

**Decision of the Accreditation Commission of AQAS
on the study programme**

- **“Geodesy, topography and cartography” (B.Sc.)
offered by Technical University of Moldova**

Based on the report of the expert panel and the discussions of the Accreditation Commission in its 63rd meeting on 23rd/24th of May 2016, the Accreditation Commission decides:

1. The study programme **“Geodesy, topography and cartography” (Bachelor of Science)** offered by **Technical University of Moldova (Moldova)** is accredited according to the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG).

The accreditation is **conditional**.

2. The study programme essentially complies with the requirements defined by the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG) and the European Qualifications Framework (EQF) in their current version. The required adjustments can be processed within a time period of nine months.
3. The condition has to be fulfilled. The fulfilment of the condition has to be documented and reported to AQAS no later than **28th of February 2017**.
4. The accreditation is given for the period of **five years** and is valid until **30th of September 2021**.

Condition:

1. The transparency of the documents must be improved:
 - a. All module descriptions (“academic discipline datasheets”) must be available to students. They must contain a transparent description of the qualification goals.
 - b. The module descriptions (“academic discipline datasheets”) must contain the form and duration of exams. Subject names and numbers must be demonstrated in a consistent way.

The following **recommendations** are given for further improvement of the programme:

1. The faculty should improve students’ information concerning international mobility programmes like ERASMUS and other alternative funding options.
2. The overlap of topics in the curriculum should be avoided.
3. The chronological order of some modules should be revised, e.g. adjustment theory and error theory.

4. Guidance and advise for students on the specific level of the programme should be assured through a more institutionalised approach including non- academic and pedagogical offers.
5. The faculty should reinforce its efforts to acquire new projects for funding and activate other sources for additional sponsoring.
6. The faculty should strengthen their efforts to extend and renew the equipment.
7. The responsibilities regarding the quality assurance should be described more transparently and published, so that the students and other stakeholders know about it. Also, the students' participation needs to be made transparent.

With regard to the reasons for this decision the Accreditation Commission refers to the attached assessment report.

Experts' Report

on the study programme:

- **“Geodesy, topography and cartography” (B.Sc.)**

offered by Technical University of Moldova

Visit to the University 2nd/3rd of February 2016

Panel of Experts:

Prof. Dr. Andreas Eichhorn Technical University of Darmstadt, Institute of Geodesy, Geodetic Measuring Systems and Sensor Technology

Inés Sánchez Giner University of Valencia (student expert)

Prof. Dr. Constantin Moldoveanu Intreprinderii de Prospectiuni Geologice si Geofizice, Bucureşti, and Technical University of Civil Engineering Bucureşti, Faculty of Geodesy (expert from the academic and professional field)

Prof. Dr.-Ing. Volker Schwieger University of Stuttgart, Institute of Engineering Geodesy

Coordinators:

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1. Introduction

This report results from the external review of the Bachelor programme “Geodesy, topography and cartography” offered by Technical University of Moldova. The review is based on the criteria that were developed jointly as part of a TEMPUS project under participation of the Ministry of Education of the Republic of Moldova. They are based on the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG) developed by the European Association for Quality Assurance in Higher Education (ENQA) and presented to the Bologna Follow-Up group in 2005.

The University produced a Self Evaluation Report (SER). The accreditation procedure was officially initialised by a decision of the AQAS Accreditation Commission on 18th/19th of May 2015. The Accreditation Commission nominated the before mentioned expert panel and the University did not raise any concerns against the composition of the panel.

After a review of the SER, on the 2nd/3rd of February 2016 a site visit to the University took place. On site, the experts interviewed different stakeholders and consulted additional documentation and student work. The visit concluded with the presentation of the preliminary findings by the group of experts to the University representatives.

2. General Information

The Technical University of Moldova was founded in 1964 under the name Polytechnic Institute. In 1993, the Polytechnic Institute was reorganised into the Technical University of Moldova (hereinafter - TUM).

TUM is a non-commercial legal entity with a statute of public institution, registered in the State Register of non-profit organisations of the Ministry of Justice. The university is financed primarily from the state budget, and alternatively from other sources: donations, sponsorships, training fees etc.

