective students to add a GRE General Test to their application[114] in order to assist application processing and

allow for a more specific advice on an applicant's file. GRE scores are not binding, and adding them to an application is not obligatory, but it is highly recommended.

Foreign students are assisted by

- the university's International Relations Office [IRO][115] (assistance in procedures mainly related to legalising diplomas);
- the faculty's International Relations Office [FIRO][116] (acting as point of contact for foreign students);
- a welcome guide[117] provided by the university's IRO;
- the SPCs (who advise on the admittance of the students to the programme).

4.2 Sources of admission and attention to diversity

As highlighted in Section 1.1.8 of this SER, the faculty endorses Ghent University's integrated diversity and inclusion policy and action plan, and welcomes all talented students and staff, irrespective of gender, ideological, cultural or social background. However, implicit or explicit barriers still impede certain groups of talented students and teaching staff to choose engineering studies or to opt for an academic career at our faculty. The faculty actively supports a number of initiatives such as a longitudinal research project in secondary schools (following a diverse group of children through their study progression, and stimulating STEM choices) and STEM activities for secondary school students (with STEM workshops and playful activities on science and technology). However, attracting diverse talent remains an important focus point and creating an inclusive institutional culture will require new initiatives and continuous efforts in the coming years. A very important focus in that regard will be to improve the study progress of students from disadvantaged groups in the bachelor years that, for multiple reasons including obstacles related to their background, experience a high drop-out rate in the first years.

Students with functional disabilities, e.g. learning disorders (typically dyslexia) or physical dysfunctions, can call on special measures to assist them in their studies. In order to assess the impact of their disability, the university's Counselling Office conducts individual assessments. Individual compensation measures (e.g. more time to complete a written examination for a student with dyslexia) are proposed, without lowering the standards of the programme.

To assist students from disadvantaged groups, several initiatives are taken by the monitoring services (mainly focusing on first-year students) and multiple new ones are in the pipeline, as described in more detail in Section 3.4.5 of this report.

4.3 Admission criteria

The admission to the bachelor is subject to the participation in a positioning test and having a certificate of secondary education. The master admission requirements are formulated in terms of required bachelor's or master's degrees. They are available in the study guide, and the details of the enrolment procedure are communicated through the university's and faculty's website and through various promotional materials.

Competences acquired from other professional and/or academic activities can be formally translated into ECTS credits through the mechanism of 'previously acquired competencies/skills' [PAC] or 'previously acquired qualifications' [PAQ]. Depending on the programme the student wishes to enter, these PAC/PAQ can lead to exemption from one or more courses. Students with PAC/PAQ can apply for a personalised learning path. The SPCs are responsible for these personalised learning paths and take into account the previously acquired competences. In order not to jeopardise the chances for successful completion of the programme, the guidelines for drawing up these individual curricula specify that the student should have acquired the same competences at the same level as the regular students before entering a programme.

Chapter 5 Graduate Employment

5.1 Graduate employment surveys

For the present SER, an anonymous survey (via SurveyMonkey) was carried out among the alumni graduated in 2016 – 2021 (the most recent graduation year does not represent a complete promotion since a number of students graduated in September 2021, after closing the survey). The alumni database is kept up to date by the FEA alumni association AIG[118] ('Alumnivereniging van de ingenieurs afgestudeerd aan de UGent' or, with its original French name, Association des Ingénieurs de Gand, founded in 1876). In total 255 responses were received[ii].

In essence, the main purpose of the survey is to assess the employability of our young graduates and to get insight in the start of their career. Respondents could choose from a limited number of broad engineering activities, in senior and junior technical or management functions, and were asked to specify their salary level. The survey also asked to what extent the alumni are satisfied with the engineering education provided by the FEA (on a scale of very positive to negative, with room for open comments).

The detailed questionnaire (in English) and the detailed analysis of the responses are provided in Annex A.16. Main trends are very much in line with the findings of the survey conducted in 2015, leading to following observations/conclusions:

 ► in the last 5 years, up to 95% of the graduates have a first job within 6 months of graduation;
 ► the bulk of the employment is in the private sector (70%), followed by the university (20%) mainly pursuing a PhD;
 ► about 30% of our young graduates have been employed abroad
 ► after 5 years of professional life, about 70% of the respondents have switched to another job or job description;
 ► up to 50% of the respondents indicate that their job belongs to the categories 'Basic and applied research' or 'Engineering studies, consulting and expertise';
 ► jobs are almost equally divided over junior/senior technical functions and junior/senior management functions with the expected shift towards senior functions and management with time;
 ► the salary data are in accordance with overall Belgian salary surveys both with regard to the starting salary as to the fact that engineering jobs rank in the top 10% or even higher of the best paid jobs;
 ► more than 90% of the respondents express a positive to very positive opinion on the FEA engineering education.

5.2 Career information and counselling

As already mentioned, the faculty organises yearly information sessions (one at the end of the first common bachelor year and one in the second term of the third bachelor year), presenting the specifics of each bachelor's and master's programme including typical job profiles resulting from these programmes.

Yearly, the student organisations VTK and DLK respectively organise a large JobFair event[119] and the Archiefair[120] job event. Section 3.7 gives more details on the various activities the student organisations set up at the master level, bringing students into contact with industry and job opportunities.

5.3 Graduate employability and employer satisfaction analysis

Graduate employability and employer satisfaction surveys were also included in previous visitation reports.

A new survey was carried out for the present SER, to assess employer satisfaction with FEA graduates/alumni and the capability of the FEA programmes to satisfy the CTI conception for an

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[ii] The data set of the alumni survey (in Excel records) is available on request.

engineering degree. This anonymous survey (via SurveyMonkey) was carried out among a selected set of 144 employer representatives, i.e. all members of the Strategic Advisory Board and all members of the industrial advisory groups of the SPCs.

The detailed questionnaire (originally in Dutch, with English translation and discussion) and the detailed analysis of the 94 responses[iii] are provided in Annex A.16. Again, the main conclusions are in line with the 2015 survey:

- short and long term adaptability score very high;
- research and innovation capabilities, communication skills and team work capabilities also score good to very good;
- the graduates' awareness of the business, economic, social, ethical and ecological context is not entirely satisfactory;
- the overall quality of the alumni is assessed as good to very good;
- a large number of respondents are active in companies with a large number of engineers. This enhances the overall reliability of the answers in the survey.

