ACQUIN
Akkreditierungs-,
Certifizierungs- und
Qualitätssicherungs-
Institut

Evaluation Report and Accreditation Recommendation

Accreditation at the

German Mongolian Institute for Resources and Technology (GMIT)

"Mechanical Engineering" (B.Sc.), "Raw Materials – Process Engineering" (B.Sc.), "Environmental Engineering" (B.Sc.), and "Industrial Engineering" (B.Sc.)

Summary

Since 2013, the German-Mongolian Institute for Resources and Technology (GMIT) has achieved remarkable success. Built on a clear vision, a university development concept has been created and implemented. By close cooperation between German universities with the DAAD and the GIZ on one hand, Mongolian authorities and companies on the other hand, the concept of the university is expected to stand for innovation as well as model function for Mongolia's Higher Education System.

The four evaluated Bachelor programmes were designed according to comparable study programmes in Germany, aiming at the potential job market of engineering graduates in Mongolia. Since the number of students is still low, the polyvalent structure of the study programmes with a joint undergraduate study of four semesters fits well into this concept.

The study programmes are internationally oriented and, therefore, offered in English. Challenging entrance requirements, in particular a sound knowledge of natural sciences and the English language, ensure that the applicants meet the high standards required. To compensate deficits the university offers a one-year "Basic Engineering Program" which most of the applicants make use of in order to prepare for their actual studies.

The students' professional internship in the sixth semester and a basic prior internship are a novelty in Mongolia and designate the distinctive character of the programme. GMIT has entered into agreements with larger companies to provide students with internships, a concept that has been unknown in Mongolia's corporate culture until recently. The expectations of the companies and the demands on the part of GMIT regarding the internships still differ to a certain extent and should soon be incorporated by means of guidelines and close supervision.

The student-centred and competence-oriented learning environment is excellent. The structure of the existing laboratories is sufficient for the number of students and for the needs on a bachelor

level. A planned laboratory building should provide the necessary capacity for larger numbers of students in the future.

The staffing of the university is good; there are – except for Business Administration – enough well-trained professors, lecturers and assistants to provide all necessary teaching. Fly-in instructors from Germany provide additional staff. Due to the small number of students, the ratio of students to teachers is excellent.

The examination system and the information situation are not objectionable. Gender equality and equal opportunities are implemented in the study programmes both conceptually and practically.

The quality management system of the university is institutionally secured and conceptually well organised, and first practical experience has already led to improvements in the degree programmes. The university has a quality policy and the individual steps of the process are compiled in a quality management manual.

The expert group comes to a very positive overall impression of the still young but dynamic university and the four study programmes subject to examination. The report indicates certain potential for improvement; however, the expert group could not determine any major problems affecting the accreditation.

Content

I Framework of the accreditation process

1 Fact Sheet

Date of Contract: 29th May 2018

Receipt of self-evaluation report: 19th September 2018

Date of the on-site visit: 6th-10th November 2018

Standing Expert Committee: Engineering

Attendance by the ACQUIN office: Clemens Bockmann

Accreditation scheduled 31st March 2018

2 Members of the expert group:

- **Professor Dr. Rainer De Groot-Lehmann,** Professorship for Process Management and Logistics, Department of Mechanical Engineering and Business Administration, Technical University of Applied Sciences Lübeck
- **Professor Dr.-Ing. Ludger Rattmann,** Professorship for Mining Engineering, Faculty Geo-Resources and Process Engineering, TH Georg Agricola University of Applied Sciences
- **Professor Dr. Andreas Schleicher,** Professorship for Environmental Metrology, Department of Industrial Engineering, Ernst-Abbe-University of Applied Sciences Jena
- **Mrs. Daalkhai Dolgor,** Chief Process Engineer, Mongolian Mining Corporation LLC
- **Mr. Erbold Enkhbold,** Student at the National University of Mongolia

3 Information basis of the Evaluation Report

The Evaluation Report of the peer group is based on the self-evaluation report of GMIT and extensive discussions with the president, members of the presidential office, heads of the study programmes, staff representatives, students, and alumni of GMIT.

4 Evaluation Criteria

4.1 General Evaluation Criteria

General evaluation criteria have been the "Standards and Guidelines for Quality Assurance in the European Higher Education Area" (ESG) and the "Rules for the Accreditation of Study Programmes and for System Accreditation" of the Accreditation Council in the actual official version. At the same time the national context, particularly the national rules regulating the establishment of study programmes, has been taken into account.

4.2 Additional Criteria

The review panel has included in the evaluation the following questions

Objectives and Outcomes

- How is the quality of the study programmes in relation to content, teacher-student-ratio and equipment?
- Are quality assurance measures be undertaken?
- What is the professional perspective of the alumni?
- What other study programmes could enhance the academic profile of GMIT?
- Are the existing laboratories and building sufficient for the undertaking of teaching and research? Where could be potential for improvement?

Coordination, Complementarity and Coherence

- Do GMIT and its cooperation universities in Germany acknowledge procedures for admission and examination? Are competences as well as (double) degrees between these institutions universally recognised?
- How is the cooperation with the business environment (e.g. research cooperation, stipends etc.)?

Sustainability

- Will the German legacy of the establishment of GMIT endure after the sponsorship ends?
- What mechanism are in place to continue the cooperation?
- How is the economic outlook after the end of sponsorship for GMIT? What recommendation for a financially sustainable GMIT could be given?

II Recommendation to the accreditation commission of ACQUIN

1 Evaluation according to the "Standards and Guidelines for Quality Assurance in the European Higher Education Area" (ESG) of 2015

The programmes have been assessed based on the "Standards and Guidelines for Quality Assurance in the European Higher Education Area" (ESG). The reviewers come to the conclusion that the standards

1. Policy for quality assurance,
2. Design and approval of programmes,
3. Student-centred learning, teaching and assessment,
4. Student admission, progression, recognition and certification,
5. Teaching staff,
6. Learning resources and student support,
7. Information management,
8. Public information,
9. On-going monitoring and periodic review of programmes and
10. Cyclical external quality assurance

are fulfilled.

2 Recommendations

The peer group proposes the following with **conditions and recommendations**:

2.1 Overall recommendations

- The recognition of competences gained on tertiary level should not be limited to 120 ECTS points (c. B § 11 (5) SER).
- The recognition of competences should not be restricted on competences gained in the last five years (c. B § 11 (8) SER).
- Competences gained outside the Higher Education System should be recognized only if adequate and limited up to half of the study programme, i.e. 120 ECTS-points (c. B § 11 (4) SER).
- A module "Entrepreneurship" should be integrated in all study programmes to enable the students to set up their own business.
- A module "Introduction to Business Administration and Management" should be included for all study programmes within the first four semesters.
- The internships should be improved by:
  - Establishing a one-week introduction to internships.
  - Enhancing the supervision of internships by GMIT staff.
  - Creating internship guidelines and presenting the internship regulations to the cooperation partners.
- The SER could be enhanced by cancelling the redundancy between A § 9 (1) and B § 2 (1) and moving A § 9 (2) to B § 3.
- The workload of laboratory-hours should be listed separately in the syllabi.
- GMIT should carefully watch the workload and level of the modules.

2.2 Study programme related recommendations

2.2.1 "Mechanical Engineering" (B.Sc.)

- The modules "Introduction to Geoscience", "Open Pit Excavation and Underground Mining machines", "Classifiers and Mixers and CC machines" and "Properties of rock" should not be mandatory, but offered as electives.

2.2.2 "Raw Materials – Process Engineering" (B.Sc.)

- The recycling lab should be better equipped; in particular, a trommel screen and sensor-based sorting unit could improve lab capabilities.

2.2.3 "Environmental Engineering" (B.Sc.)

- Aspects of Process Engineering should be included in the curriculum.

2.2.4 "Industrial Engineering" (B.Sc.)

- The structure of the study programme should urgently be changed from a structure that separates engineering modules (first four semesters) and business related modules (last semesters) to a more integrated structure. In addition, there should be interdisciplinary modules/projects.
- In the module "Engineering project" in the first semester, business related aspects should be included (e.g. cost calculation).
- The mandatory module "Law" should address contract and labour law instead of environmental law.
- An elective module covering qualitative and quantitate methods should be offered.
- There should be one professor who can cover teaching business administration.

III Introduction

1 Short profile of the Higher Education Institution (HEI)

The German-Mongolian Institute for Resources and Technology (GMIT) (Deutsch-Mongolische Hochschule für Rohstoffe und Technologie) was founded in 2013 as state university in the suburban area of Ulan Bator, the capital of Mongolia by signing a treaty between the Federal Republic of Germany and the government of Mongolia promoting bilateral cooperation for exploring natural resources. In 2015, the statutes were implemented and the respective bodies of governance introduced. Also in 2015, the two faculties "Faculty of Engineering" and "Faculty of Mathematics, Computer and Natural Sciences" were created.

The development of GMIT follows a multi-phase plan where each phase is three years: In the first phase of operation (2013-2016), the focus was on the establishment of the organizational structure of GMIT, the development and implementation of the first academic programmes, as well as laying the foundation for a sustainable infrastructure for the university. Based on a survey of almost 90 companies in Mongolia about the need for technology experts, three bachelor programmes were developed by Mongolian and German professors, supported by GIZ and DAAD. Parallel to that, in September 2013, GMIT enrolled the first students in its "Basic Engineering Program", a preparation year, which improves the pupils' competences especially in English and Natural Sciences for the following bachelor programmes similar to the Studienkolleg at German universities. To concentrate the language capacities, the "Language and Didactics Centre" was established in 2014.

In September 2014, the first three bachelor programmes "Mechanical Engineering" (B.Sc.) (ME), "Raw Materials – Process Engineering" (B.Sc.) (RMPE), and "Environmental Engineering" (B.Sc.) (EE) were launched after GMIT had moved to its new campus in Nalaikh. An additional bachelor programme "Industrial Engineering" (B.Sc.) (IE) was added in 2016; the MBA programme "International Management of Resources and the Environment" (IMRE) started in autumn 2017.

The number of students as of spring 2017 was 84 students, half of which are female. 25 academic staff and 31 administrative staff provide teaching on an international level, as well as thorough support for the students.

The Mongolian Ministry of Education, Science, Culture and Sports (MESCS) financed the buildings of the campus approx. 35 km outside of Ulan Bator. It includes the main lecture building with offices, classrooms, a library, two fully equipped laboratories for chemistry and physics, a processing and materials laboratory, a computer lab, and a dormitory.

2 Brief information of the study programme

The three bachelor programmes "Mechanical Engineering" (B.Sc.), "Raw Materials" (B.Sc.) and "Process Engineering and Environmental Engineering" (B.Sc.) are offered by the "Faculty of Engineering" since the winter semester 2013/14. The bachelor programme "Industrial Engineering" (B.Sc.) is offered by the "Faculty of Mathematics, Computer and Natural Sciences" since the winter semester 2016/17.

Every winter semester applicants can enrol in these full-time study programmes lasting eight semesters (240 ECTS-points). The study programmes have no restriction concerning the numbers of students; however, there are admission restrictions that limit the number of potential students. In addition, there is a "Basic Engineering Programme" prerequisite lasting one year and considerable tuition fees have to be paid – circa 1.200 Euro for the "Basic Engineering Programme" and circa 2.400 Euro for each year of the bachelor programmes.

Candidates for the bachelor programmes have to have completed their secondary education. The admission furthermore requires the completion of at least two of the Mongolian General Entrance Examinations in mathematics, physics or chemistry as well as the Mongolian General Entrance Examination in English. For each of the two selected examinations the score requirement is 500 or above. The exam results should not be older than 2.5 years. In addition, applicants must have successfully passed the GMIT Entrance Examination. An English language proficiency of C1 (advanced) level is required for admission to the Bachelor's programmes.