Currently, the university includes nine faculties: Power and Electrical Engineering, Mechanic Engineering and Transports, Computers, Informatics and Microelectronics, Engineering and Management in Electronics and Telecommunications, Technology and Management in Food Industry, Light Industry, Cadastre, Geodesy and Constructions, Urbanism and Architecture, Economic Engineering and Business, and the Technical College of Chisinau. The University consists of 57 chairs.

3. Profile / Outcomes of the Programme

The university describes that the bachelor programme “Geodesy, topography and cartography” is oriented towards training engineer geodesists with qualifications corresponding to level 6 of the European Qualifications Framework (EQF).

The university explains that the study programme offers a generalist approach which means the programme strives to train broad competences in the fields of geodesy, topography and cartography. More specifically, competences in the disciplines like topography, geodesy, engineering geodesy, cartography, photogrammetry, geographic information systems and satellite geodesy are supposed to be developed, added by basic competences in mathematics, physics and informatics which also form part of the study programme.

Experts' Evaluation

The profile and the contents of the programme “Geodesy, topography and cartography” at TUM absolutely coincides with the title of the programme. The taught topics reflect in a broad approach which includes all the important disciplines. Additionally, the basic disciplines like mathematics, physics and informatics play an important role in the curriculum, too. This combination conforms very well with comparable curricula in Central Europe. The experts, however, recommend a few changes for further improvement of the curriculum (compare next section). In Germany, a programme like this would be called “Geodesy” or “Geodesy and Geoinformatics” in the Anglo-Saxon states the term “Geomatics” is preferred. Nevertheless, the programme title is perfectly chosen taking into account the terms used in Moldova and the neighbouring countries. The consensus with the curricula of Central European clearly shows that the contents and its academic level correspond to the requirements of the European Qualification Framework. The correspondence to the national specific competencies is clearly outlined in the self-evaluation report.

The learning-outcomes of the programme have mainly been identified in discussions with the academic staff and the heads of department. The learning-outcomes of each academic discipline (lecture, seminar, laboratory and internship) are summarised on “academic discipline datasheets” that are almost completely available to the students. In summary, the curriculum supports the impartation of the learning outcomes of the overall programme. Due to transparency issues, the experts recommend to publish all “academic discipline datasheets” as well as the overall programme learning-outcome freely accessible e.g. on the homepage of the department (**Finding 1a and b**). This publication may also strengthen the international visibility of the programme, and this way also supporting the internationalisation of the programme.

The learning contents as well as the outcomes have a strong connection to research and development, e.g. topics for PhD theses are correlated with lectures, seminars and internship contents or a project with the industry is integrated in teaching. This way, teaching and research are treated together and not separately. To reach a high transparency the experts recommend to develop a research statement for the department, integrated into the profile of TUM, and publish it e.g. on the homepage of the department (**Finding 1a**).

The personal development of the students is supported by two components. One is the teaching of socio-humanistic disciplines e.g. Sociology, Philosophy, Fundamentals of State and Law mainly in the third and fourth semester. These disciplines help to widen the horizon of the students with respect to society. The other positive element is the so-called “group” concept. The group members are guided by a “group leader” through the orientation phase at the beginning of the programme and also during the whole study programme. The group leaders help students in meetings with the staff, in discussions about examination sessions, in meetings with practitioners and in many other activities. This strong mentoring programme intensively supports the personal development of the students. (see chapter five on student support)

The requirements of the labour market are taken into account by organising labour market surveys and drawing conclusions for the structure and content of the curriculum. Additionally a high portion of the academic disciplines are practically oriented (approximately 20 % laboratory and 23 % seminars) and a focus on internships is visible in the curriculum, too. Besides, the experts could realise during their visit at Technical University of Moldova that the relationship among students, teaching staff and companies as well as state organisations is very close. Often the students are already engaged at a company during their studies. All these facts lead to the clear consideration of labour market requirements in the curriculum and they strongly contribute to the employability of the graduates. (see chapter six on employability)

Even during the final examinations, experts from the practise are involved in the examination process. From the experts' perspective, the labour markets needs are assured in an extreme way. The faculty should consider abandoning this involvement of practitioners in examinations since these examinations are a pure academic task and should therefore exclusively lie in the hands of the academic staff (**Finding 2**).