The CTI conception for an engineering degree also pays particular attention to the capability of (part of) the graduates to pursue a PhD degree. Figure 12: Number of completed PhDs and diploma origin shows the number of completed PhDs over the last six years and the diploma origin. The research efforts of the FEA clearly translate into a growing number of completed PhDs. The figure shows that FEA graduates roughly stand for 50% of the obtained PhDs. At the same time the overall PhD student population becomes more international.
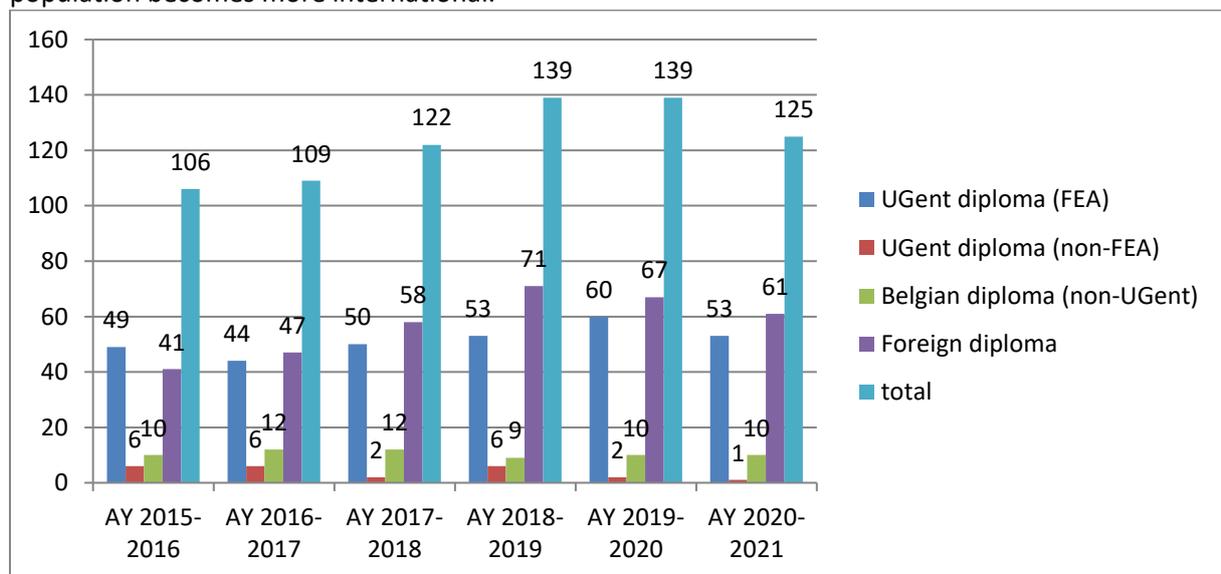

Figure 12: Number of completed PhDs and diploma origin

5.4 Alumni relationship

We refer to Section 1.1.4, in which the alumni relationships are discussed in detail. The alumni of the faculty are kept involved through the Alumnivereniging van Ingenieurs afgestudeerd aan de Universiteit Gent [AIG], the alumni association that organises networking events and cultural and/or professional activities for all graduated engineers. AIG builds and maintains the community of engineers, graduated from the FEA, and acts as a link between the faculty and the 'ie-net ingenieursvereniging'.

The FEA and AIG operate in a partnership for community building. Therefore, the FEA is represented in the management organisation of the AIG (currently the vice-dean for research is chairman of the AIG). Professors are member of the AIG, and events organised by the AIG are well-attended by faculty staff.

[iii] The data set of the employer satisfaction survey (in excel records) is available on request.

Chapter 6 Quality Assurance

6.1 Internal quality assurance

6.1.1 Quality assurance policy

In the past few years, Ghent University's quality assurance policy has been thoroughly reviewed and revised. Taking advantage of the changed legislative contours in Flanders[iv], a new system of internal quality assurance has been created, evolving from a model and procedures aimed at momentarily controlling educational practice to a continuous university-wide quality culture. Ghent University's Quality Assurance Conduct can be divided in three phases: the Quality Assurance Conduct 1.0 (2015-2019), with the new system's inception, first implementation and thorough review, Quality Assurance Conduct 2.0 (2020-2023), and Quality Assurance Conduct 3.0 (2024 and onwards)[121].

In the current period, Ghent University aims at instilling in its study programmes an attitude of data-driven critical reflection and systematic follow-up of improvement actions, through new monitoring instruments that support quality reflection.

6.1.2 Shared responsibility

The quality assurance and quality reflection on the education is based on the PDCA principle (Plan, Do, Check and Act) and is a shared responsibility on all levels, both study programme committees and the faculty, in cooperation with the university level.

At the most basic level, every lecturer is invited to self-reflect through the annual course feedback by students. In the educational monitors, the Study Programme Committees are guided by the programme-specific operational objectives (Annex A.17) to regularly carry out a critical self-reflection. The faculty, with the Educational Quality Control Unit and the faculty's Director of Studies, is the main liaison with regard to quality assurance between the faculty and the university level. The faculty also carries out a critical self-reflection on their education policy, and has an annual quality meeting with the Educational Policy Department of UGent. At the central level, the Education Quality Board [EQB/OKB] monitors and guarantees the quality culture in every study programme, and checks whether the study programmes are able to efficiently pursue a shared education policy and perform quality assurance processes.

6.1.3 Internal quality management

The Educational Quality Control Unit monitors the quality of the FEA programmes, the teaching methods, the organisation and implementation of the programmes and the infrastructure available for education.

The Director of Studies [DoS] chairs the EQCU, which is composed of 15 professors, including the chairman and the ombudspersons, 4 members of the AAS/OAS academic staff, 5 student representatives and 3 members of the administrative and technical staff. Members of the EQCU are chosen for their strong commitment to the quality of the education, and their experience in educational matters. The DoS is supported by an administrative staff.