IV Evaluation

1 Objectives of GMIT

1.1 Vision, Mission and Core Values

GMIT is a Mongolian state-owned university. The strategic outlook of GMIT is described in the "Statute of the German-Mongolian Institute for Resources and Technology". The aim of the statute is to follow the principles of the "Magna Charta Universitatum", signed by universities from many countries worldwide, including Germany. These principles are comprised of academic freedom, unity of teaching and research, and institutional autonomy. In Chapter 2 of the statute the vision, mission and core values are defined:

- Vision: GMIT strives to become a leading university of technology in Mongolia and the Asian region, thus defining the highest standards in education, research and innovation.
- Mission: GMIT is committed to serving Mongolia by educating highly qualified, socially responsible, internationally recognized technology experts and by advancing research and innovation for the benefit of society. It is guided by German excellence in science and technology and has a firm grounding in Mongolia's culture and heritage. Teaching and research are characterized by strong practice-orientation and dedication to foster creative, critical thinking.
- Core Values: GMIT is committed to the principles of ethics in all of its activities. It promotes diversity. Especially, it actively advances gender equality and welcomes students, employees and guests from all national, ethnic, cultural, and religious backgrounds, regardless of their sexual orientation.

Thus, GMIT is committed to serve Mongolia by educating highly qualified, socially responsible, internationally recognized technology engineers, and by advancing research and innovation for the benefit of society and in support of sustainable economic growth. It is guided by German excellence in science and technology, specifically engineering, and has a firm grounding in Mongolia's culture and heritage.

1.2 Guiding principles

Four principles guide the activities of GMIT:

- **Quality:** GMIT ensures that students receive a quality education.
    - This starts with a careful design of the study programmes by involving different stakeholders in the process towards employability. By engaging the faculty with experience in the industry, by including a mandatory internship in the curricula, by encouraging research at GMIT, and including students in research projects GMIT promotes both

the unity of theory and practice as well as the unity of teaching and research. This is supported by a regular evaluation and revision of the study programmes.

- In addition to that, GMIT pays attention to the recruitment of qualified staff and to staff development. GMIT monitors the teaching performance with the help of student evaluation and peer review, e.g. sit-in by colleagues (Class-Observations).
- Finally, GMIT promotes the students' success by creating a learning oriented environment. This starts with a quality-based admission procedure based on a GMIT-specific entrance examination. GMIT ensures a close supervision via small class sizes and a very favourable student-faculty ratio and offers tutorials for exam preparation. The employability is enhanced by a strong focus on mathematics, the sciences, and English language.

- **Sustainability**: The second main guiding principle for GMIT's activities is sustainability, which refers very much to the name of the university and to the origins of its foundation. The protection of the environment, the sustainable use of resources and the education of a new generation of ethic and socially responsible engineers as well as GMIT's contribution to the economic well-being of Mongolia are at the heart of the university's mission and that is reflected in the curricula of the programmes, diverse projects, and in GMIT research activities.
- **Connectivity / Interconnectedness / Integration:** Although one of the main objectives of GMIT certainly is to enhance academic and cultural exchange between Mongolia and Germany, it promotes cooperation and diversity that goes beyond this binational outlook. Internationality has been an integral part of the GMIT concept since the very beginning as the university follows European quality standards in education (ESG), uses curricula which combine German engineering expertise and international research with Mongolian needs that are, in many ways, also global challenges. Although currently GMIT's student body is 100% Mongolian, GMIT is open to all nationalities, ethnic backgrounds, local origins, and religious beliefs. GMIT's staff includes colleagues from Germany, South Korea, Canada, and the United States, and 85% of the faculty and 36% of the administrative staff was educated outside Mongolia and/or has international work experience. Furthermore, GMIT understands interconnectedness / integration as a close cooperation with partners in the public and private sector, as well as with University Partners in Germany and Mongolia. Stakeholders in industry are partners in training, especially providing internship placements, but increasingly also in research. To enhance the close cooperation with Mongolia's industry, "Friends of GMIT" was founded in 2015 with the objective, to support GMIT in its mission, to strengthen applied research at GMIT, to foster knowledge transfer, and to establish an open dialogue between university, industry and society.

- **Innovation:** Being a university, which is modelled after European standards, GMIT has been sharing experiences and best practices in different areas of the university life with the Mongolian public, particularly with the educational sector. Examples are the student centered, learning outcome based and practice-oriented education, the development of general personal and professional skills, the students' representation in all bodies of academic self-governance, their participation in research projects and their employment as student assistants on campus as well as quality assessment in teaching, career advice opportunities as well as applied research involving industry. This way, GMIT would like to contribute to the ongoing reform of Higher Education in Mongolia.

1.3 Unique Profile

GMIT's unique selling proposition is a different level of quality to the students compared to the numerous small universities in Mongolia. It is a campus university – which is an unfamiliar scheme to Mongolia –, offers an opportunity to go abroad, and the qualifications of instructors. It is the only university in Mongolia with English study programmes exclusively for eight semesters. Whereas the other universities in Mongolia try to enhance their level of excellence by cooperation with international institutions, e.g. Harvard University, GMIT is the only new university based on international standards.

Teaching and research are characterized by strong practice-orientation and dedication to foster creative and critical thinking. This practice-orientation, the promotion of professional and personal development of its students, the international character of the university as well as its adherence to European quality standards in education (e.g. "Standards and Guidelines for Quality Assurance in the European Higher Education Area" ESG, and ISO 9001:2015) and research enables GMIT to contribute to the reform of Higher Education in Mongolia.

1.4 Strategic outlook and challenges

GMIT formulated and presented its University Development Plan in 2017, which defines areas of strategic development along with goals, objectives and benchmarks until 2025. However, GMIT is facing various challenges.

The first challenge is the current economic crisis in Mongolia, which has a number of implications for GMIT. On the one hand, it affects the families' ability to pay for their children's tuition fees for a Campus University like GMIT. To a large extent it is due to the comparatively high tuition (and dormitory) fees of 1.200 Euro/year for the Basic Engineering programme and 2.400 Euro/year for the bachelor programmes that on average only half of the admitted students enrol at GMIT (52.3%). In the Student Recruitment 2018-2019, GMIT was able to convert 73.9% of the admitted students into enrolled students. Of certain help is the DAAD TNB Sur Place Scholarships that

cover the full tuition fees and paying an extra stipend of 200 Euro per month. These scholarships are awarded to approx. 20% of the enrolled students.

On the other hand, most companies are not in the position to award scholarships to students or to invest in research projects. This makes it difficult for GMIT to support students, to place them in companies for their bachelor thesis, but also to engage in applied research and to generate an income based on it. Finally, the planned campus extension, especially the construction of necessary laboratory facilities and second dormitory, is delayed, which has an impact on the quality of teaching at GMIT. The buildings shall be available in Semester Fall 2022.

Secondly, GMIT as a young university has not yet built up the renommée necessary to attack the best students of the country. It has just seen its first Bachelor graduates, who left the university in July/August 2018. Thus, GMIT cannot refer to the quality of the students measured by their employability yet, but a tracer study will be conducted in 2019. This, together with the lack of sufficient English language proficiency and knowledge in mathematics and sciences of many applicants, makes it difficult to attract qualified students to the university.

In a similar vein, it is rather challenging for GMIT to find academic and administrative staff, who is highly qualified and experienced and, at the same time, has a high English language proficiency. The increasing affinity of students with new media and IT-technology challenges classical styles of teaching. GMIT needs to adapt and/or develop new methods of teaching and learning to respond to the different needs of the students but also to different availability of learning material.

Although many of the GMIT Partner companies are generally interested in the internship concept, and some have worked with interns for quite some time, the implementation of internships is not without difficulties. On the one hand, some companies focus more on the costs of interns, rather than seeing the benefit of having interns on their premises. Instead of looking at the students as future employees, often the students are seen a burden, as they have to be guided and supervised. Most companies have no experience in the professional supervision of interns. Therefore, it is rather difficult to find internship placements for the students, specifically internship placements that also cover the costs for the intern. On the other hand, the duties or tasks that are assigned to the students are not always in line with the requirements of GMIT's engineering programmes and thus do not always give the student the expected learning experience. GMIT tries to improve the situation by giving industry workshop for internship supervisors and by offering internship opportunities in Germany.

Finally, although the Mongolian government is currently supporting GMIT in a way that goes far beyond its engagement towards other universities, it remains a fact, that Mongolian universities depend to 90% on an income that is mainly generated by tuition fees. Thus, the basic conditions for teaching and research are not provided by the government – university education in Mongolia

is seen as a commercial good. With small student numbers (Semester Fall 2018: 176 enrolled students at GMIT), it will be very difficult to maintain the high quality standards based on tuition fee income and third party research funding.

1.5 Quantitative targets and demand

In October 2018, GMIT has 176 students: 45 in the "Basic Engineering Programme" (BEP), 121 in bachelor programmes and 10 students in the Master's programme. The following table shows the distribution of the bachelor student between the four bachelor programmes:

	Environmental Engineering	Raw Materials & Process Engineering	Mechanical Engineering	Industrial Engineering
1. Year	51			
2. Year	30			
3. Year	7	6	6	5
4. Year	3	7	6	

According to the Development Plan 2017-2025 GMIT plans to reach 538 students by 2025 with the existing study programmes. Furthermore, GMIT plans to reach 304 students by 2025 with new study programmes. The bachelor students shall increase from 22 in 2019 to 80 in 2024. Additionally GMIT plans 17 new Master students in 2020, and then annually 30 Master students from 2021 onwards. The number of first year Bachelor students in these programmes shall increase from 35 in 2017 to 160 in 2023.

1.6 Conclusion

Given the few years of its existence, GMIT has achieved formidable results. One reason is a clearly defined purpose of the whole institution. Starting with vision, mission, core values, and principles, GMIT could start from sketch with a clear focus for the initial phase and beyond. The experts have great respect for these achievements and are comforted by the thought that the thorough analysis of the existing situation of GMIT as well as its prospective outlook will help to master known and unknown challenges.

2 Common Aspects of all study programmes

2.1 Basic Engineering Programme

The "Basic Engineering Programme" (BEP) is a preparatory year for all GMIT's bachelor programmes. The BEP is similar to study programmes in other countries with similar names like "Foundation Year" that prepares students for their application to study undergraduate programmes. The objectives of BEP are the acquisition of fundamental knowledge in the relevant engineering disciplines mathematics, physics, chemistry, and informatics and language proficiency in English according to level C1 of the Common European Framework of Reference for Languages (CEFR). Language of instruction is English.

The programme combines introductions into basic subjects, key competencies and a practical training:

- Basic subject are Mathematics (eight contact hours per week in a semester (contact h/w)), Physics (six contact h/w), Chemistry (four contact h/w), Computer skills (two contact h/w), English language courses (for B2-level 14 contact h/w, for C1-level eight contact h/w), and optional German language courses (four contact h/w).
- Key competences are methodological skills (one contact h/w) and social skills (one contact h/w).
- The practical trainings includes industrial / laboratory work experience of at least two weeks.

According to the review panel's opinion, the BEP is feasible to introduce the students to the learning environment of the bachelor programmes. The curriculum is balanced.

2.2 Objectives of the study programmes

The overall objectives of all study programmes are described in the "Study and Examination Regulations of Bachelor Degree Programs" (SER) in § 1:

"(1) The objective of the programs is to qualify the graduate for an application-oriented employment or entrepreneurship in the particular field of engineering, and for life-long learning.