4. Curriculum

The study programme includes four years of study. The academic year starts on 1st of September and provides 30 weeks, divided into two semesters by 15 weeks each, two examination sessions lasting three weeks at the end of semesters and three holidays. In every semester another week is reserved for an additional examination session. The curriculum provides the allocation of ECTS credits for each course unit. One credit is allocated to 15 hours of direct contact plus 15 hours of indirect contact (individual work). The studies during one academic year allow to accumulate 60 credits, and upon completion of the programme 240 credits.

The curriculum is structured into fundamental and specialised modules. The specialised modules comprise both mandatory and optional courses. The curriculum also involves socio-humanistic and general courses.

Experts' Evaluation

The given structure of the curriculum is well-suited to achieve the before defined intended learning outcomes.

Four years of study is a very reasonable duration of study and during each academic year a broad field of engineering knowledge and learning outcomes are provided without overburden the students and aiming to a good study success in an acceptable study time. The abandoning rate in 2013-14 is with 23 % rather low, the employability rate shows with 73 % in 2015 a good result. Especially the integration of the mandatory internships (e.g. in companies or using the good contacts to University of Bucharest) in the study programme is a very positive aspect in an as well research- as application-oriented study programme and partly overcomes the lacks in the own technical equipment (see also Section 7).

As described in the self-evaluation report and proved in the academic discipline data sheets, the curriculum provides the allocation of ECTS credits (CP) for each course unit. One credit is allocated to 15 hours of direct contact (e.g. in the lecture) plus 15 hours of indirect contact (individual work). The education during an academic year allows to accumulate 60 CP (30 CP per semester), and upon completion of the programme in total 240 CP. The workload is well balanced and compatible with the standards of other European study programmes. Most of the modules (at TUM denominated as subjects) cover between 4 and 6 CP (some socio-humanistic and practical courses have only 2 CP). Taking into account the allocated work load, this is a reasonable (and usual) size which also restricts the number of examination events. All modules are described in detail (name, workload, course type, preconditions, options, objectives & contents, examination type) in academic discipline data sheets, which are available for the academic staff and the students. There also exists a written curriculum for the study programme which clearly indicates the possible pathways (one main path with mandatory and optional modules, etc.).

The structure of the curriculum is a bottom-up structure, starting from the fundamentals (e.g. natural scientific basics like mathematics and physics) and going on to the more specialised courses (at TUM denominated as speciality courses). In total the curriculum shows the typical structure of a European engineering programme with 25 % fundamentals, 27 % mandatory special courses, 29 % optional special courses and 19 % of socio-humanistic and general courses. The optional

courses give the students the possibility to choose between different subjects. The studies start with a strict curriculum in the first year (fundamentals) and continue with an increasing flexibility from the beginning of the second year (specialised courses). This seems to be very useful and allows the adaptation of the curriculum to the individual preferences of the students (which they discover during their studies) but also to the current requirements of the labour market. The curriculum is finished with a thesis and two comprehensive examinations (topography and cartography / photogrammetry/ geodesy) which cover the main topics of the study programme. The combination of thesis and examinations in the last year seems to be an effective method to cross-check the actual knowledge of the students with the intended learning outcomes.

The examination methods in the curriculum are a mixture of written exams (dominating examination type), annual work and annual projects. So, different evaluation types are provided which partly build up additional qualifications for the labour market (e.g. the project oriented work). The variation of evaluation methods seems to be sufficient and adequate for an engineering study programme. There also exist several presentations, where students have to defend their results, e.g. from their practical work. This is very positive because the students learn how to present scientific and practical results in front of an expert panel and exchange their knowledge with the community. The examination grading is based on an assessment scale starting from grade 10 (excellent) and going down in single steps to grades 1 and 2 (unsatisfactory) which enables a differentiated rating. The examiners are recruited from the scientific staff in the same way as in European study programmes. One exception is the inclusion of representatives of the labour market in the two final examinations, which has already been critically discussed (see chapter 3).

In summary, the assessment reflects the knowledge, skills and competences taught in the programme. The student assessments are appropriate for their purpose and are designed to measure the achievement of the intended learning outcomes and other programme objectives. They are undertaken by qualified people who show the necessary objectivity and professional competence. The final thesis and the two final exams prove that the intended level of qualification is achieved through the programme.