Each programme or cluster of related programmes has a Study Programme Committee [SPC] (see Section 1.2) that carries out the quality control at the programme level. These committees consist of representatives of the teaching staff, the students and the industry. The SPCs evaluate the impact, the effectiveness and efficiency of the educational process. The industry members are invited on a regular basis to discuss curriculum changes and updates.

The EQCU has a supervising role. The committee observes the compatibility and harmonisation of the decisions of the SPCs across the different programmes, while at the same time respecting their autonomy. Programme reviews, revisions of study programme sheets (including the goals and objectives of the programmes), and updates of course descriptions (including the learning outcomes

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[iv] A new education decree was adopted in 2018 by the Flemish parliament, see (in Dutch) http://docs.vlaamsparlement.be/pfile?id=1398899

of the courses, the teaching and evaluation methods) are proposed by the SPCs, and are advised by the EQCU before being submitted to the Faculty Council.

6.1.4 Stakeholder involvement

The students are systematically involved in the quality process. They have a relatively large number of representatives in the EQCU and SPCs and of course also in the Educational Council [EC] of UGent. The student organisation FRiS, 'Facultaire Raad van Ingenieursstudenten', delegates students to all faculty and university committees. The student representatives in the Faculty Council convene with the Dean on a monthly basis. Lecturers are also represented in the various committees. Moreover, the SPCs involve all lecturers of a particular programme. Finally, every SPC is advised by a number of representatives from industry, and FEA's Industrial Strategic Advisory Board (as mentioned in Chapter 1) is an important instrument to monitor the quality of graduated engineers.

6.1.5 External communication and transparency

Both at the university and at the faculty website, a large amount of information is publicly available. The faculty's English website[122] includes information provided for 'Prospective students', 'Degree students', 'Exchange students', 'PhD candidates and students', and for 'Toekomstige studenten' and 'Studenten' on the Dutch website[123].

6.1.6 Guiding principles

Considerations of national and international regulations and guidelines

Referring to the 'Standards and guidelines for Quality Assurance in the European Higher Education Area (ESG)'[124] and in particular to 'Part 1: Standards and guidelines for internal quality assurance', FEA's quality assurance policy takes into account the 9 mentioned elements: (i) policy for quality assurance; (ii) design and approval of programmes; (iii) student-centred learning, teaching and assessment; (iv) student admission, progression, recognition and certification; (v) (quality assurance of) teaching staff; (vi) learning resources and student support; (vii) information management; (viii) public information; (ix) on-going monitoring and periodic review of programmes.
CTI guidelines for this SER explicitly require reporting on the above topics.

Accountability

We refer to Chapter 1 of this SER detailing the organisation of the faculty, its human, physical and financial resources and its embedding in the university. The accountability rules are those of the university, which are laid down by law. The Government Commissioner (appointed by the Flemish government) and his office supervise the correct application of these laws.

Internal management

We again refer to Chapter 1 for the management structure. The introduction of various supporting ICT infrastructures has substantially contributed to the efficiency. Efforts to simplify procedures have resulted in the implementation of ICT tools such as Plato, Ufora and OASIS, contributing to the efficiency of the programme management.

6.1.7 Continuous improvement cycle

Identification and formalisation of the process

Formally, the internal quality assurance policy of UGent consists of a continuous quality control and improvement cycle through well-defined regular quality measurements and SWOC analyses (Strengths, Weaknesses, Opportunities, Challenges). Results are systematically and critically assessed to serve as input for programme and course improvements and to provide feedback to lecturers.
The following instruments have been put into place
- biannual course feedback by students (faculty level);
- annual complete programme feedback by students (university level);
- continuous quality control via the educational monitors (SPC and faculty level);
- annual quality meeting of the faculty's Director of Studies and the university's Director of Studies and their staff (university level);

In what follows, these four instruments are discussed in more detail to serve as background for later sections.

Course feedback by students

Twice a year, students are invited to submit their feedback on the courses they took in the previous term. The course feedback sessions are always organised after the examination sessions, allowing the student's feedback on the exams and evaluations to be incorporated. The questions in the electronic questionnaires are thematically grouped, and poll the learning effect/academic value, the level of active participation and learning, the role and place of the course in the programme, the lecturing performance, the didactic approach, the approachability of the teaching staff, the learning materials, assessment, workload and pace, the exercises and supervision, etc. The questions are formulated as statements students can agree or disagree with, on a scale of one to five. Students can also give open commentary. An example questionnaire is included in Annex A.18.

The course feedback is organised through Oasis, and the surveys are anonymous. All course units and the responsible lecturers and co-lecturers as mentioned in the course sheet are evaluated every three years, but if there are valid reasons, that frequency can be increased (e.g. in the case of reviews or changes in the program, in teaching methods, in lecturers, or the evaluation of the course; or on request by the lecturer, student representatives, ombudspersons, the study programme committee,...).

In recent years, on average 60% of the students participate in the course feedback. The results are used to monitor and improve the teaching practice (HR-committees). In line with the new professorial staff career policy, quantitative evaluation or comparative frameworks, and fixed quantitative calibration points or numerical lower limits are no longer used. The focus is on self-evaluation and appreciation of the accumulated results. The results are always in their entirety communicated to the lecturers involved. Course feedback is not meant as an assessment of the lecturer, as it is not perceived as a valid content measurement of educational quality, teaching quality or course quality. The course feedback is primarily used in the context of educational development and quality assurance.

Self-evaluation is central, and lecturers are encouraged to analyse the results, and evaluate whether or not they see room for further improvement or adjustment and if so, in which area. They are invited to formulate a brief response on the course feedback by students within a given timeframe.

After this period, the results are discussed and analysed in the Educational Quality Control Unit, that makes a qualitative assessment of the results. The Educational Quality Control Unit could then decide that a course requires further follow-up, or a concrete action plan, or lecturers could be invited to a meeting with the faculty's Director of Studies or SPC chairman to discuss an action plan together.

Full transparency is maintained throughout this process, as the Chairman of the Study Programme Committee(s) and the Department Chairman are given access to the results from their programmes or departments and the action plan/improvement plan are also available to all those involved.