(2) The graduates of the Bachelor degree engineering program will be able to

- Apply mathematical, scientific and engineering principles to solving engineering problems.
- Recognize and analyse complex problems, develop engineering solutions to problems, and realize holistic solutions for them.
- Apply information science for solving engineering problems.
- Work in international teams in order to solve extensive and interdisciplinary problems.

- Assess and apply as engineers in design, development, production, distribution and consulting scientific methods in order to foster the progress both of the society and of environmental engineering.
- Recognise the consequences of engineering activities in order to act responsibly within and for the society, the economy, and the environment."

All study programmes aim at qualifying the students for an application-oriented employment or for entrepreneurship in the respected field of competence, and for life-long learning.

Both study programmes ME and RMPE aim "at providing knowledge, abilities and competencies in engineering, mathematics and natural sciences in order to enable the graduate to plan, control and operate machines and process chains for refining and processing raw materials and other products in economic, ecologic and sustainable ways. (…) The principles of sustainability, safety and environmental protection are inherent in all study projects and other educational components. Throughout the studies the prospective engineers are educated in the spirit of responsibility towards the society, towards the economy, and towards the environment." (page 4 of the respective module handbook)

In difference to the aims mentioned above both study programmes EE and IE offer "a wide variety of different disciplines, e.g. biology, geography, engineering and management. By such an interdisciplinary approach, solutions for today's and tomorrow's global challenges are developed. As all-rounders, the graduates of the bachelor programme have the knowledge and the ability to become acquainted with relevant specializations in their future professional or academic life. They have a broad understanding about technical solutions for environmental problems in Mongolia and elsewhere, but are also aware of negative environmental impacts of technocentric approaches. Based on their knowledge of various scientific and engineering disciplines, they are able to work together with specialist engineers, scientists, practitioners and policy-makers. By coordinating the work of such experts, they ensure that interdisciplinary collaborations turn out successful." (page 4 of the module handbook of EE; similar but not identical wording on page 4 of the module handbook of IE).

Further description of the competencies of each study programme are given in the respective module handbook (c. § 1 (3) SER).

In the review panel's opinion, the overall objectives of all study programmes are clearly defined and the respective target group addressed. The qualification targets do not only define knowledge competences, but also generic and personal competences. The objectives of the study programmes differ not so much, as half of the study time is spent with common modules. However, the differences between these study programmes could be addressed in more detail in the module handbooks.

2.3 Employability

There are 12 new graduates from GMIT in 2018: Five in RMPE, four in ME, and three in EE. Currently employability rate of the new graduates is 60% (three out of five graduates employed from RMPE, three out of four employed from ME and one out of three from EE).[1] Given the number of the first intake (21 enrolled students), the number of graduates is relatively low. GMIT watches and analyses the overall dropout rate with a questionnaire. Students mainly mentioned reasons that do not relate to the programmes, e.g. financial restrictions, scholarships from other universities ore changes of priorities.

There are about 15 mining projects in operation in Mongolia, nowadays. This number will increase in the next few years. Therefore, skilled worker vacancy will increase in the future. The intended range of future employment areas ranging from research and development, design and manufacture of products, installation to final commissioning and operations is far-reaching. Thus, not only the outlook for graduates of the study programmes ME and RMPE is favourable, but for the other study programmes as well.

For example, study programmes of environmental engineering exist in several countries for more than twenty years. An estimation of the economic development of environmental technology is described in a publication from the German Ministry for Environment, "The global market volume for environmental technology and resource efficiency is projected to increase from 3,214 billion euros in 2016 to 5,902 billion euros in 2025, equivalent to average annual growth of 6.9 percent."[2] The study programme EE of GMIT is preparing students for professional activities in this economic sector. An assumption of a persistent need of environmental engineers seems therefore to be realistic.

The concept of industrial engineering (aka Wirtschaftsingenieurwesen/business engineering) is relatively new for Mongolia. Nevertheless, also Mongolian companies and organisations face problems, which are not solely engineering or economic based. Industry representatives expressing that they need industrial engineering in their operations, because they all mentioned that engineers have lack of management skills. Therefore, graduates are needed which are able to solve "practical" problems in a comprehensive, integrated manner and to work in an inter-disciplinary of multi-disciplinary environment. With a focus on relevant issues like Operations Management and Supply Chain Management, graduates gain sufficient knowledge to optimize crucial processes and structures in companies. Thus, the future employment situation for graduates of the study programme IE looks promising, too.

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[1] The numbers reflect the situation in November 2018. In March 2019, all graduates have found an employment except for one who started studying a master programme.

[2] Roland Berger GmbH, Dr. Torsten Henzelmann, Ralph Büchele, Dr. Patrick Andrae, Andrea Wiedemann GreenTech made in Germany 2018, Environmental Technology Atlas for Germany, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)

Unfortunately, it seems to some extend unclear what the specific demand of GMIT graduates in Mongolia is. To analyse the situation, the review panel discussed this issue with representatives of several important Mongolian companies. The companies are the following:

- **Camens** is a distribution branch of the diesel engine supplier company with 60 employees selling their service to the industries. Most of the employees are technicians and only one or two mechanical engineers are hired every year. Camens and GMIT cooperation is at an initial stage. However, they would like to extend their cooperation with GMIT. Technical English training for the company employees is the one of their interests. Furthermore, they are expecting graduates from GMIT with good English language skills in the future. They also expressed that they are willing to offer opportunities for internships in the company for GMIT students.
- **MAK** is with 1,900 employees one of the biggest mining and construction company in Mongolia. MAK owns coal and copper mines and employs 800 people working in the mining sector, of which 100 are engineers. In 2020, a copper mine expansion project – copper concentrator – will commence. MAK is starting to hire engineers for this project. Thus, GMIT graduates can apply for the new job vacancies in this project. MAK is not just looking for experts in mechanical engineering, raw materials or process engineering; they also have interest to hire industrial engineers as well. Currently, MAK provides education scholarships to engineering students, especially for targeted students who lack the ability to pay their tuition fees due to economic limitations. They also express that they will continue this scholarship for engineering students in the future.
- **Darkhan Geomash** is a mining equipment manufacturing and repairing company with about 110 employees. Darkhan Geomash closely works with Wagner Asia LLC. They mostly desire practical skills from new graduates. They mentioned that new graduates from local technical universities in Mongolia, even from GMIT lack such practical skills.
- **Wagner Asia Equipment** is the biggest mining heavy equipment dealer company in Mongolia with 200 employees. Wagner Asia Equipment is offering service and maintenance of mining heavy equipment and has need of skilled mechanics and technicians rather than mining engineers. They hire graduates from local technical universities and train them for half a year in their workshops. The company is cooperating with GMIT for two to three years. They mentioned that it is difficult to find skilled engineers in Mongolia.

After meeting with cooperation company representatives, it can be concluded that there is a lack of skilled technical workers. All those companies are expressing their will to provide opportunities for internships for GMIT students and to offer scholarships. Although cooperation between those companies and GMIT are in its initial stages, their expectation towards GMIT graduates is high. However, most of the companies want to hire technicians rather than engineers. Moreover, even

if they hire new graduates, they need to train them in their own workplace due to a lack of practical skills. Thus, they expect the graduates to be supreme workers with technical English skills and practical skills.

Overall, the review panel's opinion is that the study programmes prepare the students adequately for the occupational demands of their professional field. In addition, due to the communication and presentation skills, intercultural communication and competences the employability of GMIT graduates can be regarded as very good. To strengthen the employability of the graduates even more and match the distinctive demand expressed by the companies during the discussion, it should be considered whether more "downstream activities"/"value added services" (e.g. manufacturing, maintenance) – at least as electives – could be integrated in the study programmes. It could be helpful to complement the description of the competencies in the module handbooks with explanation about employment opportunities and potential career prospects. Furthermore, an integration of entrepreneurship issues in all study programmes should help the students to set up their own businesses in Mongolia and should strengthen the employability of the graduates.

2.4 Admission and Enrolment Regulations

2.4.1 Admission criteria

The admission to the bachelor programmes at the GMIT is regulated by the "Admission and Enrolment Regulations" (AER), approved by the Academic Senate of GMIT in March 2017. The requirements are defined as follows:

- "Applicants are required to have completed their secondary education. Admission furthermore requires the completion of at least two of the Mongolian General Entrance Examinations in Mathematics, Physics or Chemistry as well as the Mongolian General Entrance Examination in English. For each of the two selected examinations the score needs to be 500 or above. The exam results should not be older than 2.5 years.
- Applicants must have successfully passed the GMIT Entrance Examination. (...) An English language proficiency of C1 (advanced) level is required for admission to the Bachelor's programs.
- Bachelor's programs in Engineering require the completion of 6 weeks of Basic Internship as an admission requirement. Students are granted the possibility to complete this Basic Internship until the end of the 4th Bachelor semester. (…)" (§ 1 AER).

The GMIT Entrance Examination consists of two parts: an examination in Mathematics and Natural Sciences (Physics and Chemistry) and an English Proficiency Test.

The entrance examinations in mathematics and natural sciences can be waived for applicants who achieved special awards like one of the four places in National Olympiads in Mathematics, Physics,

Chemistry or Technology. The English language Entrance Examination can be waived for applicants who can proof a completed secondary education or a completed Bachelor degree in English or a certificate of TOEFL (min. 80 iBT) or IELTS test (min. 6.5). (c. § 2 (1-7) AER)

The Entrance Exam is passed when the applicant reaches a total score of 60% in the Mathematics and Natural Science exam and can prove an English language proficiency of C1 (advanced) level. Applicants who pass with B2 (upper intermediate) level can be admitted on condition that they prove C1 level of English until the end of their first Bachelor semester at the latest.

The requirements of admission including the AER are published on the website of GMIT.

2.4.2 Rules of crediting achievements from other HEI or external achievements

The rules for crediting achievements from other Higher Education Institutions or external achievements are fixed in the § 11 SER:

"(1) Modules and their examinations completed at another institution of Higher Education in Mongolia or abroad will be recognized by the Examination Board if they are not substantially different from modules and examinations of the respective degree program of GMIT.

(2) If the modules and examinations are not recognized, the Examination Board has to demonstrate substantial differences between the modules and examinations whose recognition is requested and the modules of the respective degree program at GMIT. (…)

(4) Knowledge, skills and competencies that have been acquired informally outside of an institution of Higher Education are recognized if no substantial differences to the knowledge, skills and competencies acquired by the modules of the reference degree programs exist."

These regulations comply with the Lisbon Convention. However, the limitation to half of the study programmes modules, i.e. 120 ECTS-points, is not sufficient to German interpretation by the accreditation council (c. B § 11 (5) SER). Equally problematic – from a legal perspective – is the limitation of automatic recognition of acquired competences for only the last five years (c. B § 11 (8) SER). In addition to the recognition of competences achieved within the Higher Education System (HES), there are rules for recognition outside of the HES: "Knowledge, skills and competencies that have been acquired informally outside of an institution of Higher Education are recognized if no substantial differences to the knowledge, skills and competencies acquired by the modules of the reference degree programs exist." (c. B § 11 (4) SER) To match German legal requirements the competencies should be recognized only if they are equivalent to the competences to be gained in the modules of GMIT's study programmes. In addition, recognition of extra-curricular competences should be limited up to half of the study programme, i.e. 120 ECTS-points. In consequence, B § 11 (5) should apply only to extra-curricular recognition.

Overall, the review panel estimates the ESG standard 1.4 "Student admission, progression, recognition and certification" concerning the admission and recognition aspects to be fulfilled.