Passing the curriculum, the students are closely connected with the research activities of the academic staff. This is realised by the transfer of newest research results into the contents of teaching, the possibility to join a research-oriented conference (hosted by TUM), the possibility to work as student research assistant and the assignment to research topics in the bachelor thesis. In addition, there is access to national (e.g. the publications of the academic staff) and international literature. English research literature is mostly used in the phase of thesis preparation. Overall, the link to research is given and supported in a reasonable manner.

The curriculum also supports the mobility of the students. The mandatory internships are often completed in national companies or in Romania. In addition, the international mobility of TUM students is prepared by language courses (e.g. English and French), which are integrated in the curriculum, and by the increasing number of courses held in English language. Each year, the faculty encourages some students to go to international universities in Sweden, Portugal, etc. There is currently no official information infrastructure for international study possibilities. But according to the academic staff, in 2016 was a first informative meeting about ERASMUS plus. Further information meetings are announced to follow. The faculty is already on a good way to further extend the students' international mobility. However, the experts would like to recommend that the faculty establishes more permanent structures for the students' information concerning international mobility programmes like ERASMUS and other funding (**Finding 3**).

Besides the overall very positive aspects of the curriculum, the experts have identified the following areas for improvement:

In the photogrammetric courses, the principles of stereoscopy and triangulation are provided as well in Photogrammetry I (Semester 4) and Photogrammetry II (Semester 5). Stereoscopy and triangulation are basic skills and should be provided only in Photogrammetry I. In general, the overlapping of topics should be avoided (**Finding 4**), especially if different teachers are contributing to one topic. The faculty should check the courses carefully concerning redundant issues.

In the curriculum structure, some modules should be re-arranged (**Finding 5**). Some topics are provided in the earlier semesters when the fundamentals are only taught later: e.g. error ellipses in Error theory I (Semester 4) and variance / covariance matrices, least squares in Error theory II (Semester 5). This should be re-arranged starting with one-dimensional error measures, simple error propagation and test statistics in Error theory I (this could start even in the 1st year) and going further on to multidimensional approaches (e.g. ellipses) and adjustment theory in Error theory II. Maybe another module Error theory III would make sense, deepening and extending the least-squares methods in the direction of robust statistics and Kalman-filtering (e.g. for kinematic surveying). Also, the interaction of Error theory with other courses like Geodetic measurements by waves (Semester 4) should be carefully checked. The adjustment of networks is introduced before providing the basic theory in Error theory II (Semester 5).

The Engineering geodetic topics (contents of Engineering topography I and II) are strongly focused on staking out methods (primarily static approaches). They could be extended also to kinematic approaches. In future development, also precision measurement and analysis techniques in industry for quality control should be included (e.g. with interferometric methods like lasertrackers) and other innovative sensor systems (e.g. terrestrial laserscanning, at least the theory) should be part of the curriculum. This could be perfectly connected with applications in terrestrial photogrammetry (see Photogrammetry II, Semester 5).

The monitoring and analysis of deformations of civil engineering structures is nearly completely missing. This is a broad scientific field with big potential. In future development, the chair should think about the integration of this topic in the curriculum and establish interdisciplinary lectures not only for geodesists but also for civil-engineers.

All elements of the curriculum are described in detail in a document the so-called data sheets. The data sheets are available to the students as a central means of information. Unfortunately, they are not published. The faculty should make the data sheets available also for stakeholders outside the university, e.g. by publication on the website (**Finding 1b**, see chapter 3). In addition, in the data sheets it should be described more clearly if the exams are oral or written and indicate the examination duration (**Finding 1b**) as well as the consistency of subject names and numbers with the written curriculum should be revised since there are some contradictions and imprecisions (**Finding 1b**).

5. Student Support

Career counselling at TUM is oriented towards providing assistance to: high school graduates to consciously choose the specialty of study, to students to guide them during their studies, and to graduate students to successfully fit within their work after graduation, forming a successful career in perspective. For this purpose, various forms of career guidance are used:

- guidance of high school students;
- mentoring and extracurricular training of students e.g. on professional career.
- advisory assistance on employment after graduating from TUM;

Recognition of academic results and qualifications obtained at other higher education institutions and outside the higher education system is supposed to happen in accordance with the Regulation on recognition, equivalence and authentication of studies and qualifications – which represents a binding national regulation and is based on the ECTS credit transfer system.

