



Decision of the Accreditation Commission of AQAS

on the study programmes:

- “Water Supply and Environmental Sanitation” (M.Sc./MPhil)
- “Water Resources Engineering and Management” (M.Sc./MPhil)
- “Water Resources Management” (PhD)
- “Water Supply and Treatment Technologies” (PhD)
- “Environmental Sanitation and Waste Management” (PhD)

offered by the Kwame Nkrumah University of Science and Technology,
Ghana

Based on the report of the expert panel and the discussions of the Accreditation Commission in its 72nd meeting on 20/21 August 2018, the Accreditation Commission decides:

1. The study programmes “Water Supply and Environmental Sanitation” (M.Sc./MPhil), “Water Resources Engineering and Management” (M.Sc./MPhil), “Water Resources Management” (PhD), “Water Supply and Treatment Technologies” (PhD) and “Environmental Sanitation and Waste Management” (PhD) offered by the Kwame Nkrumah University of Science and Technology are accredited according to the AQAS criteria for Programme Accreditation.

The accreditation is unconditional.

The study programmes comply with the requirements defined by the criteria and thus the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG) and the European Qualifications Framework (EQF) in their current version.

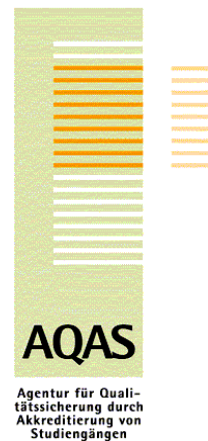
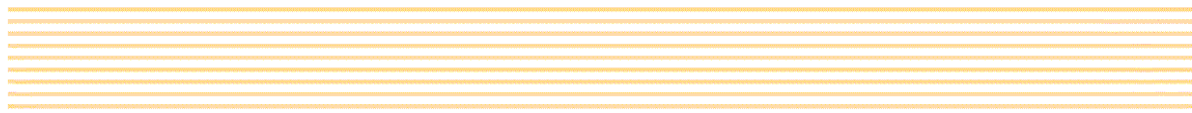
1. The accreditation is given for the period of **six years** and is valid until **30 September 2024**.

To further develop the study programmes the following **recommendations** are given:

1. All relevant information on the study programmes such as learning outcomes, module descriptions, calculation of credits according to national standards and further information on the Ghanaian higher education system, guidelines, administrative procedures, etc. should also be published online.
2. The period of courses should be extended, at least of the courses given by internal teaching staff.
3. The amount of mandatory courses should be reduced; instead the duration of core courses should be prolonged and some should be made electives.
4. The duration of the internship should be further extended, especially for Master students.
5. Especially in the Master programmes, the development of presentation skills and further soft skills should be intensified.

6. Graduates of each programme should receive a Diploma Supplement or a comparable document to inform about the Ghanaian higher education system in general and the study programme in detail, such as duration of studies, learning outcomes, calculation of credits, etc.
7. The department should get new equipment to do water quality research, and a maintenance plan for the facilities should be set up.
8. There should be a good and reliable internet access on campus, especially for students, particularly PhD students, to support the possibilities for doing research.
9. The access to international journals and databases in the fields covered by the study programmes should be improved.

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



Experts' Report

on the Master programmes:

“Water Supply and Environmental Sanitation” (M.Sc./MPhil)

“Water Resources Engineering and Management” (M.Sc./MPhil)

and on the PhD programmes:

“Water Resources Management” (PhD)

“Water Supply and Treatment Technologies” (PhD)

“Environmental Sanitation and Waste Management” (PhD)

offered by Kwame Nkrumah University of Science and Technology, Ghana

Visit to the university: April 23–26, 2018

Panel of Experts:

Prof. Dr.-Ing. Markus Disse	Technical University of Munich, Department of Civil, Geo and Environmental Engineering, Germany
Prof. Dr.-Ing. Susanne Hartard	Trier University of Applied Sciences, Environmental Campus Birkenfeld, Germany
Ass. Prof. Dr.-Ing. Abdella Kemal	Arba Minch University, Institute of Technology, Ethiopia
Dr.-Ing. Pascal Bieupoude	General Manager BPL, Abidjan, Ivory Coast (labour market representative)
Alexander Buchheister	RWTH University Aachen (student expert)

Coordinator:

Ninja Fischer, Patrick Heinzer AQAS, Cologne, Germany

Preamble

AQAS – Agency for Quality Assurance through Accreditation of Study Programmes – is an independent non-profit organisation, supported by more than 90 member institutions, both higher education institutions (HEIs) and academic associations. Since 2002, the agency has been accredited by the German Accreditation Council (GAC). It is therefore a notified body for accreditation of higher education institutions and programmes in Germany.

AQAS is a full member of ENQA and also listed in the European Quality Assurance Register for Higher Education (EQAR) which confirms that AQAS procedures comply with the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG), on which all Bologna countries agreed as a basis for internal and external quality assurance.

AQAS is an institution founded by and working for higher education institutions and academic associations. The agency is devoted to quality assurance and quality development of both academic studies and teaching in Higher Education Institutions. The activities of AQAS in accreditation are neither restrained to specific academic disciplines or degrees nor to a certain type of Higher Education Institution.

In recent years many higher education institutions and research institutes in the European Higher Education Area have set up doctoral programmes (PhD programmes) in order to boost the structured qualification of early stage researchers by providing support and guidance on a range of levels i.e. subject-specific, organisational, intellectual and/or financial.

I. Accreditation procedure

This report results from the external review of the Master programmes in “Water Supply and Environmental Sanitation” and “Water Resources Engineering and Management” and the PhD programmes in “Water Resources Management”, “Water Supply and Treatment Technologies” as well as “Environmental Sanitation and Waste Management” offered by the Regional Water and Environmental Sanitation Centre Kumasi (RWESCK) of Kwame Nkrumah University of Science and Technology (KNUST).

1. Criteria

The Master programmes are assessed against a set of **criteria for programme accreditation** developed by AQAS. The criteria are based on the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG) 2015. To facilitate the review each criterion features a set of indicators that can be used to demonstrate the fulfilment of the criteria. However, if individual indicators are not fulfilled, it does not automatically mean that a criterion is not met. The indicators need to be discussed in the context of the programme since not all indicators may necessarily be applicable to a specific programme.

The PhD programmes are assessed against the AQAS **criteria for the accreditation of structured doctoral programmes**. The accreditation by AQAS is based on the following key concepts:

- The doctoral thesis is an independent, original academic piece of research. It can take the form of a monograph or a cumulative dissertation. The assessment of the originality is based on a set of criteria:

- selection of the research topic,
 - formulation and development of questions around the research topic,
 - decision regarding the use of suitable methodological tools and methods,
 - the scientific research, and
 - the discussion and publication of research results.
- Doctoral programmes should foster subject-specific knowledge and, if possible, facilitate cross-disciplinary perspectives and inter-disciplinary exchanges.
 - Doctoral programmes are carried out and completed within a specific timeframe.

The panel of experts was asked to assess the programmes on the basis of the relevant criteria and discuss the programmes separately, when needed.

2. Approach and methodology

The initialisation

The university mandated AQAS to perform the accreditation procedure in September 2017.

The university produced a Self Evaluation Report (SER), which describes all programmes (Master and PhD). In October 2017, the institution handed in a draft of the SER together with the relevant documentation of the study programme and an appendix.

The appendix included e.g.:

- Overview over statistical data of the student body (e.g. number of applications, beginners, students, graduates, student drop outs).
- CVs of the teaching staff, including research activities
- Information on student services
- Core information on labs and the main library
- Academic regulations for Master and PhD programmes.

AQAS checked the SER regarding completeness, comprehensibility and transparency. The final version of the SER was handed in in March 2018.

The accreditation procedure was officially initiated by a decision of the AQAS Accreditation Commission 19-20 February, 2018.

The nomination of the panel of expert

The composition of the panel of experts follows the stakeholder principle. Consequently, representatives from the respective discipline/s, the labour market and students are involved. Furthermore, AQAS follows principles for the selection of experts of the European Consortium for Accreditation (ECA).

The Accreditation Commission nominated in February 2018 the before mentioned expert panel. AQAS informed the university about the members of the expert panel and the university did not raise any concerns against the composition of the panel.

The preparation of the site visit

Prior to the site visit, the experts reviewed the SER and submitted a short preliminary statement including open questions and potential needs for additional information. AQAS forwarded these

preliminary statements to the University and the panel members in order to increase transparency in the process and the upcoming discussions during the site visit.