2.5 Concept

The first two years of all study programmes focus on fundamentals in mathematics, natural sciences and engineering and have virtually the same modules for all study programmes. Starting from the fourth semester, the study programmes differ and specialize in the corresponding scientific disciplines. The existence of a common basic programme gives to the students the possibility to select their major until the beginning of the fourth semester.

The first four semesters of all study programmes contain 26 fundamental modules, of which three are electives. The common modules per semester are:

1. Semester: "Mathematics I" (8 ECTS points), "Chemistry" (6 ECTS points), "Engineering Mechanics I" (5 ECTS points), "Introduction to Computer Science" (4 ECTS points), "Intercultural Communication and Competences" (2 ECTS points), "Engineering project" (2 ECTS points) and an elective module (3 ECTS points), in total 30 ECTS points.
2. Semester: "Mathematics II" (8 ECTS points), "Materials Science" (6 ECTS points), "Chemistry Laboratory" (4 ECTS points), "Engineering Mechanics II" (4 ECTS points), "Introduction to Geosciences" (4 ECTS points), "Technical English" (3 ECTS points), and an elective module (3 ECTS points), in total 32 ECTS points.
3. Semester: "Physics" (8 ECTS points), "Statistics and Numerics" (4 ECTS points), "Engineering Thermodynamics" (4 ECTS points), "Engineering Design" (4 ECTS points), "Introduction to Electrical Engineering" (4 ECTS points), "Introduction to economics" (4 ECTS points) and one elective (3 ECTS points), in total 31 ECTS points.
4. Semester: "Measurement and Control" (4 ECTS points), "Fluid Mechanics" (4CP), "Scientific Methods" (2 ECTS points), "CAD" (4 ECTS points), "Engineer in Society" (4 ECTS points).

Some modules are mandatory only for special study programmes:

- For RMPE additional modules are "Properties of Rocks" (4 ECTS points), "Engineering Mechanics III" (5 ECTS points) and "Life Science" (3 ECTS points).
- For ME additional modules are "Properties of Rocks" (4 ECTS points), "Engineering Mechanics III" (5 ECTS points) and an elective Module (3 ECTS points).
- For EE additional modules are "Properties of Rocks" (4 CP), "Geoecology" (4 ECTS points), "Law" (3 ECTS points) and "Life Science" (3 ECTS points).
- For "Industrial Engineering" additional modules are "Management Accounting" (5 ECTS points), "Geoecology" (4 ECTS points) and "Law" (3 ECTS points).

Overall, the common modules offer a thorough introduction to engineering as well as to natural sciences. Additional modules in informatics, economics and law give a short insight in scientific

fields that are related to the engineering programmes. Language and methodological modules complete the curriculum.

The review panel's opinion is highly favourable to the structure of the first four semester as they provide common standards in engineering and natural sciences that suits the limited number of students. However, two aspects should be changed. The module "Introduction to Economics" with a strong focus on macro and microeconomics as a first non-technical module for the students seems insufficient. As a first non-technical module, a more business administration/management related module is recommended (e.g. module "Introduction to Business Administration and Management"). With such a module, the students should be able to understand the basic methods, techniques and general theories of business administration and management; knowledge of theories of macro and microeconomics are not essential for graduates of the engineering study programmes. Macro- and micro-economics could be lectured in a higher semester for students of the study programme IE. In a similar fashion, a module "Entrepreneurship" should be integrated to increase the employability of the graduates and to enable the graduates to set up their own business (c. IV.2.3). This module could be offered as an elective.

Common to all bachelor programmes beyond the fourth semester are the modules "Engineering in Society" (4 ECTS points) in the fourth semester, "Industrial Internship" (14 ECTS points), "Scientific Writing" (4 ECTS points) and "Health-Safety Environment" (4 ECTS points) in the fifth semester and the "Finale Study Project" (6 ECTS-points) and "Bachelor Thesis and Colloquium" (12 ECTS points) in the eighth semester.

Internships are regarded by GMIT as an important element to provide an inter-/multi-disciplinary thinking for their students. Both the internship before the bachelor programmes ("basic internship") and the internship of 14 weeks in the sixth semester ("professional internship") are regulated by the "Internship Regulation". Duration, objectives, status of interns and other issues such as the internship report are clearly defined. According to the review panel, it should be considered whether the internship should consist of 15 ECTS points to give the opportunity of combining internship and the bachelor thesis.

Approximately 50 Letters of intention / mutual understanding agreements were signed by the GMIT to offer students an internship in a Mongolian company. However, the concept of an internship is not yet well known in Mongolian companies. Therefore, the internships should be improved by:

- Establishing a one-week introduction to internships.
- Enhancing the supervision of internships by GMIT staff.
- Creating internship guidelines and presenting the internship regulations to the cooperation partners.

German companies are more familiar with the concept of internships. Some of the GMIT ME students are interested in an internship in Germany. Therefore, a sufficient knowledge of German is required to conduct an internship in a German company. However, the level of proficiency in German (with B1) that is offered to the students in elective modules cannot be accepted as sufficient. It should be considered how to improve the knowledge of German for students who are interested to conduct an internship in Germany.

In the last semester, the focus is set on the bachelor thesis. To emphasise the importance of the thesis, to give the students the opportunity to gain a deeper insight into their topic, and to conduct the internship with the bachelor in one semester it should be considered whether the bachelor thesis and the colloquium might have 15 ECTS points (12 plus 3 ECTS points) in total. One elective module of three ECTS points could be eliminated to compensate the enlargement of the final module. This would open up the opportunity to link the internship with the bachelor thesis.

2.6 ECTS and modularisation

All study programmes are modularised in conformity with the rules of the European Credit Transfer System. The range of credit points is from two to eight ECTS points (except internship and thesis) with the majority covering four to six ECTS points. The number of modules in each study programme is 51. Except for the sixth semester (internship) and the last one (bachelor thesis), the number of modules to be taken per semester is 6-8.

The relation of number of contact hours to ECTS points of the module is in almost every module 1:1, which is common to most bachelor study programmes in engineering. Consequently, the module structure in all core modules is a multiple of two ECTS points (two, four, six, and eight). However, language modules and non-technical electives, respectively, do not follow this scheme, but cover a workload of three ECTS points.

The workload includes the contact hours, homework and project assignments, exam preparation, the examinations and self-learning in general. For one ECTS point 30 hours of student work are set by the SER (c. A § 8 (2) SER). The workload per semester covers a range from 27 to 32 ECTS points except for the eighth semester with 25 ECTS points. GMIT should try to distribute the workload evenly over all semesters.

In discussion with the students the workload was described as tough, but not overwhelming. The same valuation can be found in the evaluation. However, it should be considered whether six to eight different modules in one semester with an examination for each module could be more streamlined. A careful observation of the actual workload during the expansion phase of GMIT could be accomplished by adding a respective question to the evaluation forms (c. IV.8.4).

2.7 Teaching methods and learning environment

The language of instruction is English. The English language competence compared to graduates of other Mongolian universities is relatively high and gives graduates of GMIT a competitive edge for leading positions in international enterprises. Given the poor English competences of Mongolian High School graduates, one major focus of the BEP is to enhance this competence to the level that students of the study programme have sufficient knowledge to master their studies and follow the lectures.

The modules of the study programme include different forms of teaching and learning, such as lectures, recitations, laboratory sessions, field trips, study projects, or internships. The teaching and learning methods are selected depending of the desired learning outcomes. Lectures are often used for teaching specific knowledge and scientific theory, seminars with presentations motivate students to take an active role, and laboratory courses help training experimental skills. Study projects promote a brought variety of soft skills like problem solving skills or time management. Depending of the subject of the courses, GMIT uses the full spectrum of possible teaching methods. Self-learning experience as well as team projects enable the students to cope with the different tasks perfectly. The peer group is very satisfied with GMIT's the learning environment.

The review panel's opinion states that ESG standard 1.3 "Student-centred learning, teaching and assessment" concerning the learning and teaching is fulfilled.

3 Objectives and Concept of the Bachelor "Mechanical Engineering" (B.Sc.)

3.1 Short summary of the study programme

The application oriented bachelor programme intends to provide knowledge, abilities and competencies in engineering so the graduates are able to solve sophisticated mechanical engineering tasks in companies. This comprises profound knowledge in research and development, but also design and manufacture of products ranging from small components to large plant, machinery or vehicle, through to installation and final commissioning and operations.

The target group of this study programme are ambitious scholars who are able to study in English and are determined to meet the requirements of a mechanical engineering study programme.

The development of the qualification targets took place based on the expected demand of the Mongolian industry of mechanical engineering graduates. The European quality standards in higher education were also an important factor for the development of the qualification targets of the study programme ME.

3.2 Objectives and competences

"The graduates of the study programme ME will be able to

- Apply mathematical, scientific and engineering principles for solving problems of mechanical engineering.
- Recognise and analyse problems, develop engineering solutions to problems, and realize holistic solutions for them.
- Assess and apply as engineers in design, development, production, distribution and consulting scientific methods in order to foster the progress both of the society and of mechanical engineering.
- Apply information science for solving mechanical engineering problems.
- Work in international teams in order to solve extensive and interdisciplinary problems.
- Recognise the consequences of engineering activities in order to act responsibly within and for the society, the economy, and the environment." (page 4 of the module handbook)

The study programme ME intends a strong practice-orientation. The graduates should be able to develop engineering solutions in a "holistic" manner. They should be able to develop "integrated engineering and economic solutions to problems". The graduates will be educated to work in companies ("application oriented employment") or to set up their own business ("entrepreneurship"). However, these ambitious objectives and competences do not always find an equivalent in the curriculum. The learning outcomes are often characterized with "described", "apply", "understand" etc. Only in a few module the words "design" or "develop" is used.

3.3 Personal development and capability for civic engagement

The study programme ME at GMIT recognizes the importance and the need to develop student's communication and presentation skills, intercultural communication and competence. These skills and competences are crucial for ME graduates in companies. In addition, a GMIT graduate should be able to reflect his/her actions. With several measures and specific modules (e.g. module "Engineer in society") the GMIT addresses these issues in an appropriate manner.

3.4 Concept

The study programme ME covers all relevant mechanical engineering topics. The relevant natural sciences were taught as well as important engineering issues and required techniques/methods.

The curriculum ME focuses especially on development/design and on mining. However, the GMIT objective of this study programme is to qualify the graduates to work in the fields of design/development, but also in manufacturing, in installation and final commissioning, and in operations. Unfortunately, relevant technical modules (e.g. production technology) and non-technical modules (e.g. operations management) which are important to work as a graduate later in these fields in companies are not available for ME students (neither in the compulsory programme nor in the electives). Therefore, the objectives of the study programme ME should be adjusted or such modules should be offered. Based on the overall objective – which is seen as good and significant for graduates – that the students are able to recognize and analyse complex problems and develop integrated engineering and economic solutions to problems, it should be considered whether at least additional non-technical modules were integrated into the curriculum (not only as electives; these non-technical electives can be "by-passed" by students). Exemplary non-technical modules could be cost accounting, operations management, and supply chain management (already existing modules in the IE study programme).

In addition, it should be considered whether it would be helpful to adjust the module "Engineering project". The module "Engineering project" in the first semester provides a good insight into engineering topics. To provide a first insight to management/business administration issues, too, basic business related aspects should be included in this project/module (e.g. cost calculation).

The Modules "Introduction to Geoscience", "Properties of Rock", "Open Pit Excavation + Underground Mining" "Machines Classifiers and Mixers + Coarse Comminution Machines" should not be mandatory for students of mechanical engineering. The reason for this suggestion is that these topics are very much related to mining industry. To broaden the scope of job opportunities for ME graduates such a strong focus on mining industry should be reconsidered. Nevertheless, these modules could be offered as electives.