Experts' Evaluation

The regulations regarding code of conduct, admission, library functioning and use, student councils at faculty and university level, assessments, ECTS, internships and PhD's are clearly defined and published through the website, available not only for students, but also for external stakeholders.

The responsibilities and structures with regard to the organisation of the exams are clearly defined. The organisation of the exams is appropriate with regard to timing. Examination dates are published to the students with appropriate timing. Resits are offered in a suitable way. In general, examinations are correctly timed and designed, covering the syllabus of the course without exceeding the taught content. The scheduling of exams are consulted with the students in order to avoid incompatibilities and post-assessment concerns and claims are attended by the lecturers. Dates and marks of examinations are published in the Moodle platform facilitating the information and reaching students in a more effective way. Moodle is also used for online assessments which take place in the university guaranteeing a correct identification of students which obtain their own ID number and password. Information about the programme, the faculty and the university is available and updated as well, through the Moodle platform.

The teaching staff have a frequent and constant coordination by establishing meetings to analyse the work and results of the courses to enhance the programme's objectives. The programme uses a credit point system, ECTS, to describe the student workload which is also monitored by regular coordination meetings among teachers and surveys to students.

As there are national regulations in place the faculty does not have specific regulations for recognition of credits gained at other higher education institutions and outside of the higher education institution. Recognition is put in practice through learning agreements for mobility programs or internships.

The recognition of credits gained at other higher education institutions and outside of the higher education institution is regulated in the documents. In addition, the recognition is facilitated through learning agreements for mobility programs or internships.

Students are satisfied with the different methods of learning and teaching, especially with the incorporation of the Moodle platform, but they propose an increase in e-learning activities and practical lessons. A close relation between teaching staff and students was remarked by students during the visit. The study programme counts with, not only guidance for entering the labour market, but a tutoring programme for first year students which assures and helps new students to follow-up and integrate themselves during their first year. Nevertheless, guidance and advisory for students on the specific level of the programme should also be assured through a more institutionalised approach including non-academic and pedagogical guidance and advice (**Finding 6**). General information to students should be addressed when they enter the programme. In this sense, students should know about the importance of gaining soft skill and having extracurricular experiences, especially by participation in mobility programs, internships and other activities organised such as language courses or research congresses, to understand their usefulness towards the labour market. In this sense, the number of courses taught in English could be even more increased to contribute to the acquisition and enforcement of language skills and contributing implementing a more internationalised focus and strategy. Internships are available and mandatory for students which state the usefulness of them towards having a broader perspective

of the profession; all the same, entrepreneurial skills are not promoted. Information about the academic options graduates have is also crucial to assure students know about possibilities aside from entering the labour market such as Master degrees and PhDs. Research skills are well developed and stimulated with conferences and congresses for students.

The programme convinces with a well-equipped library with appropriate amount of literature, journals and information sources in Romanian and Russian, but English sources could be promoted to guarantee updated literature on various research fields. In general, facilities are appropriate in terms of room and space for the number of students enrolled, however, material resources concerning technical equipment should be increased to assure students acquire the practical side of the theoretic concepts and learning outcomes. Nevertheless, students have access to the equipment available, including specific technical and professional computer programmes though the computer laboratories which should be increased according to the total number of students enrolled in the faculty. Also, the university has accommodation, managed by the student union, and canteens which, students declared, should improve their quality and diversity. (see chapter seven: resources)

6. Employability

Based on information provided by TUM graduates of the study programme Geodesy, topography and cartography, can work in companies and institutions such as: the Agency for Land Relations and Cadastre of the Republic of Moldova, State Enterprise "Cadastre", Cadastral Territorial Organisations (CTO and their subsidiaries), other public and private companies operating in surveying service, cadastral works, photogrammetry, design, surveying, etc. Graduates are also supposed to be able to start their own businesses.

The documentation provided by TUM shows that the average employment rate of the graduates of the past four years is 68.28%. This shows that more than half of graduates work in the field.