The site visit

After a review of the Self Evaluation Report, a site visit to the university took place from 23–26 April, 2018. On site, the experts interviewed different stakeholders, e.g. the management of the KNUST, the management of RWESCK, the programme management, teaching and other staff, representatives from the labour market as well as students and graduates, in separate discussions and reviewed additional documentation as well as sample student's work. The visit concluded with the presentation of the preliminary findings by the group of experts to the university's representatives.

The report writing

Following the site visit, the expert group drafted the following report, assessing the fulfilment of the AQAS criteria for programme accreditation and doctoral programmes. The report included a recommendation to the Accreditation Commission. The report was sent to the university for comments.

The decision

The report, together with the comments of the department, forms the basis for the AQAS Accreditation Commission to make a decision regarding the accreditation of the programmes. Based on these two documents, on 20/21 August, 2018 the Accreditation Commission took its decision on the accreditation. AQAS forwarded the decision to the university. The university had the right to appeal against the decision or any of the imposed conditions.

In xxx, AQAS published the report and the result of the accreditation as well as the names of the panel of experts.

II. Assessment of the study programme(s)

1. Status and Degree-awarding powers / Embedding of the programmes in the university

Standard PhD programme:

The institution is entitled to award a doctorate.

Description

Kwame Nkrumah University of Science and Technology (KNUST) was transformed into a fullfledged university in 1961 due to a process of further development of university education in Ghana. The university is thus the successor of the Kumasi College of Technology which was established by a governmental ordinance in 1951.

At the moment, KNUST has a total number of staff of 3,443 members which includes academic and non-academic staff. Among these there are 19 Professors, 53 Associate Professors, 211 Senior Lectures, 11 Senior Research Fellows, 424 Lecturers and 52 Assistant Lecturers. The student population was 42,590 in 2016 (36,807 undergraduate students and 5,783 graduate students). This number includes also 5,000 from the Institute of Distance Learning. The university is headed by a Vice-Chancellor who is supported by the Pro Vice-Chancellor.

The university is divided into 6 colleges (College of Agriculture and Natural Resources, College of

Art and Built Environment, College of Humanities and Social Sciences, College of Engineering, College of Health Sciences and College of Science). These colleges are further divided into faculties, schools and departments (among these some research centres are forming part of a college's structure).

The Regional Water and Environmental Sanitation Centre Kumasi (RWESCK) is part of the African Centre of Excellence project, which was launched by the World Bank in 2013. In accordance with this, RWESCK was established in 2014 and is hosted at the College of Engineering under the Department of Civil Engineering. The College of Engineering comprises 3 faculties, made up of 10 teaching departments and 3 other centres apart from RWESCK. During the academic year 2016/2017 the total enrolment at the College stood at 5,312 students (5,071 undergraduates and 241 postgraduates). The Department of Civil Engineering as part of the Faculty of Civil and Geo-Engineering and the RWESCK as a centre within the College of Engineering run jointly the study programmes to be accredited whereby RWESCK has the administrative lead and has set up positions such as Coordinators for the PhD/MSc/MPhil programmes, Centre Leaders, Management and Finance personnel responsible for the day to day running of the Centre. As stated by the university, the staff of the Department of Civil Engineering comprises 3 Professors, 4 Associate Professors, 10 Senior Lecturers, 7 Lecturers, 1 Assistant Lecturer, 5 Technicians and 11 Administrators and support staff.

The MSc/MPhil programmes started in 1997 (Water Supply and Environmental Sanitation) respectively 2004 (Water Resources Engineering and Management) whereas all 3 PhD programmes started in 2015.

Experts' Evaluation

As Kwame Nkrumah University of Science and Technology is a public university which has full recognition by the government of Ghana, and as it is a fully fledged university, also on the legal level, it is allowed to award Master's as well as PhD degrees.

As the water engineering programmes under review are supported by a World Bank loan to the Ghanaian government, the government knows the importance of the institute and the programmes and tries to invest which the report will comment on in a later chapter. This underlines the importance and the special status of all study programmes under review that the experts identified during the site visit. Additional to the legal status of the institution the World Bank loan underlines the importance and excellence of the programmes under review.

As PhD students regularly attend classes and do research at the university, their legal status is the same as that of Master's students. Their legal status allows the students to work as teachers during and after their doctorate studies.

Conclusion

The criterion is fulfilled.

2. Policy and Procedures for Quality Assurance

Standards MA programme:

The programme is subject to the Higher Education Institution's policy and associated procedures for quality assurance, including procedures for the design, approval, monitoring, and revision of the programmes.

A quality-oriented culture, focusing on continuous quality enhancement, is in place. This includes regular feedback mechanisms involving both internal and external stakeholders.

The strategy, policies, and procedures have a formal status and are made available in published form to all those concerned. They also include roles for students and other stakeholders. [ESG 1.1] Standards PhD programme:

The results of the internal quality assurance management are taken into account for the further development of the doctoral programme.

Description

As outlined by the university, KNUST has established a Quality Assurance and Planning Unit (QAPU) in all academic departments in order to implement quality assurance policies within the university. The aim of the quality assurance system is to improve the process of delivering training and research to reach KNUST's target to attract scholars, industrialists and entrepreneurs from Africa and the international community.

Another important role of the quality assurance unit is the assessment of the workload and the course descriptions, which is done based on teaching load, the course content or the course significance. It also enables the university to create a Student-Teacher-Ratio of a particular programme, get information on pass rates of students and identify problem areas within the programme via failure data.

In addition, the unit manages the development of policies and its implementation within the university. Currently, implemented policies are e.g. Research Policy, Quality Assurance Policy, Teaching Policy or Disability Policy. The university states that a financial guide has been implemented regarding the financial management.

As stated in the SER, an internal accreditation for programmes is mandatory every 4 years. Therefore, requirements and formats of the National Accreditation Board are applied. As a previous step the Departmental Board, College Board and Planning and Resource Board assess and approve the application documents. Feedback and the involvement of stakeholders such as industry, government agencies, professionals or students/alumni shall be included in the internal accreditation process. Consequently, and as highlighted by the university, the proof of stakeholders during the (re-)accreditation process has to be given to each programme and is demanded by the university's structure. Stakeholder's involvement shall be conducted through evaluations and dialogues which results in the review of curricula, teaching materials and a general improvement of the course structure. A typical quality assurance process would include consultative discussions regarding the curriculum development or invitations for external examiners from the industry. The reviews of the curricula are led by the Curriculum committee which includes representatives of business and industry. The committee is set up by the College board every 4 years within the internal accreditation process. At the end of every term, student's feedback is included via evaluations of the lecturers and courses which are done online. The university targets to give feedback vice versa via the presentation of annual reports.

Nevertheless, the university states that a more structured feedback system shall be developed. The university plans for instance to develop a career tracker for alumni students in order to deepen the relation between alumni and KNUST.

Experts' Evaluation

The responsibility for all Master and PhD programmes is clearly defined, the students know about the responsibilities and the individuals in charge were praised by the students whom the experts were able to talk to during the site visit for their good responsiveness and support. All programmes are nationally accredited on a regular basis and the development of the curricula is discussed at regular intervals in the institute.

The curricula are documented and published for students and applicants in different documents. In addition to information brochures and general overviews, there is also a printed handbook for every programme in which the course objectives are specified and all relevant information on the modules is included complemented by information on aspects such as the calculation of credits in the Ghanaian higher education system, the application for scholarships, etc. The experts recommend that this central document should be provided on a low-threshold basis for each study programme, for example on the website (**Finding 1**).

The study programmes under review are embedded in the quality assurance system and regulations established at KNUST at an advanced level (regulations of higher education systems, National Accreditation Board: 4 years accreditation cycle). Based on this, the internal quality assurance system was established at KNUST, broken down in quality assurance sub-committees on department level and internal criteria, set up by the Quality Assessment and Planning Unit of the university and an additional decentralized structure to develop a quality assessment culture in each unit of the university. The results of the evaluation are put together in a report. The quality assessment system has been improved under the consultancy of Dutch experts. An additional quality control was done by the AQRM (African Quality Rating Mechanisms), including experts from Africa (Nigeria) and Europe (Denmark). The report of AQRM-evaluation shall be available in 2018.

In the discussion rounds, the external experts received a comprehensive impression of the quality assurance system and activities of the university (also available as a published document) and the further planned activities in this area. As part of the document review on site, different kinds of evaluation results were also available, which impressed the expert group in the presentation. Only dropout rates of students are not recorded yet but the faculty interviews students on motivation. With the help of such documents and data, the study programme managers are well-prepared for discussions and decision-making on improving each study programme.