Since the academic year 2019–2020, course feedback no longer leads to a global assessment ranging from very good, good, sufficient, weak to very weak. The Educational Quality Control Unit makes a qualitative assessment of the results, and may either decide that no further review is required, or, potentially, that a course unit requires further follow-up or a concrete action plan. In the most recent sessions, an average of 17% of courses called for (mild) follow-up. In most cases, the follow-up meant that the course was to be evaluated in the next session, in response to the lecturer's planned actions. Only in exceptional cases (i.e. about 2% of the courses) larger problems were detected that were usually worked out through consults between the lecturer, the Director of Studies, the chair of the SPC, the ombudspersons or student representatives. The university has an in-depth course offer with thematic workshops for lecturers according to their own needs and interests (e.g. how to lecture to large groups, how to coach writing assignments, how to use lecture recordings,…). This thematic offer is continuously adjusted and complemented based on specific education-related needs that are uncovered, such as specific teaching methods, feedback, assessment,…

Programme feedback by students

Every two years, and yearly since 2020–2021, the university questions students who are about to graduate on their entire programme (see Annex A.19 for an example questionnaire). The most recent survey in 2020 had participation levels of 70% for bachelor's students, and 55% for master's students. Since 2019, students with a master's dissertation are also asked to fill in feedback forms on the master's dissertation process and supervision. The participation levels for both the programme feedback and the dissertation surveys are high, making the data reliable and enabling the SPCs to use these results to improve the quality of the programme[125].

Educational monitors by Study Programme Committees

Since 2020, all SPCs manage an educational monitor, an online platform that enables them to guarantee the continuous educational quality assurance, and allows an overview of the actions for improvement. The monitor (in SharePoint) is drawn up according to the PDCA principles. In the "PLAN" part, the SPC describes the vision and mission of the educational process and indicates the spearheads on which they focus in the programme. The "DO" describes the current processes used to roll out the educational process. For the "CHECK" the SPCs must assess 39 program-specific operational objectives (we refer to Annex.A.17). This check partly includes a qualitative assessment, but is also supplemented with quantitative data obtained from e.g. the annual programme feedback. If necessary, action points are formulated in the "ACT" part on the basis of the implemented checks. The action points are collected annually in a quality improvement plan in which the follow-up is monitored.

Annual quality meeting of Directors of Studies at faculty and university level

The annual quality meeting between the Directors of Studies at faculty and university level is intended as a two-way exchange of information to (a) report on quality assurance and quality initiatives at the faculty's level and (b) to discuss further implementation of the university's quality assurance guidelines in the faculty taking into account the specific faculty context.

Systematic evaluation of academic performance

The instruments described in the above section are used for performance monitoring and improvement. The use of the educational monitors for continuous quality assessment by the SPC, including the design of a quality improvement plan, allows for a systematic assessment of the academic level of each of the programmes. As these reports are discussed yearly in detail by the EQCU, the faculty remains informed about the status of the various action points and their impact on each programme. Both in the SPCs and in the EQCU various stakeholders are present and as such remain duly informed. The EQCU of course also reports to the Faculty Council and the Dean.

The annual quality meeting of the Directors of Studies at the faculty and university level clearly serves to evaluate the quality efforts and their impact on academic performance in the broader university context. This meeting also serves as a trigger for the implementation of general university guidelines and action plans at the faculty level.

Strategy for improvement

As discussed above, several regular quality assessment instruments have been implemented and are part of a continuous improvement cycle. Generally speaking, the strategy consists of providing appropriate instruments at different levels: the individual course and lecturers, the programme level (SPC), the university-wide guidelines and strategies and regular external quality control. The DoS and the EQCU take the responsibility for the follow-up of the action points resulting from the various quality assessment instruments.

Action plan

As pointed out in the section above, action points and plans for lecturers and programmes are part of a clearly structured process guided by the EQCU. Action plans encompassing the entire faculty are also steered by the EQCU or directly by the Educational Council of the university. Here, two recent initiatives are highlighted.

Section 3.2 presented a detailed discussion of the competence model of the FEA, with the generic competences and programme-specific competences, and the associated learning outcomes. In a first step of its improvement strategy, the university's Educational Council required each programme to

chart how individual courses of a particular programme contribute to the competences to be acquired by each student. These are the tables provided in the annexes of Part B for each separate programme. It clearly does not suffice to know to which competences a course contributes, it is also necessary to check to what extent students have acquired these competences.

In the faculty's evaluation policy, teaching staff must implement, SPCs must safeguard, and the EQCU must be able to verify the university's basic quality criteria for evaluation: reliability (accurate measurement without extraneous influences), validity (correctly measure if the competences are acquired), and transparency (clear communication about content, topics and modalities).

The Faculty Evaluation Committee [FTC] checks the faculty's evaluation practice by taking representative samples of courses in the various programmes, as well as ad hoc checks based on suggestions by the EQCU or the ombudspersons. It focuses on possible improvements and good practices, and reports directly to the EQCU. Based on these reports, the EQCU formulates recommendations and communicates good practices to teaching staff and SPCs.

In addition to the above, starting Spring 2015, application forms for professorial staff now explicitly mention the following: 'having experience with professionalisation of education is recommended'. This reflects the still growing awareness of the importance of the educational process. Moreover, the personalised professorial objectives make this professionalisation mandatory, and dedicated training is organised at the university level (see Section 3.4.3).

Impact measurement and communication

It is clear from the discussion above that the processes put in place encompass a follow-up of quality improvement actions, points and plans. Referring to Section 1.1.4, the presence of stakeholders in all committees, assures that plans and results are available to all of them.

6.2 External quality assurance

In Flanders, the system of quality assurance and accreditation in higher education has been revised since 2018. Individual programme visitations by external parties are no longer a strong prerequisite from the Flemish Government. Instead, HEI's are granted the prerogative to accredit their own programmes, after a positive assessment of the quality system put in place by the HEI itself.

The quality assurance system adopted by Ghent University is extensively described on the dedicated webpages[126] (see also Annex A.20). In the accreditation process, the programme monitor plays an important role, and in this monitor it is required there is some form of external review of the programme. The FEA has chosen to implement this requirement through a review by CTI, in line with the decision of KU Leuven and VUB to also participate in this CTI-oriented review of our programmes. This decision is inspired by the continued focus on educational quality, and the wish to have our programmes reviewed by an independent external party, well-known for assessing engineering programmes at an international level.