Experts' Evaluation

From the beginning it must be stated that there is a very good collaboration between the Technical University of Moldova (TUM) and the companies and institutions in the fields of geodesy, topography and cadastre. There are many methods by which this collaboration is established, including:

- The future students are explained in what the study programme consists, which enables them to later visit the possible employers to get an idea of how the teaching programme corresponds to the employment opportunities.
- There are teachers that also work in private or state companies, as well as PhD engineers from the field that teach courses at the university (due to low salaries, few graduates want to work in education). Thus, a better correlation between the demands of the field and the study programme is established. A lively example of the feedback from this source is the discussion on hours assigned to the teaching of gravimetric geodesy. Due to the low demand for jobs in this field teaching of this topic could be reduced in favour for newer disciplines, like satellite geodesy (GNSS).
- The companies support, even if to a limited extent at the moment, the university by offering possibilities to use part of their laboratories for practical stages or by offering the possibility of using software licenses. Thus, the students make contact with the demands and needs of the labour market.

- The practical stages, although considered by students and graduates to be too short, are performed in institutions in the appropriate work fields contributing thus to a better knowledge of the devices and software applications that are currently used in the Republic of Moldova.

Although the number of students has decreased (mostly due to demographic reasons), the demand of specialists is increasing. Even in the conditions of the decreasing of the number of students the study programme must be maintained and supported, as it is the only one in this field in the Republic of Moldova.

It must also be mentioned that the absorption rate of the graduates in the labor market, of 68.28%, in the last 4 years is a very good one, considering the decrease of the number of private companies in this period, from 246 to 120.

The study programme contributes through its competences to increase the absorption capacity of students. The qualifications obtained after finalising the study programme in geodesy, topography and cartography are relevant for the labour market and allows the graduates to occupy the positions in conformity with the code of occupations in the Republic of Moldova (OCRM), approved by the government by the Decision no. 461 of 02.07.2013.

For the graduates of the study programme of geodesy, topography and cartography the opportunities for jobs are being supplied by the following companies and institutions: The Agency for Land and Cadastre Relations of the Republic of Moldova, which is the central public administration organisation, that realises the state politics and is directly subordinated to the Government of the Republic of Moldova, the state enterprise "Cadastre", territorial cadastre organisations (CTO and their agencies), the state enterprise Geodesy Institute, the "INGEOCAD" Technical and Cadastre Prospections company, which is a leader in the Republic of Moldova in the fields of the geodetic, topographic and cartographic activities and other public and private companies that perform in the fields of topography, cadastre works, photogrammetry, projection, topography etc. or by forming their own business plans in geodesy.

It must also be pointed out that, through a decision of the Ministry of Education, the president of the commission for the final examination must be from outside of the university. He does not have a decisive role, but only one of assuring objectivity regarding the examination procedure. Through this decision the businesses are made aware of the level of training of the graduates. Purpose and sense of this regulation seem debateable from an academic point of view, however the expert panel understands the necessity to follow this regulation.

The problem of monitoring the occupancy of the work force is permanently watched by the GCG department: by designating employees to have contact with the graduates, by the annually updating of the list of graduates from the previous five years, with jobs and work force occupancy, by the consulting the graduates in technical and scientific programs by the department professors, by the continuous informing of the graduates regarding new job offers.

The diploma supplement that is handed to each graduate upon finishing the study programme reflects the qualifications obtained and constitutes an important document for possible employers.

7. Resources

The admission plan for each study programme at TUM is determined by the Ministry of Education in accordance with the requirements of the Ministry of Labour. In recent years the admission plan for the study programme Geodesy, topography and cartography provided 30-35 places annually, of which an average of half are financed from the budget, and half - are paying a tuition fee.

As laid down in the SER, the teaching staff of the programme consists of 30 people, of which $\frac{1}{4}$ are full or associate professors. The ratio between teaching staff and students is 1:5.

For the programme, a library with national and international research literature, an electronic learning platform as well as technical equipment and computers are available.

Experts' Evaluation

The qualifications of the teaching staff, their assignments to the modules and the teaching hours are well documented in the SER and the academic data sheets (see also Section 4). The ratio of teachers and students is good. There is a close supervision by the teachers which is positive evaluated in the student interviews and supports the study success.

67% of the teachers hold full-time positions. The other 33% are employed in part-time. During the interviews with the academic staff, the experts got the impression of highly motivated colleagues, which are interested in further development of the study programme as well as their personal skills. This is also documented by the list of projects, the organised events, the student evaluation reports and the international mobility of the teachers. The teachers of the study programme also take part at special qualification courses offered by TUM (e.g. education, new technologies, e-Learning, languages). They use modern communication platforms (like Moodle) to organise their lectures.