Due to the size of the course groups, the discussion usually takes place in direct exchange between teachers and students and the teachers are open to react on difficulties of the students and their needs. In the experts' point of view, this good student/teacher-ratio is considered as beneficial for the learning environment of the study programmes. In addition, students know about the responsibilities and can contact the management in case of any problem. All these actions contribute to a positive surrounding for quality assurance of the study programmes.

Institutions from the public and the private sector are in regular exchange with RWESCK through the existing cooperation and the provision of internships for RWESCK students. By this, they can contribute to the positive development of the study programmes. In addition to the general exchange, representatives of the companies can also participate in the defence of the thesis of their interns as external reviewers. The involvement of stakeholders and companies is also part of the national accreditation. This leads to a convincing strategy to include external expertise in quality assurance, also regarding societal needs as representatives of the public sector are also involved.

The formal evaluation results are sent from the Quality Unit to the teaching staff in a report. For the students, these reports are available on request. By this, results and changes in the programmes are documented in a sufficient way. In addition, RWESCK is accountable to a wide range of stakeholders (for example the World Bank or the Ghanaian government) and also presented the quality and developments of the programmes in reports to them. During the site visit, these documents were only available as printouts and unfortunately not on the website. According to the responsible persons, this was caused by the relocation of the website a few days before. The experts would appreciate if they were published on the new website in the future to enhance the information of the public on the study programmes.

Due to the special framework conditions, extensive evaluations (national, World Bank) have already taken place, the results of which have been taken into account in further developments. There was also advice from the IHE Delft Institute for Water Education in the past. In the future, the institute plans to regularly accredit other programmes on an international level. These efforts are appreciated and supported by the experts who would like to underline the convincing strategy on quality management as a whole.

Activities in the area of a coordinated alumni-management are still at their beginning. On university level, extensive activities are planned for the future in which the institute will also participate. The external experts noted with appreciation that, apart from formal instruments, the teachers have good contact with the graduates and that they are partially reintegrated into teaching after graduation. Therefore, it seems that the alumni's feedback is already taken into account when discussing possible improvements of the study programmes.

The quality assurance of the PhD programmes is aligned with the structure and the responsibilities of the other study programmes of the institute. The number of admissions is based on the possibility to provide scholarships for students. Among other things, a shortlist is drawn up in the admission procedure, and in addition to the grades and certificates applicants are asked about their motivation including the submission of a proposal of the potential research question for the PhD thesis. Particularly, convincing applicants can also be interviewed if the guidelines do not make an interview compulsory. The PhD programmes' admission process is documented and transparent to applicants.

During their studies, students are continuously supported by their supervisors, they gain access to international literature and receive support to attend international conferences. Due to the close support of the supervisors and also the connection to non-academic partner institutions, the research theses can be of practical relevance dealing with questions concerning communities or specific problems of a specific subject of the study programme, and the research question is executed on academic level.

The PhD programmes are also subject to national accreditation and are included in the quality assurance system of KNUST. From the experts' point of view, the results are used well for the further development of the programmes. In addition, graduates of the PhD programmes often stay in contact with the teaching staff, and so their feedback can be obtained.

Conclusion

The criterion is fulfilled.

The external experts are firmly convinced that students and staff are highly motivated to contribute to the further development of the study programmes. It is also positive to highlight that student evaluations are implemented for all courses. The first results from the quality management are now available and with more and more graduates there will be more material for the decision making process on improving the programmes, if necessary. Besides formal evaluation processes, the professors responsible for the programmes have already dealt intensively with possible adjustments of the programmes in the past, and the experts are confident that this motivation will continue and that in addition to the results from the university's quality management KNUST will continue its discussions with the stakeholders.

It is, however, suggested that the central documents should be provided on a low-threshold basis, for example on the institute's website.

3. Quality of the Curricula

Standards MA programme:

The intended learning outcomes of the programme are defined and available in published form. They reflect both academic and labour-market requirements and are up-to-date with relation to the relevant field. The design of the programme supports achievement of the intended learning outcomes.

The academic level of graduates corresponds to the requirements of the appropriate level of the European Qualifications Framework.

The curriculum's design is readily available and transparently formulated. [ESG1.2]

Standards PhD programme:

The institution defines the aims of the doctoral programme.

The doctoral programme is aligned with the aims of the defined qualification.

The doctoral theses provide evidence that the appropriate level on the European Qualifications Framework (EQF) or the respective level on the national qualifications framework for the award of Higher Education degrees have been achieved.

Doctoral programmes are structured in such a way - with regards to the research content and the required time - that students are enabled to progress efficiently through all stages of their research and achieve their doctorate within an appropriate timescale.

Description

As stated by the university, the **MPhil/M.Sc. programmes** are designed as 2 years programmes with 4 semesters. Participants undertake 1 year (2 semesters) of taught courses and 1 semester of research leading to the thesis which will be written in the last semester. The minimum time for the completion of the Master programmes shall be 3 academic semesters.

The "Water Resources Engineering and Management" (WREM) programme aims at imparting an understanding of Integrated Water Resources Management and strives to facilitate knowledge on hydrological and meteorological data, management of water resource systems or the planning and implementation of water policies. In contrast, the "Water supply and Environmental Sanitation" (WSES) programme aims at enabling its students to develop and manage training programmes regarding human resources for sanitation and waste management or to manage projects in the relevant field of expertise.

The WSES and WREM Master programmes have a total amount of 48 local credit points. WSES and WREM students undertake some common modules such as "Introduction to Environmental Sanitation", "Mathematics and Research Methods" or "Environmental Quality". Each module consists of up to 5 courses and each course is assessed by a combination of individual assignments, group work and an exam. As outlined by the university, the courses worth 1 credit have an average teaching amount of 4 teaching days in a row and the final exam is taken after the weekend, on the fifth contact day. Courses which are worth more credits have more teaching days accordingly. The common courses have a total credit amount of 12 credits (WSES) or 14 credits (WREM). Due to its differentiation in the additional courses, WSES students focus more on questions on sanitation and water and waste management whereas WREM students focus more likely on the field of water resources, hydrology, hydraulics and environmental management. Therefore, WSES undertake additional modules such as "Sanitation and Waste Management" or "Wa-

ter Supply” and WREM students centre their studies on “Water Resources Management”, “Water Resources Engineering” and “Advanced Hydrology and Modelling”.

The university provides a module handbook for the PhD and MPhil programmes, which is updated when there are changes of course content, credit hours, new courses are introduced or courses are taken out.

According to the self-evaluation report, the **PhD programmes** are designed to be completed within 3 years and the programmes start each year in September. Each programme has a total amount of 51 credit points. Programme participants undertake 1 semester of taught courses and 2 and a half years of research which is supposed to lead to their thesis (12 CP). Nevertheless, a few courses are also to be attended during the second semester. The university states that a one month-long internship which has now been upgraded to six weeks, in an industrial field after the course work is supposed to allow students to gain practical and field experience.

The course content is delivered in the form of lectures, workshops and design exercises, field visits and community engagement. The programmes have a modular structure and each of the 6 modules contains between two and three courses. Each course has a teaching amount between 1 and 4 weeks and every courses ends with an exam. The PhD programmes’ modules comprise topics like “Integrated Water Resources Management”, “Applied Statistics and Modelling”, Skills Development and Research Methodology”, “Geo-Spatial Analysis”, “Environmental Quality and Climate Systems” and “Resilient Water and Environment Systems and Management” with a total amount of 39 CP.

Since RWESCK has 2 research groups (Water Resources and Environmental Quality), students can select their research topic after the completion of the course work and propose their topics to the supervisor in order to get feedback on possible problems.

During the time at their home research institution, students have to hand in quarterly reports on the progression of their thesis work. Likewise, in-country supervisors hand in reports on their students biannually.

Experts’ Evaluation

Considering the documentation on the study programmes, which should be published on the internet, the experts come to the conclusion that the learning outcomes of the study programmes under review are defined in an adequate way. The descriptions include both subject-specific and interdisciplinary aspects in a cogent way. The study programmes are designed to qualify the students very well on the respective academic level of a Master’s degree. The qualification aims of the PhD programmes are clearly stated by state-of-the-art targets and adequate demands to fulfil the programme’s requirements. Especially the need to write and publish two articles in peer-reviewed journals will ensure the high quality of the doctoral programmes.