The study programme ME offers many electives for the students. Considering the limited personal resources at GMIT, it should be considered whether it would be reasonable to consolidate the

range of electives and focus more on relevant topics of mechanical engineering. In addition, the curriculum of the study programme ME can be designed more compelling.

Overall, the existing study programme ME of GMIT fulfils the requirements of a bachelor programme. Therefore, an appropriateness according to educational level is given.

3.5 Teaching methods and learning environment

The study programme ME has a strong emphasis on practice-orientation. The modules offer a wide range of different teaching methods (e.g. lectures, recitations, laboratory sessions, field trip, and study projects). According to the review panel's impression, this is very good. However, it should be considered whether a more project-oriented teaching approach (with more independent work of the students with scientific papers as an important result/outcome) could be integrated at least at the end of the study programme ME. Most literature mentioned in the module handbook are American textbooks. For a more comprehensive understanding and a more "International" orientation also other textbooks should be considered (e.g. from UK).

3.6 Conclusion

The study programme ME is a good and innovative programme for Mongolia. The content of this programme covers all relevant subjects. It can be assumed that the graduates of the study programme ME will be able to work successfully in companies/organisations.

The main area of improvement can be seen in an integration of additional technical modules (e.g. production technology) and an integration of non-technical modules (e.g. operations management) which will help to provide the knowledge and competencies for the graduates needed in the intended field of employment.

4 Objectives and Concept of the Bachelor "Raw Materials and Process Engineering"

4.1 Short summary of the study programme

The study programme RMPE aims at providing knowledge, abilities and competencies in engineering, mathematics and natural sciences in order to enable the graduate to plan, control and operate machines and process chains for refining and processing raw materials and other products in economic, ecologic and sustainable ways.

The target group of the study programme RMPE are ambitious scholars who are able to study in English and are determined to meet the requirements of a raw materials and process engineering study programme.

The development of the qualification targets took place based on the expected demand of the Mongolian industry of process engineering graduates. The European quality standards in higher education were also an important factor for the development of the qualification targets of the study programme RMPE.

4.2 Objectives and competences

"The graduates of the study programme RMPE will be able to

- Apply mathematical, scientific and engineering principles for solving problems of processing resources, raw materials and other products.
- Recognise and analyse problems, develop engineering solutions to problems, and realize holistic solutions for them.
- Assess and apply as engineers in design, development, production, distribution and consulting scientific methods in order to foster the progress both of the society and of process engineering.
- Apply information science for solving resource-processing problems.
- Work in international teams in order to solve extensive and interdisciplinary problems.
- Recognise the consequences of engineering activities in order to act responsibly within and for the society, the economy, and the environment." (page 4 of the module handbook)

The learning outcomes are fully appropriate and fully in line with the Framework for Qualifications of the European Higher Education Area. However, an overview of the leaning outcomes specific to RMPE, including information, which modules contribute to the different learning outcomes, could improve the communication of the specific profile more clearly.

4.3 Personal development and capability for civic engagement

The study programme RMPE at GMIT recognizes the importance and the need to develop student's communication and presentation skills, intercultural communication and competence. These skills and competences are crucial for RMPE graduates in companies. In addition, a GMIT graduate should be able to reflect his/her actions. With several measures and specific modules (e.g. module "Engineer in society") the GMIT addresses these issues in an appropriate manner.

4.4 Concept

The last four semesters of Raw Materials and Process Engineering contain the following modules:

- Fifth Semester: Introduction to Mining (6 ECTS points), Mechanical Process Engineering I and Process Mineralogy (6 ECTS points), Thermodynamics for Chemical Engineering (4 ECTS points), Raw Materials and Recycling (4 ECTS points), Health-Safety-Environment (4 ECTS points), Two electives (3 ECTS points each).
- Sixth Semester: Fossil Fuel Technology (4 ECTS points), Mechanical Process Engineering II (6 ECTS points), Mining and Environment (4 ECTS points), Industrial Internship and Reflection (14 ECTS points), One elective (3 ECTS points).
- Seventh Semester: Chemical Reaction Engineering (4 ECTS points), Heat and Mass Transfer (4 ECTS points), Hydrometallurgy (6 ECTS points), Thermal Unit Operations (6 ECTS points), Scientific Writing (4 ECTS points), Two electives (3 ECTS points each).
- Eights Semester: Process System Engineering (8 ECTS points), Final Study Project (6 ECTS points), Bachelor Thesis and Colloquium (12 ECTS points).

The content of the study programme RMPE gives a clear picture of a well-structured and balanced study programme. Yet, one adjustment could be done to the structure of the study programme: The modules "Process System Engineering" (8 ECTS points) and the "Final Study Project" (6 ECTS points) should have 15 ECTS points in total and be provided as condensed block courses. This would better allow for a Bachelor Thesis project in industry without the obligation to follow contact courses at the same time.

4.5 Conclusion

The study programme RMPE is well balanced. The qualification targets can clearly be achieved by the revised curriculum. The students learn the major topics in the field of raw material and process engineering suitable for bachelor level. Without reservation, the study programme fits into GMIT's policy and the Mongolian Higher Education landscape.

5 Objectives and Concept of the Bachelor "Environmental Engineering" (B.Sc.)

5.1 Short summary of the study programme

Environmental Engineers are developing, planning and realizing environmental technologies with the objective to minimize the environmental impact and to increase resource efficiency. Experts for sustainable technologies are needed in industrial as well as in emerging and developing countries. The qualification goes beyond the purely technical and engineering aspects. Technical expertise and ecological judgment are combined to provide comprehensive solutions. The qualification objectives reflect the needs of relevant professional practice for environmental engineers in Industry as well in as state institutions for environmental protection.

The study programme EE is addressed to students with a completed secondary education and interest in science, technology and interdisciplinary issues.

The study programme has been developed in participation with representatives of professional practice. In agreement with the concept of quality management GMIT holds yearly Curriculum Workshops to evaluate and revise the curricula (c. IV.8.2). The curriculum of this study programme has been revised in 2018.

5.2 Objectives and competences

"The graduates of the study programme EE will be able to

- Apply mathematical, scientific and engineering principles for solving problems of environmental engineering.
- Recognize and analyse complex problems, develop engineering solutions to problems, and realize holistic solutions for them.
- Assess and apply as engineers in design, development, production, distribution and consulting scientific methods in order to foster the progress both of the society and of environmental engineering.
- Apply information science for solving environmental engineering problems.
- Work in international teams in order to solve extensive and interdisciplinary problems.
- Recognise the consequences of engineering activities in order to act responsibly within and for the society, the economy, and the environment." (page 4 of the module handbook)

The professional tasks of environmental engineers are mostly related to interdisciplinary questions. In many cases, environmental engineers collaborate with scientists and engineers from different disciplines. According to the professional requirements, the Bachelor of programme is intended to impart:

- Fundamentals in mathematics, information science, natural sciences and engineering,
- Understanding of ecological connections
- Knowledge and understanding of environmental technologies,
- Understanding multidisciplinary connections,
- Understanding of economic and social conditions.

In addition to technical expertise and subject related competences, the programme aims to convey:

- The ability for lifelong learning,
- The ability for interdisciplinary cooperation,
- Language skills to communicate in an international professional environment.

5.3 Personal development and capability for civic engagement

Several modules of the study plan are supporting the personal development of students. The compulsory module titled "Engineer in society" is a part of the bachelor programmes. The aim of this module is to develop students' professional and personal ethics via promoting critical thinking. Besides the compulsory courses, the university offers a big variety of non-technical elective courses. Several student club activities as the student club for disabled schoolchildren are helping the personal development and the capability for civic engagement.

5.4 Concept

In the study programme EE, the module of "Geoecology" offered in the fourth semester is the first module dealing with environmental issues. In the third and fourth year, the study programme concentrates on environment science and technology. It includes topics of environmental science, technologies for air pollution control, water treatment, waste treatment, energy sources, energy production and energy efficiency:

General Environmental Aspects and Methods	Geoecology (4CP) Health-Safety-Environment (4CP)
Air Pollution Control	Air Pollution (6CP)
Hydrology, Water treatment, Supply and Management	Wastewater Treatment (6CP) Water Supply (8CP) Principles of Water Management (6CP)
Soil formation, soil properties, soil types	Soil science (6CP), Properties of Rock(4CP)
Waste Technologies and Recycling	Solid waste technologies (6CP) Raw Materials and Recycling (4CP)
Special Applications	Energy Systems (6CP) Mining and Environment (4CP)
Remediation	Remediation of Contaminated Sites (4CP)

The handling of complex environment technology-related problems needs in many cases an interdisciplinary approach. The study programme EE aims at training a combination of experts and

generalist. As consequence of this difficult combination, the curricula of environmental engineering offered by different universities show a big variety. With the modules, "Introduction to Geosciences", "Properties of Rocks" and "Mining and Environment" the curriculum of GMIT places an emphasis on the geoscience, which might be reasonable for the industrial environment of Mongolia. The module "Law" aims at conveying familiarity with legal conditions in the professional activities. The modules "Scientific Methods", "Scientific Writing", the "Engineering Project" and the "Final Study Project" promote scientific competences, methodological study competences and management skills and the modules "Intercultural Communication and Competence", "Engineering in Society" and several non-technical elective modules aim to develop social skills and personal growth.

Overall, in the review panel's opinion, this combination of expert and generalist works well through most of the curriculum. However, two flaws remain. First, the curriculum does not include a module concerning business administration, an issue raised before (c. IV.2.5). A competence in business administration is needed for environmental engineers to develop and implement technical solutions. Second, aspects of Process Engineering should be included in the curriculum and not reserved to the study programme RMPE.

5.5 Conclusion

The study programme EE is a study programme of high quality. The objectives of the study programme are clearly defined and realistic. The curriculum seems to match essentially the professional demands. The wide range of disciplines reflect the interdisciplinary character of environmental engineering. The feasibility of the study course seems to be appropriate.

6 Objectives and Concept of the Bachelor "Industrial Engineering" (IE)

6.1 Short summary of the study programme

The application oriented study programme IE intends to provide knowledge, abilities and competencies in engineering and business administration for their graduates so the graduates are able to solve complex tasks in companies an interdisciplinary manner.

The target group of this study programme are ambitious scholars who are able to study in English and are determined to meet the requirements of an interdisciplinary study programme.

The qualification targets were developed according to the expected demand of the Mongolian industry for IE graduates and additionally inspired by the successful German "Wirtschaftsingenieur". The European quality standards in higher education were also an important factor for the development of the qualification targets of the IE study programme.

6.2 Objectives and competences

"The graduates of the study programme IE will be able to:

- Apply mathematical, scientific, engineering and economic principles for solving industrial engineering problems.
- Recognize and analyse complex problems and develop integrated engineering and economic solutions to problems.
- Use their industrial engineering knowledge to assess and to apply in the design, development, production, distribution and in business; and also consult scientific methods in order to foster the progress of both society and industrial engineering.
- Apply information science for solving industrial engineering problems.
- Work in international teams in order to solve extensive and interdisciplinary problems.
- Recognise the consequences of engineering activities in order to act responsibly within and for society, the economy, and the environment." (page 4 of the module handbook)

The IE study programme intends a strong practice-orientation and dedication to foster creative and critical thinking. Nevertheless, the graduates should be able to apply principles and methods for solving interdisciplinary problems in companies. Furthermore, the graduates should be able to work in international teams. These objectives and competences are important for graduates to work successfully in companies/organizations.