The yearly financial donations to the chair are based on the state budget (payment per student), tuition fees, national and international projects and company sponsoring. The dominating part comes from the state budget (63%). Tuition fees (15%) and international projects (18%) fill up the budget. National projects and company sponsoring represent only a marginal part. The yearly budget is used for the purchase of teaching equipment (also geodetic instruments), infrastructure measures and sometimes for salary supplement. The distribution of the money is realised on faculty level. In the last two years, the financial resources have decreased, as well in the state budget as in international projects. To maintain the high education standard, it is recommended to increase the financial resources again, especially looking to the instrumental equipment of the chair. This recommendation is directed to the Ministry of Education but also to the chair, who needs to reinforce the efforts to acquire new projects and should try to activate other sources for additional sponsoring (**Finding 7**).

As mentioned above in context with the financial resources, the university should strengthen their efforts to extend and renew the equipment (**Finding 8**). Talking to the students, this became very evident. In Geodesy, the practical training with measuring instruments (e.g. modern digital levels and tachometers, GNSS receivers) is a fundamental part of each curriculum. The curriculum at TUM provides these slots in a very good way (see chapter 4). Nevertheless, the individual training must be improved, reducing the number of students in the training groups. Currently, the students partly overcome the lack of technical equipment by external internships (e.g. in companies or by stays abroad). This is only sub-optimal because the theoretical contents of the lectures and the practical measuring training should be part of the same workflow.

In contrast to the measuring instruments, computers and available software packages are on a good level and cover the student requirements. This statement is also valid for teaching rooms and provided computer workplaces.

The chair owns a library with technical and scientific literature (mostly in Romanian or Russian language) and also offers the access to English literature and selected international journals e.g. via internet. The library also contains the scientific publications and lecture notes of the teaching staff. The students have free access to the library. There is a special reading room where they can make in situ studies. It is also possible to loan out literature or to make copies. The suggestion regarding the library is to expand the available English literature and to encourage the stu-

dents to use it. Currently, the English literature is primarily used at the end of the study programme, strongly depending on the topic of the bachelor thesis. An earlier introduction would have a very positive effect on the language skills and also on an extended view to international teaching (and possibly research) literature, which could also trigger the student mobility.

The administration of the chair is performed in the office of the dean. Here, all data of the students (e.g. passed and still open exams, marks) and courses are stored in a database which is updated by a secretary. This may also give the possibility for some optimisation. In the opinion of the experts, there exists much redundant administrative data (e.g. the additional folder of the course holder) at the chair which could be reduced and would have a time saving effect for the lecturers, who could more concentrate on their core areas, i.e. research and teaching.

8. Quality Assurance

According to Quality Management System (QMS) documents implemented and certified at TUM, the bodies responsible for the maintenance and management of the QMS are: (1) Management Representative in the area of Quality, (2) Senate Commission "Training and Quality Assurance Process", (3) QMS coordinator, (4) Quality Management Committees (QMC) are permanent structures of the Faculty Boards, and (5) The person responsible for quality assurance (at the chair level) has the authority and responsibility for quality assurance of all processes carried out within the subdivision (education, research, organisation and external relations).

According to the SER, the chair is the main responsible person for continuous quality improvement. He/She ensures public transparency of data and information about all study programmes offered and those related to quality management. The chair schedules and applies immediate and long-term preventive and corrective measures in order to address non-compliances.

The following activities are examples of Quality Assurance measures carried out by TUM respectively the faculty:

- questionnaires of students and teachers (e.g. course evaluations, graduate surveys),
- permanent labour market surveys are performed in order to determine the kind of specialists required by the national economy, and
- annual organisation of labour fairs.

Results are analysed at all management levels and, depending on the views expressed, solutions are being sought to mitigate or to eliminate them.

Experts' Evaluation

The experts can confirm that a quality culture among the teaching and administrative staff exists which assures that quality evaluations and analysis is being done, concluded from the interviews, as well as positions responsible for quality at all levels. There is a QA department at the university level and each faculty and department has a person responsible for quality. At the same time, the faculty keeps records of specific information which allows obtaining different indicators such as success rates or profile of student population of the programme.