The curricula of the Master and the PhD programmes are impressive and in total adequacy with the objectives as well as with the expectations of the country and the labour market. A studious student should become an excellent professional after receiving his/her diploma. By offering these well organized and set programmes, the Regional Water and Environmental Sanitation Centre Kumasi (RWESCK) entirely fulfils its mission. The syllabus of the PhD programmes is detailed and adequate. Doctoral graduates have a systematic understanding of their research discipline and are able to master all the skills and methods which are used in their research field. They have a comprehensive knowledge of the relevant literature. They contribute – through their research work – an original piece of research to the international community. Doctoral graduates have comprehensively developed skills: They identify and solve new problems in the areas of research, development and/or innovation in a specialised academic field, and they identify independently scientific questions of research. They carry out critical analysis, development and synthesis of new and complex ideas, advance the societal, scientific and/or cultural progress in an

academic or non-academic professional context, discuss research findings of their areas of expertise with (international) subject-specific colleagues, and they present and defend concepts and their research findings in front of an academic audience. However, the PhD students in their second and third year might need some additional courses for their specific research. One possibility to bridge their knowledge gap could be to allow them to take online courses (MOOCs). Additionally, the experts want to make some more suggestions to further improve the programmes which are discussed in the following part of the report.

In the current state, most of the courses of the study programmes are taught within four to five days, starting from Monday afternoon and ending on Friday afternoon (see description) for equivalent of one (1) credit hour and are assessed after the weekend (usually a Mondays). This concentration is comprehensible when courses are taught by external lecturers which are usually not located in Kumasi. The students are surely very happy to have the chance to attend classes by these professors, and the students the experts had the chance to talk to confirm the experts' impression. But still, they also pointed out that they would wish for a prolongation of the courses, at least of some, to have more time to get engaged in a specific topic. This might not be possible for all (international/external) lecturers but at least the courses taught by KNUST internal teaching staff should be considered to be extended over a longer period of time to give the students the chance to engross their minds in some subjects (**Finding 2**).

The curricular structure of each study programme supports the achievement of the learning outcomes in an adequate way. All curricular elements (courses/modules) and their functions are documented comprehensibly. An idealised typical course plan is available for each programme. The order of curricular elements supports the learner's progression. Each curriculum is well structured and covers all main aspects and learning targets of the three PhD and two MSc/MPhil study programmes. However, the curricula are very dense so that not all topics are taught in a comprehensive way due to time constraints. Therefore, the experts recommend reducing the amount of mandatory courses in the programmes in favour of the prolongation of some core courses by changing some of the current mandatory ones into electives (**Finding 3**). Courses to be extended for example are CEWS 556 "Water Distribution" and CEWS 543 "Water Treatment". Both are included in core module 5 of the WSES Master programme. The two courses cover the principal concerns of water engineers in West Africa. An expansion of the preoccupation with questions related to these topics would allow the students and the professors to work deeply on the design methods of captation, transport, storage and distribution systems, and to sharpen the students' skills in modelling including single reservoir/water tower & multi reservoirs modelling in distribution systems. Also, the course CEWR 531 "Applied Hydrology" should be extended over 3 to 4 weeks to have the chance to work more in detail in the laboratory. Moreover, an elective course "Hydrological Modelling" should be offered to improve the students' capacity building in this area. There were also requests from the labour market representatives to include this topic more extensively. They also asked for additional elective courses in "Water quality (Treatment and Monitoring)", "Experimental Hydrology" and "Programming Skills (e.g. the programming language R)".

By offering elective options in the course plans, the students would have the freedom to select more courses in order to deepen their expert knowledge in their preferred study line. One solution to get more elective possibilities without restructuring the current curriculum of each programme is that each Master student of "MSc/MPhil. Water Supply and Environmental Sanitation" and "MSc/MPhil Water Resources Engineering and Management" must take seven mandatory modules and can choose two elective modules from the other MSc (or even of a PhD) programme.

The internships, which are integrated in the study programmes, are of the short period of one month at the moment. The experts see the problem that time is limited, especially in the compact phase of studies, but still, it probably takes the student one month only to understand what exactly is done in and by the company (like the general ideas and processes). So when this goal is

reached, the student does not have the possibility to go into detailed work in the area the company works in. Also professional tutors probably are not comfortable with exposing an intern to sensitive issues before he or she has got to know the student for two or three weeks whereas after four weeks the student has to leave again. Therefore, the experts suggest extending the duration of the internship to a longer period, preferably to 45 days or two months (**Finding 4**).

In the labour market today, computer literacy is a crucial criterion for an engineer. What is designed in the programmes is good but there is room for improvement by intensifying imparting knowledge and skills in this area. However, the experts are aware that doing so requires funding for additional equipment like hardware, software licences, etc. What could easily be realized would be the enhancement of the acquirement of other interdisciplinary abilities such as presentation skills. Especially in the Master programmes this should be intensified (**Finding 5**). Maybe it would be possible to replace some exam based assessment by oral presentations including interrogations.

One option could be to have the results of the students' Master thesis research to be presented, e. g. in a student conference with speeches and workshops on specific topics. Additionally, some new elective courses could be offered in order to train soft skills (presentation skills, team work, scientific writing).

In contrast, PhD students are assessed through written examinations and presentations in their first study year. This includes individual examinations as well as group work. An examination is conducted after every course. Group works are assessed by presentations. In the second and third year they work on their individual PhD thesis and are mentored closely by their professors. The students have to submit a progress report every two months to their supervising professors. This structure ensures that the students have the possibility to remain in their time schedule. Also, a yearly summer school is provided by RWESCK. KNUST started convening an Early Career Scientists Conference (planned every 2 years) last year which is very beneficial for the Ph.D. and Master students.

Another strong point of the study programmes under review is that the university was able to show proof of the appropriateness of the learning outcomes by evaluations, graduate surveys, and/or feedback from the labour market from those representatives the experts were able to talk to during their visit. It became obvious that the programmes are highly valued also from possible employers of the graduates. For further improvement, the experts want to suggest including formal feedback from the labour market as part of the evaluation reports by developing specific surveys to gain the employer's points of view on the quality of each study programme.

Also, the interdisciplinary character of the courses should also be highlighted by showing the content related interconnections between the courses (modules) in their descriptions. For example,

CEWR 511: "Integrated Water Resource Management" has strong interlinkages to CEWR 556: "Irrigation Engineering" and CEWR 564: "River Basin Management". This relation should be addressed in the module handbook by adding a sentence in the field "course structure". All courses should be checked for possible interconnections, and these should be documented more comprehensibly in the course descriptions. For getting a better overview of the five study lines "PhD Water Resources Management", "PhD Water Supply and Treatment Technologies", "PhD Environmental Sanitation and Waste Management", "MSc/MPhil. Water Supply and Environmental Sanitation" and "MSc/MPhil Water Resources Engineering and Management", it is recommended to create a matrix of all courses indicating which courses are offered exclusively for each programme and which parts are also used in other programmes. Furthermore, it should be checked in the next version of the handbooks that all courses have a related teacher (for instance, the course CEWR 564 "River Basin Management" has no assigned teacher). It should be indicated if external teaching staff is needed for a course.

Though the experts identified areas of possible improvements, they also want to highlight that the programmes at the current level already are of convincing quality, and the recommendations should be considered as suggestions how to enhance the quality even more.

Seminars of faculty members, external experts and students are offered which include presentations. The benefits of these seminars are:

- to give students and staff the opportunity to communicate with experts from outside the university, thus enhancing understanding between academia and practice;
- to allow to share topics of relevance with the students which are not covered by the prescribed courses;
- to give students the opportunity to share their work and knowledge including constructive criticism.

In recent time, a short course was offered on entrepreneurship for staff and postgraduate students. It was based on a running cooperation with the Maastricht School of Management, Netherlands. The panel of experts recommend that such offers should be a regular part of the Master and PhD programmes, for example by training internal staff of KNUST to teach these skills in the future themselves (“train the trainer”).

The research proposal for the PhD thesis including the research plan should be completed within three months after the course work. During this period, students are expected to do comprehensive literature review of their chosen topic. The programmes seek to develop the ability of students to do independent research. Therefore, students are expected to apply their knowledge from the research methodology to plan their research work. This should be prepared in close consultation with the prospective or appointed PhD supervisors. The plan will be presented before a panel of academic staff that will make suggestions and guide the students. The students will undertake laboratory or fieldwork based on their area of specialization. Each student shall submit manuscripts for the publication of at least two papers in journal. This ensures the quality of the PhD theses.