6.3 Follow up of CTI-recommendations

During the spring of 2016, the CTI visited the faculty for the first time, resulting in a general appraisal of the faculty's programmes and a set of recommendations. As part of the process, the FEA submitted a mid-term report (see Annex A.21) on how these recommendations were implemented or planned, both on the faculty level and on the programme-level. In this SER, we present a new state-of-affairs on the follow-up of these recommendation on the faculty level as an update to the intermediate report submitted in September 2019. The follow-up actions at the programme level are described in specific sections of the "Study Programme" (SER Part B).

The faculty-wide recommendations made by CTI in 2016 are summarised below:
1. Reinforce the means of the Faculty Board to facilitate actions across the different programmes and to coordinate initiatives;
2. Continue the excellent work in preparing the auto-evaluation report, and define a detailed action plan, guided by a global vision on the faculty's future;
3. Translate the university policy with respect to maintaining relations with alumni of the faculty;

4. Develop the exchange of ideas, best practices, and initiatives between the different study programmes;
5. Take action, at the university level to fine-tune common marketing tools and approaches for student selection.

Reinforce the means of the Faculty Board

As described in the intermediate report, an extended Faculty Management Team has been installed, containing 6 members, assuming the day-to-day management of the faculty. The support team (administration) of all campuses were brought together on a single location, allowing to optimize the effectiveness of this support team through exploiting synergies.

Define a detailed action plan

The FEA decided to draw up a vision/strategy document (see Annex A.1) to be reviewed and updated on a 2-yearly basis. As part of the Ghent University quality system, also the faculty as a whole is expected to adopt the PDCA-cycle, which has to be evidenced in a faculty wide monitor. Detailed actions are an integral part of this cycle, and operational actions in accordance with the vision and strategy are articulated in this monitor.

As a result of the review of the Bachelor programmes, these were re-organised in the following respect:

- Reinforce the engineering project in the first bachelor year: the project is now spread over the full year. The second semester is now focused on a set of new themes, of extremely high societal importance, notably: Sustainability, Entrepreneurship and Ethics. The approach taken consists of critically reviewing the project realised in the first term from these perspectives. During the second semester, a specific project week (during which all other courses are suspended) is devoted to this highly interactive project effort (the so-called "DOE-week", inspired by the "Joker-week" of the BSc and MSc in Engineering: Architecture). Details on this new approach can be found in Annex A.22 of this report.
- Topics in the math-courses have been reviewed, also in view of the skills and knowledge of new students entering the first bachelor year. This has resulted in less emphasis of formality for some topics, re-ordering of topics and extending the emphasis on a number of other topics (e.g. differential equations and complex analysis).
- The original bachelor structure, consisting of 6 different bachelor programmes, has been transformed into a single bachelor with 7 main subjects (each main subject corresponding to an original bachelor programme with the addition of a major in Biomedical Engineering). This is in accordance with the view of the faculty to further foster exchange of ideas and approaches in a faculty-wide fashion.
- A new main subject on Biomedical Engineering has been organised since academic year 2019-2020. This programme is very successful and attracts a student group of typically 40 to 50 students in the second bachelor year.

The actions detailed in the intermediate report have all been successfully implemented.

Meanwhile, the University Board has proposed a set of six university-wide objectives, most of them related to education, with the request to the faculties to subscribe to at least three of these objectives, and to also devise an action plan in accordance with the faculty's goals and vision. The faculty has chosen to invest in the objectives concerning:

1. Active Learning
2. Diversity and talent development
3. Sustainability

For all three areas, specific actions and metrics to monitor progress have been defined (Annex A.23, in Dutch).

Relation with FEA-Alumni

The faculty pursues its efforts to organise events to strengthen its relation with the alumni of the faculty. These initiatives include TechBOOST, visits to companies, Update@Campus lectures, the Engineer of the Year competition as well as other non-academic social activities (bbq, reunion,...). Furthermore, a portfolio of brief witness statements (on video) by alumni is used in communication

to students and prospective students. Also at the level of departments and programme committees initiatives are taken to maintain relations with their alumni (see part B with programme reports).

Exchange across study programmes

This recommendation has been implemented through the installation of the "United Study Programme Committees" (VOC), facilitating information sharing, development of common views and exchange of best practices among different study programmes.

Student recruitment

The positioning test (see Section 4.1.1) is now a requirement for entering the BSc in Engineering and BSc in Engineering: Architecture, resulting in all candidate students getting feedback (and in many cases an "early warning") on their math skills and the expectations in this respect of the BSc-programmes. Although at the faculty level a number of actions have been taken (see the intermediate report), no university-wide initiative was undertaken (possibly due to the difficult international coronavirus related context).

Selection tools and support tools for incoming international students

An important issue remains to assess the level of incoming students, as to safeguard the level of the programmes on the one hand but also to avoid disillusioned students caused by false expectations. Unfortunately, the procedure provided by the Lisbon declaration requires that admitting students can only be done based on degrees issued by an HEI, and not through personal screening. To somehow overcome this, the faculty recommends students to take a GRE-test, and provides feedback based on the score obtained. Moreover, the assessment of the level of incoming students is also a concern for other faculties in Ghent University. The Faculty Chair Internationalisation has discussed this in detail with his colleagues from other faculties and also indicated this concern to the central UGent staff Internationalisation.

In case of identified shortcomings in the background of the student, it is also possible to direct the incoming student to the preparatory study program for international students. The admission requirements for this program depend on previous degrees (type of degree, country of issue,…). This set of preparatory courses is co-organised with the Faculty of Sciences and the Faculty of Economics and Business Administration. The content of the preparatory programme is determined for each student separately by the Curriculum Committee taking into account the background of the student with respect to his/her intended master's programme. It will consist of courses to a total number of at least 27 credit units. It is organised in the 2nd semester, i.e. the semester before the student starts his/her intended master's programme. At least 15 credits should come from a list of General Courses, e.g. Mathematics, Physics, Chemistry, Economics, Materials Chemistry, Academic English, Advanced Academic English,.. while additional courses, coming from the Ghent University study programmes and depend on the intended master's programme.