Information on the quality assurance system (QAS) is published on the website. There is a general strategy with broad objectives on QA of the university and overall responsibilities of the different bodies and positions of the quality assurance system at all levels; all compiled in the regulation of the Quality Management System of the university and the Council's rules for Quality Assurance. However, no clear connections between these aspects are visible in the documentation. It is advisable that the university establishes procedures and indicators and visualises them in a

monitoring document such as a strategic time-framed plan with actions for improvement taken as a result of the analysis of all the information gathered in the QA system.

There is a regular feedback from all the stakeholders with surveys. Students have mandatory surveys about all their lessons and teaching staff. Graduates also have a survey once they end the programme and a few years after, to tackle their development in the labour market. Answers are analysed and conclusions are made, changing those aspects which need to improve. Furthermore, once every five years, the study programme is updated with all the information and substantial changes gathered during the years. With this survey, there is information about employability of graduates and evaluation of the programme by graduates, students' satisfaction with their programmes and results of teaching-staff and course evaluations. Surveys are also conducted to employers about the programme but also about the labour market and their own companies.

Information on course descriptions is available for students but not for external stakeholders. The coordination of the courses is established by monthly meetings in the department where discussion about the quality of the teaching process and the follow-up of the development of the courses is produced. There are additional meetings for members who teach the similar discipline to avoid overlaps in the contents as well as specific meetings to deal with administrative and scheduling issues.(see also chapter four: curriculum) Internships are mandatory and are well coordinated and guarantee students to end their programme in the advertised course duration as they last three weeks.

Teachers update themselves in various ways: content wise by working in the private sector which makes them have contact with new technology, methodologies and innovative knowledge and methodological wise by training, assessment between themselves and by more experienced staff and by e-learning, psycho-pedagogical and specific content courses. They also check programs from other universities as well as participate in mobility projects and programmes to have a broader perspective of the programme's field.

Quality evaluations will be a factor taken into consideration for the implementation of new programmes and during the interviews of the visit, there was a clear priority of ensuring quality in the programme. New positions will also be established to coordinate and contribute to implement the quality assurance system, not only at the university level but at the faculty and programme level. It is recommended to define and publish the responsibilities regarding the quality assurance more transparently so that the students and other stakeholders know about it. Also, the students' participation needs to be more transparent (**Finding 9**).

Student representation is present and regulated in the faculty. However, the experts experienced that the link between then student representatives and the students of the programme is not that close. The students, on the other hand, mentioned that this is the task of the students themselves to assure the communication. The experts advise to the faculty to encourage the students to strengthen that link. In this sense, student representatives can contribute in the daily management, decisions, aspects of the programme and daily problems.

9. Recommendations of the panel of experts

The panel of experts recommends to accredit with conditions the Bachelor programme "**Geodesy, topography and cartography**" (**B.Sc.**) offered by **Technical University of Moldova**.

Findings:

1. The transparency of the documents must be improved:

- a. The qualification goals must be described in a transparent manner. The integration of the study programme in the research profile of the faculty/department must be clear and freely accessible e.g. on the homepage of the department.
 - b. The module descriptions (“academic discipline datasheets”) must be revised in order to improve the transparency on the programme: the form and duration of exams must be defined as well as the subject names and numbers must be demonstrated in a consistent way. The module descriptions must also be available to stakeholders outside the university.
2. The faculty should consider abandoning the involvement of practitioners in examinations since these examinations are a pure academic task and should therefore exclusively lie in the hands of the academic staff.
 3. The faculty should establish more permanent structures for the students’ information concerning international mobility programmes like ERASMUS and other funding.
 4. The overlapping of topics in the curriculum should be avoided, especially when different teachers are contributing to one topic.
 5. Some modules should be reorganised in their chronological order, e.g. adjustment theory and error theory.
 6. Guidance and advisory for students on the specific level of the programme should also be assured through a more institutionalised approach including non- academic and pedagogical guidance and advice
 7. The faculty should reinforce the efforts to acquire new projects for funding and activate other sources for additional sponsoring.
 8. The university should strengthen their efforts to extend and renew the equipment.
 9. The responsibilities regarding the quality assurance should be defined and published more transparently so that the students and other stakeholders know about it. Also, the students’ participation needs to be made transparent.