However, for the future the experts would like to give an advice on how to further improve the academic setting of the PhD programmes. It should be considered – adequate funding assumed – to organize cooperative PhD supervision of the theses by holding conferences with professors and their PhD students from different universities of the same research field on a regular basis. In Germany, there is a successful example by the German Waste Management Association (DGAW) (see last PhD conference „Abfall- und Ressourcenwirtschaft“ (Waste and Resource Management) on 15/16 March, 2018, in Vienna). In this yearly conference, hosted alternately by different universities, PhD students of DGAW-member professors present their projects and publish a book based on their interim results. For them this is an important incentive and motivation to improve their work and compare their progress with PhD colleagues in the same field from other universities, and to get feedback from attending professor supervisors

Eventually, it should be considered to adapt the European Credit Transfer System (ECTS) or to account the national and the European credit points in the documentation. At the moment, the credits awarded are based on teaching hours in the Ghanaian system and not on the total amount of hours a student probably has to take for learning (at university and at home, in the library, laboratory, etc.) to achieve the learning outcomes of a course. The credits are based on the following calculation: one in-class hour or two hours of practical work * 13 weeks = 1 Ghanaian credit. Thus one credit of a module is equivalent to 13 hours of lecture or 26 hours of practical work. The clarification of the calculation in the documents handed out to the graduates is suggested to simplify the adequate assessment and acknowledgment of degrees from RWESCK/KNUST (respectively any Ghanaian university) on international level. Therefore, the

graduates should receive a document like a Diploma Supplement which describes the surrounding conditions of the degree awarded (**Finding 6**; also see chapter 5).

Conclusion

The criterion is fulfilled.

The experts only see room for improvement in some areas which could help to further optimize the study programmes with regard to documentation and its publication online, curriculum design (duration of courses, implementation of electives) and preparation of the students for the labour market (duration of internships, acquirement of soft skills).

4. Learning, Teaching and Assessment of Students

Standards MA programme:

The delivery of material encourages students to take an active role in the learning process.

Students are assessed using accessible criteria, regulations, and procedures, which are made readily available to all participants and which are applied consistently.

Assessment procedures are designed to measure the achievement of the intended learning outcomes. [ESG 1.3]

Description

Learning, Teaching

At the Kwame Nkrumah University of Science and Technology, courses are typically conveyed as power point presentations, lectures and seminars. According to the SER, a committee ensures that the course contents are designed according to the syllabus. The learning modes of the courses are thus tailored to suit the students of each programme and include guided reading, design exercises, laboratory sessions, individual and group assignments or field trips.

In situations which require extra teaching or assignments, extra tutelage on a one-to-one basis or as a group is offered. Since the teaching language is English, the university offers also English courses to international students who are struggling with the language.

Due to a double degree agreement with UNESCO Institute for Hydrological Education (UNESCO-IHE) students are able to take courses of the programme at IHEy, and UNESCO-IHE can support KNUST regarding the research phase. Students of the programme can therefore do research either at KNUST or at UNESCO-IHE.

Assessment

The examinations are guided by rules and regulations of KNUST which have been legally assessed. These guidelines are also available to students. In general, each examination is conducted by at least one invigilator. The dates for the examinations are published at the beginning of each semester. According to KNUST, the university facilitates repeat exams at the following batch or at a special time coordinated between the programme coordinator, lecturer and student.

Depending on the course, curriculum and the course outline, learning objectives are achieved by assignments, masterplan and field trips as outlined by the university. For other learning objectives a written examination is used to assess technical knowledge. Throughout the programme, students are made to present written and oral assignments which aim at improving their communication and presentation skills. The PhD programme employs more case studies and practical evaluations and analysis of options and presentations to assess the students.

As stated by the university, students are given worked examples to get an overview of the examination type. Assignments are also fashioned in a similar way as the exams and in some cases exam types are discussed after the end of the module.

Regarding the graduation, the university demands to undertake a research project under supervision of a university lecturer which shall lead to an externally and internally examinable thesis. The School of Graduate Studies also provides a handbook to guide all postgraduate students on issues relating to exams and dissertation.

Experts' Evaluation

The didactic methods in the Master and PhD programmes comprise different teaching modes including power point presentation, lectures and seminars. Learning modes include guided reading, design exercises, laboratory sessions, individual and group assignments, a master plan, community study and field trips. The use of such teaching methodologies has a paramount importance to transfer the necessary information and skills to students. The basic courses offered at the beginning of each Master and PhD programme intend to raise students' knowledge to the same level and to get them used to study (again), as some of the students return to university after a working period. This is why there are senior PhD students from partner organizations in the programmes, too. The two semesters of lectures for PhD students intend to do repetition and to level-out differences. These curricular arrangements are reasonable to make sure that all students can reach a comparable level.

As already mentioned above, courses are often carried out by external lecturers as intensive courses for a short period of time. This might lead to a situation in which students will not be able to gain specific knowledge as it should be in an ideal way, so it should be considered to extend the period of the courses, at least in certain cases, especially those given by local professors or lecturers (**Finding 2**; also see chapter 3).

In order to give students an idea what to expect, they are given worked examples that reflect the range of examination types. Additionally, questionnaires are made available to students. Assignments are also fashioned in a way that gives an idea of the type of exam questions one would expect, and in some cases lecturers discuss the exam types with students at the end of the module. The panel of experts highlights that by using old exams the department might run the risk that exam questions are repetitive.

The assessment procedure for most of the courses is based on course work and written exams. This procedure is valid for most of the courses listed in the curriculum. None withstanding, it might be helpful to introduce more oral examinations to foster presentation skills of the student body, especially in the Master programmes (**Finding 5**; also see chapter 3). Regarding the appropriate spectrum of examination types during the studies, most of the courses are designed depending on the course curriculum and the course outline. Learning objectives are achieved by assignments, the master plan and field trips, including the PhD students. For other learning objectives a written examination is used to assess technical knowledge of students. However, some improvements could be made to have more variety of exams for all courses in both the PhD and the Master programmes. This, for instance, might apply for courses such as data management, GIS and spatial planning, and research methods where the assessment could be done in a more practice-oriented exercise or in group work presentation.

The university informs its students in case of changes of the examination in duly time and in case of the make-up of an exam the date is arranged between the instructors and students. As stated during the discussion rounds, every student is informed about the necessary requirements and conditions to be fulfilled including the completion of the course or minimum attendance requirements for course work. During the discussion with Master and PhD students it has also been

confirmed that examination dates are marked clearly on their time tables and are made available to them at the beginning of the semester.

If a student misses an exam a possibility to re-sit the exam is given within a convenient time as per the request of the student. Apart from the allowance to re-sit an exam twice in case a student fails, the department provides tutorials for Master students to eliminate possible problems. Methods of teaching and learning, regarding the diversity of students and their needs, enable flexible learning paths. By offering English language courses for non-native English speaking students the university also enhances the general study conditions for students from neighbouring countries.

Although the structured PhD programmes have obligatory modules, which shortens the time for research in the end, the structure supports students to gain a better understanding and knowledge in the specific field. Furthermore, PhD students present their research outputs three times a year. PhD students develop their research proposal in consultation with their professors, which will be defended in front of a panel. After having successfully defended the proposal, students carry out their thesis which is to be defended in the end and the output is evaluated by two external and internal reviewers. This process ensures a high quality considering the code of good academic practice. Still, the standards should be documented more transparently, and it should be made clear in the description of the PhD programmes that aspects like plagiarism are taken into consideration. The experience of the professors involved in the evaluation of the programme shows that plagiarism is often not understood as a problem or finally ignored by students. This might lead to plagiarism cases which can be avoided by systematic information (such as it being a criminal act in many countries).

According to KNUST rules and regulation for the Master programmes regarding the minimum pass mark for any course subject shall be 50%, and the minimum Cumulative Weighted Average (CWA) for graduation shall be 55%. For PhD students, the minimum pass mark for examinations in any course shall be 55%, and the minimum Cumulative Weighted Average (CWA) for graduation shall be 60%. However, the distribution of grades above the pass mark is not clearly stated in the SER, neither is the grade distribution for thesis results as excellent, very good, good, satisfactory and non-satisfactory given. Considering the information gathered during the site visit, the experts conclude that most of the students achieve good results in the exams.

The School of Graduate Studies offers a handbook to guide all postgraduate students on issues relating to exams and dissertation, and examinations are guided by rules and regulations as cited by the university. These guidelines are made available to students or published on student's notice boards. To strengthen this transparency, the university should make all exam regulations and further information accessible in hard and soft copy, especially by publishing it online (**Finding 1**, also see chapter 2).