In order to facilitate integration of international students, the International Relations Office initiated, together with the students of VTK, a buddy program. The purpose is to organise several activities during which international students get to know local students, which will help them to integrate in our local student life, but also helps them to get acquainted with for example how local students experience studying in Ghent, to inform them (from a student perspective) how UGent professors organise their exams,… The buddy program started with its first successful activities in the autumn of 2019, but was subsequently impacted by the coronavirus pandemic. Nevertheless, some activities were still organised. For example, in March 2021, a staff member of the Faculty International Relations Office, organised an online cooking class for the international students of Ghent University, in collaboration with the central International Relations Office. About 50 students (29 different nationalities) joined and each student made in his/her own kitchen a local dish ('Gentse Waterzooi') This way, the students still experienced a bit of "Ghent culture and folklore" in these difficult times.

Future Strategy for international collaboration

The faculty is involved in a large number of bilateral agreements. While all Erasmus agreements were supposed to expire in 2020, the coronavirus pandemic postponed the expiring by one year. Several inactive agreements were cancelled, while for inactive agreements which a specific programme

committee wanted to keep, an activation strategy was formulated. In the end, this will lead to a reduced number of agreements. The strategy is now indeed deployed to focus on a limited number of agreements with well-established international partners, to start building a long-standing relation with these institutions. In practice, the imbalance between incoming and outgoing students for multiple collaborations continues to be an important challenge. However, the faculty has identified a number of preferential partners to approach internationalisation in a more structured fashion. A memorandum of understanding with Politecnico di Milano and the University of Twente was recently signed.

Secondly, a new course will be organised, facilitating students to take an international internship abroad, during the summer period, in one of the preferred partner institutions.

Faculty-wide SWOC analysis

Strengths

The education organised by the faculty enjoys a **strong commitment from all its stakeholders**:

- Dedicated teaching and support **staff**, with strong and proven expertise in the courses' subjects based on their specific research expertise,
- Strong involvement of the **students** (active presence in various management entities of the faculty (SPC, QCU, Faculty Council, …) resulting in a de facto partnership between the faculty and these student organisations (VTK, DLK) and student representatives (FRiS). For all bachelor/masters, a specific student organisation strongly contributes to the community building,
- Structural Involvement from **industry** through active participation in the SPCs, the ISAR, as well as by offering internships and master dissertation subjects. Also visiting professors and guest lectures ensure relevant exposure to industrial context and engineering practice in our programmes.

The programmes offered by the FEA share the following **strategy**:

- The faculty has taken the deliberate option for a deep understanding of the subjects, as this deep understanding is essential to acquire new knowledge in the field,
- Programme delivery follows the "active learning" strategy as much as possible. To this end, the faculty heavily invests in practicals (exercise sessions, lab sessions, projects, …) and novel delivery methods and teaching paradigms (e.g. flipped class room, student coaching, peer-assisted learning, …),
- In line with this strategy, all programmes share a strong project line, starting in the first bachelor year and culminating in the master dissertation. The project line develops technical, research, design and soft skills in a balanced and integrated way. Especially focus is put on soft skills, which were perceived as under-developed in previous programmes,
- Increased focus on societal and environmental topics in the curricula. Specifically for the first bachelor year in Engineering, a new project course on Sustainability, Entrepreneurship and Ethics has been introduced, and efforts are ongoing to extend this focus throughout the programmes, in line with the University-Wide Policy Choices of the Faculty.

The faculty operates in a **collaborative** way with various parties:

- Strategic partnerships with research institutes (both national and international) ensure synergy and complementary in research efforts,
- The faculty has a strong link to the "Dare to Venture"- programme (originally initiated by the faculty and now deployed across the University in view of the success),
- Organising the UGain academy (a continuing education institute in cooperation with the Faculty of Bioscience Engineering and the Faculty of Sciences) and offering courses for live-long learning and for maintaining links with work field,
- Commitment of alumni association to organising different faculty wide events and building and maintaining a community of graduated engineers (former students) and the work field.

The degrees issued by the Faculty are highly esteemed by the work field. This is clearly observed from the feedback employer's survey and the **excellent employability** of our graduates. Some degrees are unique within the Flemish/Belgian academic landscape.

Weaknesses

Internationalisation

- Incoming mobility (ca. 10% of Master students): despite various initiatives related to internationalisation (most notably organising the education in the masters in English), the number of incoming students is below expectations. It is difficult in practice to safeguard the intrinsic quality level of incoming students, as systematic screening on study results for admission decisions is actually not allowed (as a consequence of the Lisbon declaration).

In some programmes good practices with screening interviews are applied to assist the students in their decision about an international study at UGent;
- Outgoing mobility: about 25% of our students participate in mobility (including Erasmus exchange, international internships, summer schools,…). The faculty - and in fact the University - is eager to increase this participation.

Teaching Infrastructure
- The buildings and teaching infrastructure are mainly conceived for the more "traditional" lecture-oriented teaching/training methods, and less for activating teaching approaches (involving discussion, group work, flexible set-ups). The vision of the University is to invest to accommodate these modern methods, but this is a relatively slow process,
- The infrastructure is spread over different campuses, resulting in organisational inefficiencies for both students and staff,
- A considerable fraction of the teaching facilities is located in historic/old buildings, that don't comply to the current building comfort standards, and are in need of renovation.

Staff recruitment
Despite efforts to publish available positions through various channels (relevant academic websites, systematic notification of vacant positions to Flemish and Dutch Universities, as well as in personal networks), it is difficult to attract high-profile external candidates.

Education staff
The success of our programmes builds to an important extent on the commitment of PhD-students. Whilst this is considered a strength in master courses (clear link to recent research trends), this is sometimes seen as an issue in more basic courses, where educational continuity is a strong asset.

Communication with students
Students are typically informed on a course-by-course basis, rather than through a channel for the programme as a whole. Although programme-wide communication through Ufora is possible, students are insufficiently triggered to consult programme-wide pages, and hence are insufficiently aware of programme-wide initiatives (for instance about internationalisation).