However, these ambitious objectives and competences do not always find an equivalent in the IE study programme. The learning outcomes are often characterized with "described", "apply", "understand" etc. Only in a few module descriptions the learning outcomes comprises "design"

or "develop". Furthermore, the teaching in the fields to solve problems in an interdisciplinary manner and to work in an international context could be strengthened.

6.3 Personal development and capability for civic engagement

The study programme IE at GMIT recognizes the importance and the need to develop student's communication and presentation skills, intercultural communication and competence. These skills and competences are crucial for IE graduates in companies. In addition, a GMIT graduate should be able to reflect his/her actions. With several measures and specific modules (e.g. module "Engineer in society") the GMIT addresses these issues in an appropriate manner.

6.4 Concept

In general, the study programme of IE (aka "Wirtschaftsingenieurwesen") cover engineering and economic/ management topics as main content. In addition, an interdisciplinary and integrated approach is a characteristic feature of industrial engineering study programmes. The GMIT study programme IE is also based on this idea. As consequence, the study programme IE at GMIT covers relevant engineering and economic/ management topics.

Unfortunately, the content of both academic fields were more or less strictly separated in chronological order: In the first part of the study programme – semester 1 to 4 – natural sciences and engineering contents dominate, whereas in the second part – semester 5 to 8 – mostly business administration/ management contents are covered.

According to the review panel's opinion, a comprehensive, integrated approach should be taught throughout in the study programme IE. Therefore, the structure of this study programme with engineering related modules in the first semesters and business administration/management modules in the last semesters is not sufficient. A more integrated structure in addition with interdisciplinary modules/projects is highly recommended.

Serving as an example, the module "Engineering project" in the first semester – which is mandatory for the all students – provides a good insight into engineering topics. Unfortunately, no business related aspects are included in this project/module (e.g. cost calculation). These could be included easily and would be beneficial to students of the other study programmes as well. Therefore, in the module "Engineering project" in the first semester, business related aspects should be included (e.g. cost calculation). Also in other modules, the interdisciplinary approach could be strengthened or integrated. In addition, more interdisciplinary modules could be offered as electives (i.e. investment appraisal for technical projects).

In addition, some changes to the curriculum should improve the study programme. The mandatory module "Law" should address contract and labour law instead of environmental law. Contract and labour law are typically more crucial topics for graduates of industrial engineering in companies than environmental law. Furthermore, the modules "Introduction to Geoscience" and

"Geoecology" should not be mandatory; these topics are not typically relevant for graduates of industrial engineering. Nevertheless, they could be offered as electives for all engineering students.

The study programme IE offers many electives for the students. Considering the limited personal resources at GMIT especially in the area of business administration/ management it should be considered whether it would be reasonable to consolidate the range of electives and focus more on relevant industrial engineering topics.

Apart from these shortcomings, the existing study programme IE fulfils the requirements of a bachelor programme. Therefore, an appropriateness according to educational level is given.

6.5 Teaching methods and learning environment

The study programme IE has a strong emphasis on practice-orientation. The modules offer a wide range of different teaching methods (e.g. lectures, recitations, laboratory sessions, field trip, and study projects). According to the review panel's impression, this is very good. However, it should be considered whether a more project-oriented teaching approach (with more independent work of the students with scientific papers as an important result/outcome) could be integrated at least at the end of the study programme IE. Most literature mentioned in the module handbook are American textbooks. For a more comprehensive understanding and a more "International" orientation also other textbooks should be considered (e.g. from UK).

6.6 Conclusion

The study programme IE is a good and innovative programme for Mongolia. The content of this programme covers all relevant subjects. It can be assumed that the graduates of the study programme will be able to work successfully in companies/organizations.

The main area of improvement can be seen in a more interdisciplinary approach in the curriculum. A closer entanglement of engineering and business administration/ management topics is strongly recommended.

The underlying concept of the study programme IE is related to the German study programme "Wirtschaftsingenieur". The term "Industrial Engineering" is commonly used as a translation for the German "Wirtschaftsingenieur". Thus, the name of this study programme should be reconsidered, because the name "industrial engineering" is more related to engineering programmes and covers only a small range of potential/ future employment areas of the graduates. At least in the Diploma supplement a reference to "Business Administration and Engineering" should be made.

7 Implementation

7.1 Resources

7.1.1 Personal resources

According to GMIT's statutes, there are the following positions for academic personal with different teaching load: Full professor (requiring a Ph.D.), associate professor (Ph.D.), assistant professor (Ph.D.), senior researcher (Ph.D.), senior lecturer (Master), researcher (Master), lecturer (Master), research assistant (Bachelor), teaching assistant (Bachelor) – in order of precedence. The teaching load for a full professor is 8-12 units of instruction (UoI), for associate and assistant professors min. 12 UoI, for lecturers 12-16 UoI, and for researchers max. eight UoI. One UoI corresponds to 45 minutes of the lecture period per week.

The academic staff of GMIT consist currently of 33 staff members, amongst them ten associate professors, two assistant professors, one researcher, 16 lecturers and four assistants. More that half of the academic staff has a Ph.D. degree. 16 members of the academic staff belong to the "Faculty of Engineering", 11 members to the "Faculty of Mathematics, Computer and Natural Sciences" and 6 members to the "Language and Didactic Center" (LDC). All faculty members have to dedicate 10-20% of their work capacity to academic administration. This includes membership in the Academic Senate and committees concerning education and research.

The university administration has 34 non-academic staff members, all Mongolian nationals, and one German colleague. Currently three long-term DAAD professors are working at GMIT: one in Mechanical Engineering, one in Environmental Engineering, and one in Raw Materials and Process Engineering. One international expert (DAAD) is running the LDC. Furthermore, the long-term faculty is supported by approx. 15 guest lecturers per semester, most of which come from Germany, supported by DAAD.

To enhance the academic and didactic as well as linguistic qualification, GMIT offers professional training and development opportunities. Supported by DAAD, several staff members are sent abroad for Ph.D. degrees. Staff members are supported to participate in didactic conferences and workshops.

In total, the 12 associate and assistant professors, the 16 lecturers and the 1 researcher provide a maximum teaching capacity of 408 UoI. This number is not covering the need for the four bachelor programmes, the master programme and the basic engineering course. Thus, GMIT needs additionally external lecturers as guest lecturers from abroad. Currently the number of guest lecturers is fulfilling the need. To close this gap with regular staff, GMIT has adopted a "Staff Recruitment and Selection Policy" with clearly defined steps and responsibilities for the staffing process. Especially one professor lecturing business administration should be hired.

To sum up, the review panel estimates the ESG standard 1.5 "Teaching staff" to be fulfilled, as GMIT has primary responsibility for the quality of its staff and for providing them with a supportive environment that allows them to carry out their work effectively.

7.1.2 Financial Resources

Approximately one third of GMIT's revenues are generated by tuition fees and research education services. The Mongolian government covers for the rest of the operational costs, including costs for staff and infrastructure. The German Government contributes to GMIT via BMZ and the Federal Foreign Office. Via DAAD, the Federal Foreign Office finances long-term lectureships at GMIT and provides scholarships for GMIT students. The GIZ/GMIT project volume regarding the current second phase of GMIT (July 2016 to June 2019) is 4,200,000 EUR, funded from BMZ budget. Within the scope of German-Mongolian Financial Cooperation, a loan will be provided for GMIT campus extension. GMIT campus extension should be finalized by the autumn of 2022.

The initial inter-governmental agreement stipulated that the Mongolian government is responsible for the operational costs of GMIT whereas the German side supports the establishment of the university in terms of organizational and academic development as well as short and long-term professors from Germany. The current agreement Phase II continues until June 30, 2019, the next phase has been positively decided by the German government.

The Mongolian government's support to state-owned Higher Education Institutions (HEI) is limited to payments for utilities' costs. In addition, HEI are eligible to receive capital investment, e.g. for new buildings or laboratories, depending on the budget availability. In other words, the institutions cover own operational costs with revenue from tuition and fees, mostly (90 or more percent of the overall cost). However, in the case of GMIT the Mongolian government allocated an additional budget that counts for the most of its operational cost. GMIT contributes to this budget with its own revenue generated by tuition and fees. The government's commitment was renewed with signing of the Phase II implementation agreement. In addition, the Higher Education landscape in Mongolia has been changing and there is a growing realization on all parts that Higher Education should receive more strategic and sound support from the government.

On the other hand, the university itself has been aware of the need to become sustainable by enabling its financial independence. This point is being reflected in the University Development Plan as one of the main criteria. Within this context, GMIT plans to develop its capability to attract external funding and donations, and provide academic, research, and business services within its profile.

In the review panel's opinion the financial situation is far from robust due to the lack of own resources sufficient to pay staff, to maintain buildings and equipment, and to conduct costly research. However, the rectorate of GMIT is well aware of the problem and has started to find means to overcome potential shortcomings in the middle term perspective.

7.1.3 Infrastructural Resources

The Campus of the GMIT includes a lecture building with seven classrooms, five lecture halls, laboratories, a computer pool, a library and offices. Currently GMIT has the following five laboratories: "Chemical Laboratory", "Physics Laboratory", "Raw Materials and Mineral Processing Laboratory", "Environmental Engineering Laboratory" and a "Mechanical Engineering Laboratory".

The laboratories of physics and chemistry are adequately equipped for the basic education within the bachelor programmes. The other laboratories give students a first insight in experimental methods and offer the opportunity to some currently running small research projects. The expansion of the laboratories is in progress. For the Raw Materials and Process Engineering programme the recycling lab could be better equipped, in particular a trommel screen and sensor based sorting unit could improve lab capabilities.

Besides the premises for education, research and administration, the campus includes a dormitory, a canteen and a fitness centre. The dormitory offers actually a space for 160 Student. A second dormitory is planned.

The GMIT library has a collection of more than 7.500 books in various subjects: 80% are in English language, 20% are in German or in Mongolian. Furthermore, student have access to 150 audio sources and several international databases, and journals. The library is open from 9.00am until 10.00pm on workdays, and from 10.00am to 6.00pm on weekends. Beyond regular working hours, student assistants ensure library services. The library offers an appropriate capacity of seats, tables and PC and an agreeable atmosphere for the students and the academic staff.

The office of academic affairs is open for consultancy of the students. All lecturers offer consultancy hours. The high ratio of staff to lecturer offers best opportunities for individual consultation of students.

The review panel believes ESG standard 1.6 "Learning resources and student support" to be fulfilled.

7.2 Organisation and Cooperation

7.2.1 Organisational and responsibilities

The "Statute of GMIT" defines the organizational structure of the university. This Statute defines the responsibilities and the composition of the Board of Governors, Rectorate, Academic Senate, Faculty Council(s), and Students' Council of GMIT.

The Board of Governors is the highest decision-making body of GMIT. Among its activities, the Board of Governors approves and amends the statute, defines GMIT's development strategy and policies, as well as its long- and medium-term operational planning, it decides on GMIT's overall organizational structure, approves the annual global budget, determines the tuition and dormitory

fee, and selects, appoints and – if necessary – dismisses the Rector and Vice Rector. Its members are appointed by the Mongolian Government and the German Government, the GMIT rectorate and the Academic Senate. The Mongolian government entity in charge of education appoints four members, the Federal Republic of Germany sends three members, the Rectorate of GMIT assigns three members, and the Academic Senate appoints three members. The members of the rectorate are non-voting members of the Board of Governors. The tasks and composition of the Board of Governors reflects the joint Mongolian-German character of GMIT.