The panel of experts is excited about the opportunity that Master and PhD students receive the possibility to carry out research activities in communities which are based on local problems. By doing this, students get very good contact and the possibility to gain experience of cooperation with different fields. Moreover, this is supported by internships the students have to complete during their studies, which sharpens the awareness for community problems and possible solutions. This helps students to relate theoretical knowledge with practical experience. Notwithstanding this satisfying trend, it has to be underlined that the length of the internship should be extended (especially for Master students) in order to strengthen the practical experience (**Finding 4**; also see chapter 3).

Conclusion

This criterion is fulfilled. The panel of experts gained a very positive impression during the site visit of how and to what extent courses are taught at KNUST. The learning and teaching methods for all programmes facilitate a very good and deep knowledge in the specific fields.

5. Student Admission, Progression, Recognition and Certification

Standards MA programme:

Consistently applied, pre-defined, published regulations are in place which cover student admission, progression, recognition, and certification.

[ESG 1.4]

Standards PhD programme:

The relevant formal criteria such as admission requirements and procedures, examination conditions and the award of the degree are described and have been published.

Description

Admittance to the study programmes

According to the report, the minimum entry requirement for the MPhil/M.Sc. programmes is a First

Class or Second Class (Upper Division) degree or its equivalent from a recognized university in Civil or Chemical Engineering, Water and Sanitation, Chemistry or any field of specialization relevant to the water and sanitation industry. Nevertheless, applicants with Second Calls Honours (Lower Division) and several years of experience can also be considered for a selection interview. Candidates from non-Anglophone countries must also provide an internationally recognized Certificate of English Proficiency (e.g. TOEFL or IELTS) with above average score or have the availability to attend a three-month class with a written exam.

As stated by the university, the selection procedure is launched by the Head of the Civil Engineering Department in collaboration with the programme coordinators. In a first step every application is checked whether the candidates fulfil the minimum requirements. Thence, a shortlist of applicants is created in order to invite possible candidates for an application interview. In a last step the committee decides on the admittance to the programmes according to the planned enrolment and based on the score achieved by all applicants.

KNUST charges tuition fees but provides financial support like scholarships that cover tuition and research costs. As stated by the university, the revenue of tuition fees is mostly distributed to the Department/RWESCK (60%) whereas the rest is distributed between College (20%), Administration (10%), Faculty (7%) and College Library (3%).

Progression

According to the university, the programmes' structure takes into account the level of readiness of the students, occupational requirements as well as age requirements of the students. As the programmes are taught in English, the university offers English language courses for international students.

Creditation and recognition

As explained by KNUST, there is no policy on credit transfer for postgraduates but consideration is done on case-by-case instances. The university, nevertheless, gives an example for credit transfer with an agreement between KNUST and UNESCO-IHE due to the joint programme of-

ferred by both institutions. Credits gained in both KNUST and IHE are accepted at each institution and contribute to the award of a double degree.

University credits and workload are assigned on the basis of the teaching load, importance of the course as well as the type of course (group exercise, field trip, etc.). KNUST uses local credits.

Experts' Evaluation

The requirements for admission are defined and accessible on the KNUST websites for all interested applicants. The formal transcript can be found in the official records of KNUST. In addition, all programmes have a handbook with more detailed background information about each programme including descriptions of learning outcomes, employment opportunities, entry requirements, scholarships, and information on the modules.

In addition to the formal requirements such as a corresponding preliminary degree, English language skills are required. To support francophone students from neighbouring countries there are English language courses (and French courses for the Anglophone students in some programmes to enable exchange programmes). Applicants who do not fully meet the formal requirements are interviewed and, if necessary, examined in a written test. This procedure is adequate and the regulations are transparent to the public.

Entry requirement for the PhD programmes is a good Master's degree in a subject-appropriate field to the PhD programme. In principle, an interview takes place in the admission process of the PhD programmes on the basis of the research proposals of the applicants. Furthermore, the work experience must be set out. In case of admission to a PhD programme, the research proposal needs to be further specified together with the supervisor. In the experts' point of view, this is a suitable way of admission and of guaranteeing that the PhD students can be successful in time. This impression is also supported by the low dropout rates. Up to 20 scholarships are available per year for PhD studies; making it about five scholarships or more per year for each of the three PhD programmes, with minimum of three years and maximum of four support. PhD students present their progress quarterly to the funding organization; the financial funding is limited in time, a penalty fee on exceeded dissertation time is an incentive to finish in time. The mode of presentation depends on the supervising professor, for example it was mentioned during the site visit that some advisors demand three presentations per year, which is very demanding. An international conference was recently hosted including PhD presentations of RWESCK PhD students. These processes ensure that PhD students can finish the thesis in time and that the progress of their research is supervised on a regular basis.

Basically, statistical data on teaching loads, student/graduate and failure rates is provided by the administration and the reviewers also had access to exemplary datasets. Due to the size of the cohorts, the responsible actors at RWESCK do not only rely on statistical data, they also know the individual situation of the applicants and students. This is beneficial for professors and students alike. Due to the close relationship problems can be detected and solved easily.

Basically, the institute wants to recognize equivalent and non-KNUST-awarded qualifications/credits but this has never been requested until now. Therefore, there is no published regulation on this in a formal document at the present time. Due to the structure of the programmes and the funding conditions of the World Bank, no exchange programmes are currently in place, no student has gone to study abroad or to another university in Ghana in the past during the time of studies at KNUST, and therefore learning agreements have not been necessary yet. For thesis' work in companies and public institutions, contracts are made between RWESCK and the partners in which the recognition of the work is regulated.

All essential information can be found in the programme handbook. However, the reviewers suggest that this information should be concentrated again in a separate document (such as a Diploma Supplement) and should be given to the graduates alongside the certificate to inform po-

tential (national or international) employers about the study programmes and the acquired competences in more detail (**Finding 6**; also see chapter 3). This might also facilitate the acknowledgement of the degree in other countries.

The examination procedures are known by the PhD students. The PhD dissertation (monograph and cumulative dissertations are accepted) needs to be defended orally in front of an internal and external mixed panel in a public presentation. The final grade is made up of the mark of the dissertation and the oral presentation plus of the discussion. This procedure is published by KNUST in official records.

Conclusion

The criterion is fulfilled.

However, it is suggested that graduates should receive a separate document (such as a Diploma Supplement) which informs e. g. employers about the study programme and the acquired competences. Furthermore, the topic of learning agreements should be dealt with in the context of the transparent documentation of the programmes in the future. Therefore, appropriate formal recognition rules should be developed and the students should be informed about them.

6. Teaching Staff

Standards MA programme:

The composition (quantity, qualifications, professional and international experience, etc.) of the staff is appropriate for the achievement of the intended learning outcomes.

Staff involved with teaching is qualified and competent to do so.

Transparent procedures are in place for the recruitment and development of the staff. [ESG 1.5]

Standards PhD programme:

The qualification of supervisory staff (m/f) is appropriate to ensure that doctoral students are supervised at the correct academic level.

The personnel are sufficient in number to safeguard supervision arrangements on the doctoral programme.

The remit of supervisors is clear and transparent.

Description

As outlined by the university, KNUST currently employs overall 770 full time academic staff. Among these are 19 Professors, 53 Associate Professors, 211 Senior Lecturers, 11 Senior Research Fellows, 424 Lecturers and 52 Assistant Lecturers.

KNUST outlines that it adheres to a defined process for hiring new staff. Vacancies are announced online on the university's website and print media. Applications are passed on by the Human Resource Development Office to the corresponding department which evaluates the applications and forwards recommendations to the College Appointments Committee. The committee scores the candidates based on set criteria which include research and teaching experience.

Regarding the promotion of staff, the university requires the demonstration of publications in high impact journals as well as confirmations of grants obtained and social services rendered to the community.

Newly recruited staff members are given special training sessions to formally introduce them into the university structure. In addition to this, training programmes are given at the annual summer school and cover topics such as financing of higher education, teaching techniques or innovative

teaching. The university provides also a mentoring programme for new staff which comprises the mentorship of staff during their last two years before retirement. During the academic year teaching and non-teaching staff might have the opportunity to attend short term courses which can be sponsored under certain conditions.

The university also points out that new teaching methods have been implemented in the recent years. In particular, KNUST highlights the Danish funded BSU II project which focused training on problem based learning.