Opportunities

The coronavirus pandemic has put a lot of strain on staff and students. In this context, a set of **new teaching methods** had to be explored. Positive experience gained with these methods will be applied in post-coronavirus times:
- More systematic use of video-fragments to explain difficult topics of the course in more detail,
- Online, low-threshold availability of staff to students,
- Self-tests and quizzes through the e-learning platform (Ufora).

The faculty management has approved a **master plan on educational facilities**, that is well-received by the University Board. This plan aims at bringing all education together at the Technology campus (Ardoyen), with the exception of the programmes in Architecture taking the opportunity to also invest in infrastructure more adapted to novel, more activating, teaching methods. In addition, grouping all activities on a shared campus will surely contribute to the educational offer of the faculty, foster collaboration between programmes and research groups and further improve community building between the engineering students and staff. The process of moving to the campus is under way, but important investments (or decisions on investments) are needed. For the department and programmes of architecture the renovation of one of the Technicum buildings in the city centre is planned to be completed in 2025.

On the regional level, a number of **strategic research centres** are funded through public means (FlandersMake, imec, SIM, VIB) and the Flemish government recently launched the Flanders AI and Cybersecurity research programs. The involvement of the relevant departments and research groups in these strategic research centres and research programs is an important asset both for education and research.

The University is well-integrated in the vivid city of Ghent, which is perceived as an **attractive and innovative city** to study and live in by prospective students.

Challenges

The number of generation students entering the bachelor programme is relatively stable (typical 350-380 students enroll in the BSc in Engineering, and 120-150 in the BSc in Engineering: Architecture). The ambition remains, given the need for engineers in society, to attract a higher number of talented and ambitious students, eager to obtain a degree in engineering. Initiatives to **broaden the recruitment base** by attracting a more diverse population (gender, social and cultural background), have been put in place, but have not resulted yet in a relevant increase of starting students. These initiatives include:

- Organisation of different STEM-events to increase the interest for science, technology and mathematics, early in the secondary school programmes in the Ghent region,
- Organisation of a Bachelor in Biomedical Engineering since 2019-2020, which is expected to be more attractive for female students (we indeed see that female students prefer this bachelor main subject, but we do not yet see a relevant increase of the number of incoming female students in the BSc in Engineering programme).

Flemish students keep performing very well in PISA-tests[127] (7th position for 15-year old boys, 23th position for 15-year old girls in 2018). The faculty is however vigilant for a potential **decline in interest and proficiency in mathematics, science and technology** in the high-school population. A very important problem in this respect, is the lack of mathematics/science teachers in secondary school, possibly resulting in a quality drop in education for crucial engineering topics and skills. The efforts of dedicated and gifted teachers who can motivate and inspire talented students are of crucial importance to continue to attract high-profile students in our programmes. While the Flemish Government is taking action to improve the teacher situation in secondary schools, the situation is worrying. The positioning test allows the faculty to monitor mathematical and scientific background of prospective students, and to remediate if necessary (organisation of summer course, retake of important topics for which students underperform based on their knowledge acquired in the secondary school, …).

Ghent University promotes the use of a rather austere house style for marketing purposes. Especially for **fine tuning the faculty website** to different audiences, this poses a problem, resulting in a non-intuitive, less appealing website for prospective students.

The coronavirus pandemic has put a heavy burden on public budgets, and it is anticipated that **budget cuts** will affect the university, necessitating also the faculty to focus on core business.

The concern relating to **increasing number of administrative procedures**, leading sometimes to an unnecessary high workload, already reported in the previous SER, unfortunately did not disappear.

Strategies for improvement

Recruitment of international students through personal screening and selection is unfortunately not allowed, making it difficult to guarantee the quality of these incoming students. The faculty now encourages the incoming students to take a GRE-test, prior to entering the programmes. The intention is to discourage prospective students to enter, if they achieve an unsatisfactory GRE-score, and to keep statistics relating GRE-scores to study results in our programmes to be able to inform prospective international students about their chances of successful programme completion.

To improve on its **international profile**, the faculty plans to

- Focus on collaboration with a limited set of high-profile international partners: it is felt that the growing number of bilateral agreements puts the efficiency on recruitment at risk. Therefore, the faculty plans to make bilateral agreements with a limited number of preferential partners. Such agreements are currently concluded with Politecnico di Milano, Italy, UTwente, the Netherlands, and NTNU, Norway. Also, faculty members participate in the university initiative to develop high-profile institutional partnerships (a.o. facilitating mobility of staff). The list of these institutional partners is available online[128]. In addition, partnerships with only a limited number of participants or with an unbalanced incoming vs. outgoing mobility will be evaluated on their strategic merit, and discontinued if such merit cannot clearly be identified,

- Introduce a new research-oriented internship possibility, offering students to take a research stay abroad, at one of the preferred partner institutions,
- Improve its international visibility: increased and systematic presence on international information fairs. The faculty will team up with the Faculty of Bioscience Engineering to kick-start this initiative. This action was already planned, but due to the coronavirus context was put on hold,
- The development of a more attractive and informative website (for which negotiation with the communication department of the University is needed),
- Investigate how to create exchange opportunities for students, even though the structure of the academic year in Ghent does not align with institutions abroad.

In order to rapidly get feedback on the efficacy of the measures highlighted above, the faculty considers initiating a pilot for one master programme.

The **teaching infrastructure** needs proper attention. Therefore, the faculty will continue its lobbying efforts to secure the necessary funds to realize the vision to bring the whole faculty together at the Ardoyen Technology campus in Zwijnaarde, as explained above, and to improve on the reachability of the campus. In addition, the faculty will spend a large fraction of the budget on new ICT-support ("Voorsprongfonds") for educational infrastructures.

The FEA is an attractive environment for high-profile academic staff, as is witnessed by the desire of several international ERC grant-holders to take up their grant in one of the departments of the faculty. For this reason, we believe that the lack of high-profile external candidates for regular positions (not in the context of ERC) is most probably due to insufficient advertisement for these positions. To encourage external candidates, the faculty plans to:
- Reform its **recruitment policy** (e.g. extending the time frame for application submission),
- Encourage research groups to actively identify high-profile candidates (even before the position is officially opened) and encourage them to apply.