The rectorate manages GMIT and its operation. It discusses and decides on all matters related to GMIT's academic, administrative and financial development, for which it is authorized by this Statute or the Board of Governors. The Rectorate consists of the Rector, the Vice-Rector of Academic Affairs and the Vice-Rector of Research. The position of the Vice-Rector Finance and Administration is currently vacant. By now six departments support the rectorate: Department Finance and Procurement, Department Development and Communication, Department Human Resources, Department Campus and Infrastructure, Department Academic and Student Affairs, and Department Information Technology. In the peer group's opinion, the contemporary department structure is feasibly and rational.

The Academic Senate is the highest academic body of the University. It directs the academic work of GMIT in both teaching and research. It protects academic freedom and good academic practice. The Senate has been working since Semester Spring 2015 and convened, more or less regularly, once a month. The Academic Senate consists of the Rector, the Vice-Rector Academic Affairs, all professors, a representative of lecturers, the Head of Department (HoD) in charge of Academic and Student affairs, the President of the Student Council, and the diversity liaison officer.

The "Faculties of Engineering" and "Mathematics, Natural and Information Science" were recently established and the responsibility for the study programmes have been handed over them. The Faculty Council consists of the dean, all academic staff of the respective faculty, one student representative from the faculty student body and one administration representative. Each member has one vote. In case of an equal numbers of votes, the dean's vote decides.

The "Faculty of Engineering" is in charge of the Bachelor ME, RMPE and EE. The "Faculty of Mathematics, Computer and Natural Sciences" is responsible for the Basic Engineering Program, and for the Bachelor IE, as well as for the study programme IMRE. The "Department of Academic and Student Affairs" administers all study programmes, coordinates the examinations, provides the academic schedule for the semester and administers the student files.

A Student Council represents the students. The Student Council is the students' self-governing body and represents the students. The members of the student council are elected by and amongst all GMIT students. The student council comprises at least five members, representing

every study programme including the "Basic Engineering Programme". The student representatives are strongly involved in the Examination Board, in the Admission Committee, in the Internship Committee, in the Academic Senate, in the Senate Committee for Education and in the Scholarship Committee.

The experts believe that the institutional framework established during the last years is fully capable to guide GMIT's expansion over the upcoming years.

7.2.2 Cooperation partners

a) German cooperation

The GMIT was founded by a cooperation of the Mongolian and the German governments. The main partner organisations supporting this project from the German side are the "Gesellschaft für Internationale Zusammenarbeit" (GIZ) and the "Deutscher Akademischer Austauschdienst" (DAAD). The German partner universities "Technische Universität Bergakademie Freiberg" (TU Freiberg), the "Rheinisch-Westfälische Technische Hochschule Aachen" (RWTH), and the University of Cottbus-Senftenberg (UCS) are supporting the university in the development of study programmes, education and research.

The latter has signed an „Agreement on student exchange" in June 2018. Up to three students per semester and up to 15 students for a summer school can go abroad for an exchange. Competences achieved during the exchanges are fully recognised by both universities. Double Degrees are not planned in the immediate future. For the third project phase (starting June 2019), there are plans for a "PhD Sandwich Programme": The aim of the programme is to promote the further education of young academic staff at GMIT via a PhD program with integrated research phases in Germany. An "International academic agreement for doctoral programmes leading to a Joint Doctoral Degree" was signed for a double PhD degree.

RWTH Aachen and GMIT conduct several joint project related to mining. Some of the have been finished recently, others are still ongoing (e.g. OPTIWIM – Optimization of the value chain for polymineral ores of economically strategic metals). Based on such projects, there are multiple option for further cooperation, e.g. in mining and environmental issues. German partners benefit from the scientific expertise of GMIT and GMIT's network of local and regional partners.

An example for such further cooperation is a joint proposal of RWTH Aachen und GMIT for funds from the funding guideline "Client II – International Partnerships for Sustainable Innovations"[3] of the German Federal Ministry of Education and Research. For Mongolia, funds are available for resource efficiency and sustainable resource technologies, water management, land management, and energy efficiency.

[3] URL: https://www.bmbf.de/upload_filestore/pub/Client_II_eng.PDF

A precondition for this cooperation is a sufficient equipment of GMIT's laboratories. The contemporary equipment of the laboratories lack the apparatus necessary for high-level research and study programmes on PhD-level. Recent projects had to use external laboratories. E.g., topographical studies could not be performed with the existing capabilities of the Computer Lab. Thus, the RWTH Aachen supports GMIT's strategy to improve the quantity and quality of the laboratories.

The University of Cottbus-Senftenberg (UCS) undertakes several research cooperation. GMIT serves not only as partner, but also as base to reach out for potential resource- and research-cooperation with Mongolia. Especially environmental projects are in the focus of UCS's cooperation. UCS special expertise in renaturation could help Mongolia's mining industry minimizing environmental pollution.

The German cooperation partners estimate a reduced mid-term engagement of the German Federal Republic as risky and urge for a long-term commitment. Mongolia is geopolitical significant due to its resources that are of strategic importance for German industries. An ongoing involvement of the German government would support the efforts of the German industry in developing Mongolia's economy and securing Mongolia's resources for German companies.

b) Mongolian cooperation

GMIT is collaborating with other Mongolian universities, research institutes and institutions for vocational education. Practical oriented education and applied research are primary objectives of GMIT. To adapt the learning outcomes to the needs of Mongolian economy GMIT is strongly committed in keeping a close cooperation with industry. GMIT has founded for this purpose an association "Friends of GMIT". GMIT has signed internship contracts and various other cooperation agreements with more than 50 companies and professional associations.

c) Conclusion

In the review panel's opinion, the cooperation to German universities should be maintained as link not only to a wider scientific community, but as a unique feature in the Mongolian Higher Education landscape. It will serve to promote GMIT not only towards potential students, but to the industries as well. Close cooperation with companies should be improved, as the numbers of internships will rise with the number of students (c. IV.2.5).

7.3 Examination system

7.3.1 Organisation and grading scheme

The "Study and Examination Regulations of Bachelor Degree Programs" (SER) approved by the Senate on April 4th, 2017 regulates the examination procedures of the bachelor programmes. An attendance record of min. 80% of the classes in the module is the admission requirement for

module examinations (c. B § 2 (1) SER). Normally, every module concludes with one examination (c. A § 6 (3) SER).

In most modules, the grading system is composed of continuous assessment during the semester (30%) and a final exam in the exam period (70%) (c. B § 2 (2) SER). In other modules, the academic performance during the semester accounts for 100% of the module grade, e.g. laboratory modules, academic writing (c. B § 2 (3) SER). Some of these modules are not graded but assessed as pass or fail, e.g. "Engineering Project", "Engineering Summer School", "Learning Strategies", "The Engineer in the Society" and the "Professional Internship".

The three-week examination period of is directly following the lecture period of every semester. An additional one-week retake exam period is offered prior to the winter semester. Participation in the first module examination is mandatory for the students. A registration for this examination is not necessary. Failed examinations can be repeated twice, usually in the following semester. The student has to register for the retake examinations.

7.3.2 Examination Forms

In accordance with the modularization of the study plan, all modules are concluded with individual assessments. The form of assessment of the modules differ according to the learning targets and learning forms. Every module description contains information on the assessment methods and the grading system. Module examinations can be written examinations (minimum 60 and maximum 180 minutes) (c. B § 4 SER), oral examinations (minimum 15 and maximum 60 minutes per student) (c. B § 5 SER) or alternative examinations (c. B § 6 SER) such as oral presentations, seminar papers, essays, projects, posters, reports. In addition to these module examinations, there is, of course, the Thesis and the colloquium (defense of thesis). The forms of continuous assessment may be assignments, laboratory or internship reports, supervised tests or quizzes, presentations or homework. Students who cannot take the examination in the ordinary form due to personal circumstances (illness, pregnancy, disability, care of children or family members etc.) are allowed to pick-up an alternative form of examination (c. B § 3 (5) SER). Every module description contains information on the assessment methods and the grading system.

For the Thesis, there is a "Guideline for the Bachelor Thesis" (GBT). Students who have achieved 180 ECTS-Points may start their Thesis. For a Thesis there must be two examiners, including at least one professor or lecturer (with Ph.D.) from GMIT. The scope of the Thesis is 12 ECTS points for three months of workload for 50-60 pages. The GBT provides information for feasible planning of the Thesis and comprises details about formal requirements such as structuring, formatting, citation style and references.

According to the review panel's opinion, the examination regulations and practices for the bachelor programmes are consistent with the assessment's part of ESG standard 1.3 "Student-centred

learning, teaching and assessment". Equally, the ESG standard 1.4 "Student admission, progression, recognition and certification" concerning the progression and certification is fulfilled. However, the SER could be enhanced by cancelling the redundancy between A § 9 (1) and B § 2 (1) and moving A § 9 (2) to B § 3.

7.4 Documentation and transparency

All formal documents available were presented to the peer group: For every study programme, a "Module Handbook" is available. It contains the description of the aims, objectives, and learning outcomes of the programme and the description of every module. The "Admission and Enrolment Regulations" define the rules for admission of students. The "Internship Regulation" define every aspect concerning internship like admission, selection, recognition etc. The "Study and Examination Regulations for Bachelor Degree Programs" explains relevant terms like core modules and elective modules, credit points, workload and define the duration and structure of the programmes and the examination procedures. The "Guideline for the Bachelor Thesis" provides general information and formal requirements and explains the Colloquium and Grading. The SER serves as a general regulation document with the module handbooks for each study programme as annexes. All these documents have a high standard providing information as well as legal clarification. The transparency could be further improved by listing the workload of laboratory-hours separately in the module handbooks and the labelling of the elective modules as such in the same handbooks. The Quality Management Department administers all these documents centrally and publishes them via the GMIT homepage.

GMIT has created an informative website in Mongolian, English and German that provides information about GMIT, the study programmes, the faculties, students' life and FAQ. All the documents mentioned above can be found on the webpage of GMIT. An image brochure, a recruitment flyer, a flyer of the study programmes, and a research flyer can also be downloaded. The website, brochures and flyer of GMIT and the study programmes give clear information on the offers and activities of the GMIT.

According to the review panel's opinion, the ESG standard 1.8 "Public Information" is fulfilled without any reservation.

7.5 Gender justice and compensation opportunities for disabled people

The statute of GMIT states in the chapter "Mission, Vision and Core Values": "GMIT is committed to the principles of ethics in all of its activities. It promotes diversity. Especially, it actively advances gender equality and welcomes students, employees and guests from all national, ethnic, cultural, and religious backgrounds, regardless of their sexual orientation." (Chapter 2.3: Core Values) The GMIT Statute stipulates the appointment of a Diversity Liaison Officer at GMIT. Currently, the Associate for Organizational Development is serving as an acting Diversity Liaison officer.

The gender ratio of students, administrative and academic staff is nearly 1:1. Only in the group of professors, females are underrepresented with a proportion of 29%. For a technical university, this is a high percentage when internationally compared. Within the last year GMIT organised or participated in several conferences and workshops concerning gender based topics.

7.6 Conclusion

Established in 2013, GMIT is still a university with a small number of students. GMIT has the goal of growing and becoming a leading university of technology in Mongolia. The development plan expresses an optimistic strategy of growth of students and study programmes. With the current support of guest lecturers, the personal resources are actually sufficient for evaluated study programmes. The existing staff showed a high level of commitment. The organisational structure and the responsibilities are clearly defined. The SER and examination procedures are sufficient. Currently, GMIT relies strongly on funding from the Mongolian and German Government. On long term, it will be necessary for GMIT to reach a financially more sustainable solution.