Experts' Evaluation

The required resources for the Master programmes under review are checked with regard to the capacity of the institution. The successful completion of this check was documented and discussed during the site visit as part of the accreditation process. According to the national standard of Ghana, the student/teacher ratio should be one lecturer in relation to 18 students in Engineering. Compared to standards, this is a very positive regulation as it gives teachers and students the possibility to work together closely which both sides benefit from.

At KNUST, part-time lecturers are very common and external lecturers are difficult to hire due to financial limits. Professors are directly hired by the university, the mechanisms of the hiring process are explained in the National Accreditation report of Ghana, and by thus are transparent to all persons involved. From an external point of view one future target should be the increase of full time professorships, encouraging especially experienced PhD graduated women to apply for these positions.

In the self-evaluation report, all human resources (professors, associate professors, senior lecturers, lecturers) and staff from other supporting departments are documented, including their academic qualification, teaching experience, teaching hours and their instructional area. If their teaching hours include offerings open to other programmes, this is transparent. The report includes publications of all staff members within the last five years, donor funded projects and extracurricular activities. The teaching staff is well chosen and their academic profile ensures that many subjects can be taught by teachers who are locally based.

It is ensured that long-term accounting of the teaching hours is available for the period of accreditation. KNUST is supporting continuity by mentoring new staff two years before the retirement of faculty members. The transparent recruitment procedures for teaching staff are in place, as mentioned above. The KNUST study programmes exchange academic staff and thereby help each other but during the site visit it was mentioned that the interlinkage of programmes could be improved on curriculum level (see chapter 3).

Procedures are in place to ensure and develop appropriate didactic qualifications of the teaching staff. Especially new lecturers, part-time lecturers and associate lecturers are trained by additional offers like "training on the job" for one year (in case of lacking teaching experience), special training sessions for new lecturers which make them familiar with the KNUST structure including didactics and teaching schedules. A regular repetitive offer for lecturers is the annual "summer school" training special skills like leadership, financing/funding, science management and university didactics. An offer for the administration staff provided by Ghana Association University Administrators is the so-called refresher trainings.

KNUST has been supporting e-learning and problem-based learning in the last years, as mentioned above. RWESCK enables research sabbaticals for the staff but only some of the study leaves are paid. Every two years the Excellence Award of teaching is given, an incentive to improve the didactic skills of teaching staff members on a regular basis.

The Master programmes are integrated in the national accreditation system of Ghana, as discussed above. These processes also include the check of the quality of the teaching staff which ensures a high level of their proficiency and development.

The supervision of PhD students seems to be very personal and comprehensive (see above). Students are supported if they struggle during their thesis phase or other obstacles like with children's care occur. PhD candidates requested to have more opportunities to present the status quo of their research directly to their guiding doctoral supervisor. The supervisor has the task to support developing the research question after two semesters of study and finding an internship of six weeks.

KNUST has been entitled to grant PhD degrees for many years. It is clearly stated that the scientific staff is doing supervision of PhD students. There is a KNUST fund to support research projects of the teaching staff, enabling them to combine research questions with PhD theses on selected topics. Lecturers improve their knowledge by inviting them to the yearly summer school and by participating in international conferences. Due to the close cooperation with the Water Research Institute of Ghana and the Water Resources Commission there is a tradition and existing culture to include external representatives in the defences of dissertations at KNUST. The discussion with the experts underlined this impression.

Before a PhD thesis is submitted and the oral presentation is given by the PhD students, there are different means of internal discussion and criticism of the status quo of the research project within the group of teaching staff. Five experts are involved in total in the oral defence of a PhD Thesis: these are two external professors, the guiding professor/supervisor, one internal professor from another department and a department supervisor. By involving the teaching staff this way, the academic quality and supervision of the dissertation can be ensured.

The academic supervisors have in-depth subject-specific knowledge which is documented by their recent publications and the involvement in the above mentioned international conference organized by KNUST that shows activity in the improvement of the new programmes. These facts guarantee a suitable subject-specific supervision of the PhD students.

The high academic standing of KNUST academic staff is supported by the fact that many faculty members have an international education background like Master studies abroad; PhD degrees in the Netherlands or China, Japan, Russia, Germany. A longstanding cooperation with the UNESCO-IHE Institute for Water Education located in Delft, The Netherlands exists with RWESCK, which the students of the study programmes under review can profit from. UNESCO-IHE is organizing world-wide education on water quality and water supply, founded in 2001. This cooperation also guarantees the quality of the study programmes by enabling students to study abroad and receive a double degree if they are accepted to do the programme.

Conclusion

The criterion is fulfilled.

The high quality of the teaching staff at RWESCK ensures the high quality of the study programmes under review, and the experts were impressed by the commitment of the teaching staff to support the students both in the Master and the PhD programmes.

7. Learning Resources and Student Support

Standards MA programme:

Appropriate facilities and resources are available for learning and teaching activities.

Guidance and support is available for students to advise on achieving successful completion of their studies.

[ESG 1.6]

Standards PhD programme:

There is a research environment in place which facilitates the relevant research and fosters the qualification which is necessary for a future research career inside academia or outside an academic context.

Doctoral students have access to access to an appropriate infrastructure.

Sufficient and suitable guidance and supervisory systems are in place.

Description

Facilities and resources

According to the SER, the university disposes two lecture rooms and two study rooms. The programmes have a library in addition to the College of Engineering Library and the University Library. Student's library fees are covered by the overall fees paid. In addition to the Central Laboratory, Food Science Laboratory and other laboratories on campus which support student's research, the department has its own Environmental Quality Laboratory for teaching and demonstration. Being funded by the World Bank and using this loan, RWESCK has three new laboratories within the new Centre Building to which augment the existing campus.

Information, consultation and guidance

According to the self-evaluation report, KNUST offers orientation and introductory events to freshmen. At this, the centre management welcomes the freshmen and introduces them to the programme by explaining the university and the programme modules and its contents. Additionally, KNUST illustrates research interests of staff and both past and on-going research. During the welcome event freshmen will get to know as well all points of interest for the study programme as e.g. lecture rooms, department offices, Centre management office, laboratories or libraries.

Students are informed on any relevant information by mail, telephone calls and via the programmes' website. The secretariat makes information available on the academic year (teaching schedules, oral presentation schedules) or gives advice on internship placement and research interests of staff. Students also have the possibility to arrange appointments with the teaching staff for consultations. The university also aims at dealing with the concerns of international and exchange students by giving them briefings on travel information, transportation arrangement, security, accommodation options or cultural belongings. The university has established the University Counselling Unit to provide support to students with disability or with special life situations.

Experts' Evaluation

The detailed campus tour offered to the panel showed in many cases a high level of laboratory equipment at KNUST labs. The lab offers are split in several faculty labs all over the 20 km² campus site of KNUST. European and German manufacturers of lab equipment were identified. The labs are funded mostly by World Bank loans. The faculty was able to provide an overview on lab trainings in water quality and water supply, waste water treatment, split to undergraduate, graduate and PhD offers on site. As these are facilities of high standard in different areas, they should be pointed out more clearly. This could be used for quality control and future marketing of RWESCK and KNUST as a whole.

However, the old water quality control lab is in a poor state at the moment and the hydraulic lab was not ready for operation in many parts. Fortunately, the new building is under construction and the experts were assured that the department will have a new lab there. The experts assume

that the funding will be sufficient to provide adequate new equipment to do up to date research there but also want to stress that this is required because the state of the current lab is not sufficient (**Finding 7**). As the experts were not able to visit the new lab yet, it is unclear which training will remain in the old lab building and by how many students the new lab and equipment can be used (PhD, Master, Bachelor). Because of additional offers and existing excellent interdisciplinary cooperation (e. g. with the Medical Faculty lab, Bio-lab, Pharmaceutical Faculty lab, food quality control lab) it would be useful to have a technical list with existing analytical instruments for water research, their lab location and contact partners. This would offer an easier access for future PhD activities, especially for international students and guest researchers of RWESCK. As the highlights of the facilities should be documented, preferably online, also these facilities should be illustrated on the department website. Also, the department could broaden its cooperation with other departments to do interdisciplinary teaching and research, for example in the current research field of plastic waste and ocean pollution (including aspects of Civil Engineering, Water Engineering, and Chemistry).

It is also recommended to establish a maintenance plan of the old and new lab in total and the laboratory devices (maintenance responsibilities, possibly donors/sponsors of expensive devices, university internal usage fees to feed fund for replacement purchase). Due to the natural depreciation of devices and repair efforts caused by long-term usage the quality maintenance of the facilities has to be ensured, especially for those lab facilities which have been set up as part of the World Bank funding loan (**Finding 7**). The future sponsorship by local partner organizations can be discussed in this context like grant agreements, crowd funding, et cetera.