A number of good practices exist in specific programmes to inform and engage students, e.g.
- Distribution of "programme newspaper" at the start of the academic year,
- Inspiring opening lecture (guest speaker) at the start of the semester.

The faculty considers extending these good practices to all programmes, and identifies a number of additional initiatives:
- Welcoming day for all students (currently only for 1st bachelor year),
- Newsletter to all students on a monthly basis,
- Organisation of activities, together with the student associations.

Lexicon (Dutch – English)

Dutch	English
Administratief en Technisch Personeel	Administrative and Technical Staff
Academisch Secretaris	Academic Secretary / Vice Dean of Research
Academische Strategische Adviesraad	Academic Strategic Advisory Board
Adviesraad OC's	Industrial Advisory Group
Afdeling Internationalisering	International Relations Office
Afdeling Studieadvies	Counselling Office
Afstudeerrichting	Main subject
AP/ATP-Beleidscommissie	HR Policy Committee
Assistententraining	Training for teaching assistants
Assisterend Academisch Personeel	Assistant Academic Staff
Begeleidingscommissie (masterproef)	Dissertation Supervisors (master's dissertation)
Onderwijsbeleidsplan	Faculty's Educational Policy
Beoordelingscommissie (masterproef)	Dissertation Assessment Committee (master's dissertation)
Bestuurscollege	Executive Board
Bibliotheekraad	Library Council
Bouw- en Milieucommissie	Buildings and Environment Committee
Brugprogramma, horizontale instroom	Bridging Programme, Horizontal intake
Commissie Diversiteit en Inclusie	Diversity and Inclusion Committee
Commissie Ethiek en Datamanagement	Ethics and Data Management Committee
Commissie Hoger Onderwijs	Commission for Higher Education
Commissie Internationalisering	International Relations Committee
Commissie Kwaliteitszorg Onderwijs	Educational Quality Control Unit
Commissie Wetenschappelijk Onderzoek	Scientific Research Committee
Competenties (eindcompetenties opleidingsonderdeel)	Final course competences
Competenties (generieke of opleidingsspecifieke opleidingscompetenties)	Competences or learning outcomes (generic or programme-specific competences)
Computercommissie	ICT Committee
Curriculumcommissie	Curriculum Committee
Didactische werkvormen	Teaching methods
Directie Informatie en Communicatie Technologie	Department of Information and Communication Technology

Dutch	English
Directie Onderwijsaangelegenheden	Department of Educational Policy
Directiecollege	Management Committee
Docententraining	Training for tenure track staff
Eerder Verworven Competenties	Previously Acquired Competencies/Skills
Eerder Verworven Kwalificaties	Previously Acquired Qualifications
Examencommissie	Examination Board
Facultair Beroepsorgaan	Faculty Internal Appeals Committee
Facultaire Commissie Internationalisering	Faculty Committee for Internationalisation
Facultaire Commissie Sabbaticals	Research Sabbatical Committee
Facultaire Dienst Onderwijsondersteuning	Faculty Education Services
Facultaire Doctoraatscommissie	Doctoral Training Programme Committee
Facultaire Raad Ingenieursstudenten	Faculty Council of Engineering Students
Facultaire Toetscommissie	Faculty Evaluation Committee
Facultaire Welzijns- en Veiligheidscommissie	Well-being and Safety Committee
Faculteitsbestuur	Faculty Management Team
Faculteitsraad	Faculty Council
Financiële Commissie	Finance Committee
Gastprofessor	Visiting professor
Gastspreker	Guest lecturer
Geïndividualiseerd traject, GIT	Personalised learning path
Gepersonaliseerde doelstellingen	Personalised Professorial Objectives
Hoger Onderwijsregister	Higher Education Register
HR-commissie	Personal HR-committee
IJkingstoets	Positioning Test
Industriële Strategische Adviesraad	Industrial Strategic Advisory Board
Inkomende uitwisselingsstudent	Incoming exchange student
Instellingsreview	Institutional Review
Institutionele Beroepscommissie	Institutional Appeals Committee
Leerlijn Ondernemen	Entrepreneurial Track
Maatschappelijke keuzevakken	Elective social courses
Masterproef	Master's dissertation
Modeltraject	Standard learning track
Monitoraat	Monitoring service

Dutch	English
Onderwijsdirecteur	Director of Studies / Vice Dean of Education
Onderwijskwaliteitsbureau	Education Quality Board
Onderwijsraad	Educational Council
Onderzoeksgroep	Research Group
Opleidingscommissie	Study Programme Committee
Opleidingsfeedback (door studenten)	Programme feedback (by students)
Overig Academisch Personeel	Other Academic Staff
PR-commissie	PR Committee
Projectlijn	Project line
Promotor (masterproef, stage)	Supervisor (master's dissertation, internship)
Raad van Bestuur	Board of Governors
Regeringscommissaris	Government Commissioner
Ritsweg	Switching Track
Stagecommissie	Internship Committee
Schakelprogramma	Linking Courses
Studentenvereniging	Student organisation
Studiefiche	Course sheet, course descriptions/specifications
Studiekiezer	Study guide
Studiepunt	Credit, ECTS credit
Studietrajectbegeleider	Learning Track Counsellor
Toetsbeleid	Evaluation policy
Uitgaande uitwisselingsstudent	Outgoing exchange student
Universiteitsbrede beleidskeuzes	University-wide policy choices
Vakfeedback (door studenten)	Course feedback (by students)
Vakgroep	Department
Vakgroepraad	Department Council
Vakgroepvoorzitter	Department Chair
Visitatie	External Quality Assessment
Visitatiecommissie	Assessment Panel
Vlaamse Interuniversitaire Raad	Flemish Interuniversity Council
Vlaamse Universiteiten en Hogescholen Raad	Flemish Universities and Colleges Council
VOC – Verenigde opleidingscommissies	United Study Programme Committees
Voorbereidingsprogramma	Preparatory Courses

Dutch	English
Wetenschappelijk Personeel	Research Staff
ZAP-commissie	Professorial Staff Committee
ZAP-Evaluatiecommissie	Evaluation Committee for the Professorial Staff
Zelfstandig Academisch Personeel	Professorial Staff

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