8 Quality Management

8.1 Organisational Framework

GIZ and GMIT jointly developed a Quality Management System (QMS) addressing teaching and learning. Its underlying concept is based on the European Standards and Guidelines for Quality Assurance (ESG) and adapted to the requirements of the ISO 9001:2015 standard. In accordance with the process of teaching and learning, quality assurance is being organised along a „student life-cycle". This model takes into account the specific needs and requirements of students within the scope of different phases and levels. Each of these phases will be analysed using the "Quality Management circuit" of "Plan – Do – Check – Act". Respective evaluation results shall be used systematically for the implementation of follow-up measures. The following issues describe important components of the GMIT's QMS:

- Definition of quality standards (quality of the input, quality of the process, quality of the output and respectively quality of the expected learning outcomes)
- Organisation of the Quality Management System (Document Control Procedure with Master list of Documents; Record Control Procedure with Master list of Records; Internal Audit Procedure; Non-Conformance Procedure; Corrective and Preventive Actions Procedure)
- Management responsibilities for quality and quality assurance, incl. resolution for Internal Monitoring Officer, resolution for Quality Steering Committee, resolution for Internal Audit Team
- Monitoring the teaching and examination processes
- Analysing data and act on results.

GMIT's QMS is described further in the Quality Management Guidelines (QMG). The QMG define the necessary steps to introduce the QMS starting with document control – all documents such as Policies, Procedures, Forms, and other documents (e.g. work instructions, guidelines) are to be controlled and documented (c. 1.a). Equally important is the 1.b) record control of students' activities – data potentially to be used for analysis (e.g. exam results, student attendance, questionnaire feedback etc.). Correspondingly, control of non-conformities, corrective action, and preventive action will be installed (c. 1.d-f).

GMIT has established the necessary operational framework to formulate a quality policy and monitor all instruments of QM: In September 2018, a quality steering committee of 15 members was created. Headed by Quality Manager, the committee comprises the rectorate, professors from each study programme, the heads of department and an Internal Monitor Officer/ Legal Counsellor (IMO). In close cooperation with the Department of Quality Assurance, the IMO is responsible

to establish, implement, review and maintain the QMS. The IMO reports the QMS performance and the need for any improvements to the GMIT Management, i.e. the rectorate.

The Rectorate of GMIT formulated a quality policy, which takes into account the ten quality criteria for the institutional accreditation: 1. Mission and objectives, 2. Design and quality assurance, 3. Governance and legal framework, 4. Human resources, 5. Technological resources and facilities, 6. Curriculum reformation, 7. Student services, 8. Research and innovation, 9. Social services and 10. The institution status at national and international level.

The responsibilities and task of the stakeholder of GMIT concerning quality will be defined and published in the Quality Management Manual within the next months.

The review panel is impressed by the design of QMS and especially by the improvements since the last external audit just one year before. The organisational framework of GMIT's QMS is sophisticated and tailored not only for the existing size of GMIT, but potentially for the enlargement envisioned for the next years.

8.2 Evaluation procedures and data analysis

The evaluation of modules is characterised by the following features:

- All courses including courses of fly-in-staff are being evaluated at the end of the semester after the exam.
- All evaluations are based on an online-system. Students can only see the schedule of the next term, when evaluations are completed.
- The evaluation form contains more than 30 closed questions addressing the following aspects: Overall impression, Students, Competencies, Instructor, Learning environment, Module concept (including workload), Overall evaluation
- For privacy reasons only modules with more than five students are evaluated.
- Evaluation outcomes are public to the students and are discussed with the students.

GMIT informs the deans and the individual instructors (internal moderation) about the evaluation results, shares a summary with the Academic Senate, and communicates the anonymized summary to the students.

Given the novelty of GMIT, enhancement of teaching is not restricted to the teacher's performance, but applies to the overall teaching methods. Therefore, the curricula of the study programmes have been revised by GMIT academic staff, professors of German partner universities and the implementing partners GIZ and DAAD over the last years. In addition, GMIT's visiting professors (fly-in) have been asked to submit reports about their short-term lectureship at GMIT.

The results of these reports are shared with GMIT and an overview as well as important suggestions were presented at the last revision workshops in March 2017 and March 2018 by DAAD.

8.3 Activities to improve the quality management

Based on the development workshops and the feedback from professors (c. IV.8.2), the Curriculum Workshop in 2018 discussed the bachelor study programmes and numerous changes in module name, credit point, and workload are carried out. The Module Handbooks for all bachelor programmes were updated. The updates were finalized and approved by the Academic Senate meeting on September 13th, 2018.

8.4 Conclusion

The procedure and the questionnaire are well conceived and suited for the university's needs. In accordance with good quality management practise, the following aspects have been improved compared to the last accreditation report:

- A question regarding the student workload has been included.
- The evaluation system has been switched completely to a computer-based system.
- Privacy issues have been addressed (no more hand-written evaluation forms, modules with less than five students are not evaluated).
- The results of the evaluation are discussed with the students on a regular basis.

The review panel suggests an additional question in the module evaluation concerning the learning objectives, e.g. "The learning objectives of the module are clear to me". GMIT should also consider to include open questions ("What could be improved and how?").

The students indicate that the level of teaching in all modules is high and, therefore, the workload is high, too. Although this might be due to the reason that the evaluation takes place immediately after the exams, GMIT should keep track of the evaluation of workload and level of the modules.

Seeing no flaws in the QMS itself, the review panel is sceptical about the campus management system necessary to fulfil all aspects of the QMS. Currently, it is working well; however, it seems to be at the limit of its capacity and it might need improvements as GMIT is in a state of expansion.

Nonetheless, according to the review panel's opinion the ESG criteria 1.7 "Information management", 1.9 "On-going monitoring and periodic review of programmes" and 1.10 "Cyclical external quality assurance" are fulfilled.

V German Summary

Die Deutsch-Mongolische Hochschule für Rohstoffe und Technologie hat seit 2013 einen bemerkenswerten Erfolg zu verzeichnen. Aufbauend auf einer klaren Vision wurde ein Hochschulentwicklungskonzept erstellt und gezielt in die Tat umgesetzt. Durch enge Zusammenarbeit zwischen

deutschen Hochschulen, dem DAAD und der GIZ einerseits, mongolischen Behörden und Unternehmen andererseits, wurde eine Hochschule entworfen, welche für die Mongolei ein Novum und gleichzeitig ein Modell sein soll.

Die hier untersuchten vier Bachelor-Studiengänge sind auf Basis vergleichbarer Studiengänge in Deutschland entworfen worden und richten sich an den potentiellen Arbeitsmarkt ingenieurtechnischer Absolventinnen und Absolventen in der Mongolei. Da die Studierendenzahlen noch niedrig sind, handelt es sich um ein polyvalentes Studienangebot mit vielen Überschneidungen wie bspw. dem gemeinsamen Grundstudium von vier Semestern.

Die Studiengänge sind international ausgerichtet und werden daher auf Englisch angeboten. Anspruchsvolle Zugangsvoraussetzungen, insbesondere naturwissenschaftliche Vorkenntnisse und vor allem Englisch-Kenntnisse, sorgen für die zielgruppengenaue Passung der Bewerberinnen und Bewerber. Die Studierenden verfügen so über die notwendigen Eingangsqualifikationen, um die anspruchsvollen Studiengänge bewältigen zu können. Ein einjähriges „Basic Engineering Programme“ wird von den meisten Bewerberinnen und Bewerbern als Vorbereitung für das eigentliche Studium in Anspruch genommen.

Die Besonderheit und für die Mongolei auch Neuheit der vierjährigen Bachelorstudiengänge sind die Praktika der Studierenden im sechsten Semester. GMIT hat mit größeren Firmen Übereinkünfte getroffen, um den Studierenden Praktikumsplätze in Aussicht zu stellen, die in der Firmenkultur der Mongolei bislang unbekannt sind. Die Erwartungen der Firmen einerseits und die Ansprüche von Seiten der GMIT an das Praktikum andererseits liegen noch etwas auseinander und sollten durch Leitfäden und enge Supervision bald eingeschliffen sein.

Die studierenden-zentrierten und kompetenzorientierten Lernformen sind hervorragend. Der Aufbau der bisherigen Laboratorien reicht für die Anzahl der Studierenden und für das Bachelorniveau (aus). Ein Laborgebäude soll in Zukunft für größere Studierendenzahlen die nötigen Kapazitäten bereitstellen.

Die Personalausstattung der Hochschule ist gut; es gibt – bis auf Business Administration – genügend gut ausgebildetes Personal, um alle Studieninhalte anbieten zu können. Zusätzliches Personal wird durch fly-in Lehrende bereitgestellt. Durch die noch geringe Studierendenzahl ist der Verhältnis von Studierenden zu Lehrenden sehr gut.

Das Prüfungssystem und die Informationslage sind nicht zu beanstanden. Geschlechtergerechtigkeit und Chancengleichheit wird sowohl konzeptionell, als auch praktisch umgesetzt.

Das Qualitätsmanagementsystem der Hochschule ist sowohl institutionell abgesichert, konzeptionell gut aufgestellt und erste praktische Erfahrungen haben bereits zu Verbesserungen in den Studiengängen geführt. Die Hochschule verfügt über eine Qualitätspolitik und die einzelnen Prozessschritte sind in einem Qualitätsmanagementhandbuch zusammengetragen.

Die Gutachtergruppe kommt zu einem sehr positiven Gesamteindruck der noch jungen, aber dynamischen Hochschule und der hier zu begutachteten vier Studiengänge. Einzelne Verbesserungspotentiale sind im Bericht aufgezeigt, größere Problembereiche im Sinne einer Akkreditierung konnten nicht festgestellt werden.

VI Accreditation Decision

Based on the report of the peer group and the statement of the standing expert committee the accreditation commission took unanimously in its session of March 25th, 2019 the following decisions:

The bachelor programmes Mechanical Engineering (B.Sc.), Raw Materials – Process Engineering (B.Sc.), Environmental Engineering (B.Sc.), Industrial Engineering (B.Sc.) are accredited without conditions. The accreditation is valid until September 30th, 2024.

To enhance the study programmes the accreditation commission advises the following recommendations:

Overall recommendations

- The recognition of competences gained on tertiary level should not be limited to 120 ECTS points (c. B § 11 (5) SER).
- The recognition of competences should not be restricted on competences gained in the last five years (c. B § 11 (8) SER).
- Competences gained outside the Higher Education System should be recognized only if adequate and limited up to half of the study programme, i.e. 120 ECTS-points (c. B § 11 (4) SER).
- A module "Introduction to Business Administration and Management" should be included for all study programmes within the first four semesters.
- The internships should be improved by:
  - Establishing a one-week introduction to internships.
  - Enhancing the supervision of internships by GMIT staff.
  - Creating internship guidelines and presenting the internship regulations to the cooperation partners.
- The SER could be enhanced by cancelling the redundancy between A § 9 (1) and B § 2 (1) and moving A § 9 (2) to B § 3.
- The workload of laboratory-hours should be listed separately in the syllabi.
- GMIT should carefully watch the workload and level of the modules.

Recommendations for "Raw Materials – Process Engineering" (B.Sc.)

- The recycling lab should be better equipped; in particular, a trommel screen and sensor-based sorting unit could improve lab capabilities.

Recommendations for "Environmental Engineering" (B.Sc.)

- Aspects of Process Engineering should be included in the curriculum.

Recommendations for "Industrial Engineering" (B.Sc.)

- The structure of the study programme should urgently be changed from a structure that separates engineering modules (first four semesters) and business related modules (last semesters) to a more integrated structure. In addition, there should be interdisciplinary modules/projects.
- In the module "Engineering project" in the first semester, business related aspects should be included (e.g. cost calculation).
- The mandatory module "Law" should address contract and labour law instead of environmental law.
- An elective module covering qualitative and quantitate methods should be offered.
- There should be one professor who can cover teaching business administration.