In spite of this one negative aspect of the facilities used for the study programmes, the experts want to emphasize that they are convinced that the conditions to run the programmes are good and on their way to be improved in short time, and that they rely on the statements of the people in charge at KNUST that the new facilities with adequate equipment will be available soon.

During the site visit, the internet connectivity was low or non-existent. Therefore, the experts suggest improving it (**Finding 8**). The students complained about low internet access on campus. The existing problems are power cuts, a slow speed and the possible risk of hacker attacks on department sensitive documents (as it happened in the past). Furthermore, in the future there should also be internet access in the dormitories, and as an interim solution WLAN hot spots could be improved. A reliable and fast internet connection is needed to do research, especially for PhD students but also for those in the Master programmes.

Also the faculty should discuss the advantages of floating software licences and server supported software offers for students. Some German universities have the offer of floating licences, for example the use of Life Cycle Assessment training software (like Umberto®, GaBi®, SIMAPRO®). With a floating licence the individual can get access on the internet with a password and work with the special software at any place. This offers attractive flexibility for PhD students and those students who are not staying at dormitories on the campus, and such offerings also enhance the possibilities to do research for students with home care duties.

An additional library room called “research corner” is offered for postgraduate students, based on the concept of a teaching library. This is an attractive working space offside the areas of the crowded library rooms. There are also additional team-work and conference rooms at the university library. It was explained to the experts that a potential increase of full internet access computer working spaces in the library is in the offing which the experts would appreciate.

During the site visit the experts gained the impression that the students’ and teaching staff access to international journals and databases in the fields covered by the study programmes should be improved, especially those with a high impact factor (IF) and international renowned book series (e. g. Springer link: English books in engineering, etc.) in the scientific field the RWESCK teaching staff does research on (water supply, water quality, water engineering, waste

water, integrated water management; waste management and recycling, cleaner production, chemistry, soil science, civil engineering). Another important basic mean for research are public databases e. g. for modelling, regional, national and international statistics (**Finding 9**).

Due to the small student groups in Master courses (30 students per year) and PhD courses (15 students per year) the offers of two lecture rooms and two study rooms (initial report) plus library spaces like “research corner” plus lecture rooms in the dormitories plus lab offers at different campus sites seem to be sufficient.

KNUST also offers orientation and introductory events to freshmen by the centre management. The department secretariat makes information available and is very helpful to the students, as they mentioned during the site visit. Advice on internship placement can be given to advanced students, if needed. The new domain of KNUST RWESCK shall offer all programmes’ information and module descriptions. Students are able to arrange appointments with the teaching staff for consultations. The excellent relationship of teachers and students and the individual support were already valued above. KNUST and RWESCK also offer information and consultation for students with special needs, such as pregnant students or students with children, disabled students, students from foreign countries, etc.

At the moment, the funding for PhD students is mainly based on scholarships. Some also teach at other educational institutions. In the future, KNUST could discuss to implement new positions as research assistants for PhD Students. The experience with scientific assistant positions for PhD students in Europe shows that they benefit from daily academic work duties like exam draft, exam supervision and exam corrections, and holding interim lectures when the professor is not available. This could also support their qualification to become professors after the PhD. **Conclusion**

The criterion is fulfilled.

The study programmes benefit from the cooperation with other departments and the possibility to use several labs of high standard for different research areas. Also, the campus is spacious and has room to expand the possibilities in the future by building more facilities. But still, some of the department’s facility should be equipped with up to date equipment in the near future when the new building is completed. Also, there is room for improvement considering a reliable and fast internet access. And the access to relevant international journals and publications as well as databases should be improved.

8. Information

Standards MA programme:

Data is collected from relevant sources and stakeholders, analysed, and used for the effective management and continuous enhancement of the programme. [ESG 1.7]

Impartial and objective, up-to-date information regarding the programme and its qualifications is published regularly. This published information is appropriate for and available to relevant stakeholders. [ESG 1.8]

Description

According to the university, KNUST gathers information from stakeholders via consultations to discuss new trends in the fields covered by the study programmes, research gaps and requirements of the labour market and to tailor the study programme to its needs. Due to the proximity to the labour market, external lecturers are also an important source of information.

The university publishes information on the study programmes yearly during the admission window on its website and in print media. The information comprises admission requirements, appli-

cation window, funding opportunities and contact for enquiries. The department has set up its own website which shall be used to provide information on the study programmes.

The university confirms that it collects data on students' profiles and progression, their satisfaction as well as on the effectiveness of teachers with the help of an information system. KNUST also states that it is aiming to implement a programme evaluation system which involves graduating students/alumni.

Experts' Evaluation

During the site visit it has been demonstrated that all the relevant information on the study programmes were collected, analysed and published. After being hacked the website moved to a new site and thus is still under construction. As the teaching staff is very supportive to the students, the experts assume that all relevant information which was available in hard copy will soon also be at disposal on the internet.

The connection between the department and the labour market is in good working order which results in the capacity to react to new trends in the field on short-time period, and necessary additions of specific research fields are taken into account easily.

As stated during the site visit, the university publishes information on the study programmes under review on a regular basis during the admission window on its website and also as hard copies on notice boards, etc. This information basically covers admission requirements, funding for students and information on the study programmes. Additionally, students can approach the teaching staff or the administrative staff to receive information on a specific study programme on an individual and informal basis. The expert panel suggests publishing all relevant information on the study programmes in a more continuous way, especially online since the new website is online now. To raise the transparency of the documentation of the programmes, it is recommendable to publish the relevant information such as learning outcomes, module descriptions, calculation of credits according to national standards and further information on the Ghanaian higher education system, guidelines, examination regulations and administrative procedures in soft copy as well as in hard copy (**Finding 1**; also see chapters 2 and 4), and also to hand out a Diploma Supplement or a comparable document to the graduates (**Finding 6**; also see chapters 3 and 5).

Conclusion

The criterion is fulfilled.

The panel of expert highlights the strong commitment of the department to make available all kind of information on the study programmes under review. To strengthen the transparency in a more formal way, it is recommended to publish all relevant information in a systematic way online.

In general, the experts want to conclude that besides some minor critique and recommendations to improve the programmes, the strong points of the Master and PhD programmes of KNUST, hosted by the Regional Water and Environmental Sanitation Centre Kumasi (RWESCK), are:

- The commitment and engagement of both students and lecturers;
- the expertise of the professors as well as of the external lecturers involved;
- PhD students are committed to publish in international peer-reviewed journals;
- very good relation between students and lecturers; professors have time for their students;
- the numerical relation of students to professors is excellent;

- the professors keep in touch with the alumni; this gives good opportunities for further teaching recruitment and internships;
- most of the facilities of KNUST and the upcoming building of the Regional Water and Environmental Sanitation Centre Kumasi (RWESCK) are very good and have a high standard which should be adapted to all facilities and be maintained systematically; □ funding of the PhD and also the Master students is well provided.

III. Recommendations of the panel of experts

The panel of experts recommends to accredit without conditions

- the Master programmes **“Water Supply and Environmental Sanitation”** and **“Water Resources Engineering and Management”** and
- the PhD programmes **“Water Resources Management”**, **“Water Supply and Treatment Technologies”** and **“Environmental Sanitation and Waste Management”**

offered by **Kwame Nkrumah University of Science and Technology, Ghana.**

Findings:

1. All relevant information on the study programmes such as learning outcomes, module descriptions, calculation of credits according to national standards and further information on the Ghanaian higher education system, guidelines, administrative procedures, etc. should also be published online.
2. The period of courses should be extended, at least of the courses given by internal teaching staff.
3. The amount of mandatory courses should be reduced; instead the duration of core courses should be prolonged and some should be made electives.
4. The duration of the internship should be further extended, especially for Master students.
5. Especially in the Master programmes, the development of presentation skills and further soft skills should be intensified.
6. Graduates of each programme should receive a Diploma Supplement or a comparable document to inform about the Ghanaian higher education system in general and the study programme in detail, such as duration of studies, learning outcomes, calculation of credits, etc.
7. The department should get new equipment to do water quality research, and a maintenance plan for the facilities should be determined.
8. There should be a good and reliable internet access on campus, especially for students, particularly PhD students, to support the possibilities for doing research.
9. The access to international journals and databases in the fields covered by the study programmes should be improved.