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Evaluation Report

Bachelor and the Master Degree in Food Technology as well the international Master degree in Food Science and Technology

Provided by
Chulalongkorn University, Bangkok

Version: 04. October 2018

Inhalt

1) Formal Data

Name of the degree program	Statistical Data ECTS/corresponding Thai credits/duration of study/mode of study/level of the national qualification level	Labels applied for	Intake rhythm /first time to offer in current version
Bachelor in Food Technology	214,5 ECTS/143 CU credits 8 semesters/full time/NQF level 6	EQAS Food Label	Twice a year/new program version as of 2018
Master in Food Technology	54 ECTS/36 CU credits/4 semesters/full time/NQF level 7	EQAS Food Label	Twice a year/since 2018
International Master in Food Science and Technology	58,5 Credits/39 CU credits/ 4 semesters/full time/NQF level 7	EQAS Food Label	Twice a year/since 2018

Date of the contract: 04.06.2018

Submission of the final version of the self-assessment report: 26.09.2018

Date of the onsite visit: 20-21.09.2018

at: Department of Food Technology, Faculty of Science, Chulalongkorn University, Bangkok

Expert panel:

Prof. Dr. Vasso Oreopoulou, National Technical University of Athens, School of Chemical Engineering, Athens, Greece

Prof. Dr. Saverio Mannino, University degli Studi di Milano

Dr. Mihaela Begea, Senior Researcher, Polytechnic Universita of Bucharest

Oraphan Chucklin, APAC RD Director, Pepsico Services Asia, Bangkok

Darika Awapak, Thammasat University, Faculty of Science and Technology, Ph.D. Student

Representative of the ASIIN headquarter: Dr. Iring Wasser, Managing Director
Responsible decision-making committee: Accreditation Commission of IFA, Criteria Used: European Standard and Guidelines , 15.05.2015, IFA Accreditation Criteria

2) The rationale of the programs

2.1 Needs of Stakeholders

There are many educational offerings in the area of food science and technology in Thai higher education institutions. Today students can enroll in study programs at more than 70 universities in the country. As to Chulalongkorn University, the Faculty of Science has offered its Bachelor program since 1963 under the Department of Chemical Technology, the national version of its Master program since 1973 and the International Master program since 2001. The Department of Food Technology has been established in 1984 and today offers one undergraduate and three graduate programs (including a doctoral program in food technology, which however has not been reviewed during the accreditation visit at this time).

The University convincingly argues that there is a considerable demand for graduates on the Bachelor as well as (to a lesser degree) on the Master level. This claim is justified by the fact that the food industry is the country's third largest industry and with more than 10,000 food and beverage processing factories operating in the sector. It accounts for almost one fourth of Thailand's Gross Domestic Product (GDP). Thailand aspires to become a world leader in the food processing industry as "kitchen of the world".

The program coordinators claim that there are manifold job opportunities available for its graduates. They accordingly are set to assume positions in the management of food production lines as well as in the management, supervision and inspection of food processing systems and related products. They also can find employment in the distribution and purchasing of raw materials and finished products, food additives and food equipment, in the analysis and quality control of raw materials, finished products, additives, packaging and other aspects of food production, in the area of market and consumer research and related activities in food production as well as in research and development of food processes and products.

The program coordinators at Chulalongkorn University point to the fact that the demand of the market and consumers is subject to continuous changes together with an increase in the consumer's awareness of the importance of food quality, nutrition, and food safety.

At the same time the global competition in the food sector is increasing, which is contributing to the need to offer modern food science programs. Thailand´s current National Economic and Social Development Plan (year 2017-2021) also aims at strengthening the agricultural production capacity in the industrial chain.

In summary, there is a need for specialists in the field, which have a strong scientific knowledge and ability to respond to the needs of the agro-industrial sector. Thailand, according to the department, currently lacks these agro-industry specialists, which provides a rational to educate skillful professionals for food industry in all levels.

The expert team, after speaking to all stakeholder groups during the on-site visit, confirms that there is a high demand for graduates on the Bachelor level and that job perspectives overall are good in the sector. As regards the national Master program however, the number of applicants and graduates are considerably lower, which resulted in complaints by CU professors, who were interested in engaging in research activities, but were lacking qualified Master students for support.

In as far as the International Master program is concerned, the graduation figures are exceedingly small over the past 17 years of its existence, with only a one-digit number of foreign students enrolling in the program every year.

There are a number of factors, which in the expert´s view must be attributed to this lack of enrollment on the graduate level. On the one hand, a Bachelor qualification continues to be the standard entry qualification level to the Thai job market. In addition, Master graduates in comparison are not receiving a corresponding much higher salary on the entry level. Apart from these external factors, there are however also intrinsic problems regarding the profile and structure of the programs which are further specified in this report. The experts before this background see a need to sharpen the profile **of the national Master program** in line with the specific research strength of the department instead of offering a "generalist" profile not being to a sufficient degree distinguishable from educational offerings at other institutions. **As to the international Master program**, they recommend critically reevaluating the existence of the program altogether and either to invest in major recruitment efforts/start serious marketing campaigns, while modernizing it along the lines mentioned in this report or to stop offering it as the output does not justify the considerable investments made by Chulalongkorn University).

2.2 Educational Objectives and Program Objectives

The Department according to its Self-Assessment Report has defined a number of educational objectives and program learning outcomes for the three programs under review.

All three programs without distinction are supposed to produce graduates in accordance with the ***Chulalongkorn University´s "desired characteristics"***, which according to the Self-Assessment Report consist of the following major elements. Graduates accordingly "are knowledgeable and in possession of well-rounded and in-depth knowledge. They are disposing of good morals and ethics, showing an awareness of etiquette. They are demonstrating higher order thinking skills, trained to think critically and creatively while being

skillful in problem solving. They are having strong professional and communication skills as well as skills in information technology, mathematics, statistics, and management. They dispose of an inquiring mind and know how to learn. In addition to these compulsory characteristics, graduates optionally should have leadership qualities, maintain their well-being, be community-minded and demonstrate social responsibility, while sustaining their Thai identity in a globalized world."

Apart from these "generic competences", graduates of **the Bachelor of food technology program** according to the department are supposed to demonstrate the following additional specific program learning outcomes upon their graduation:

Well-rounded, systematic and in-depth knowledge in food science and technology (including food chemistry, food microbiology, food processing and engineering, food quality assurance, food hygiene, food laws and standards, as well as human nutrition) and dispose of the ability to apply it to everyday life. In addition, they should have the ability to analyze topics in a rational way and being able to think creatively. Graduates should be able to solve problems in a systematic way using knowledge pertaining to food science and technology. They should be able to demonstrate professional skills and practical skills for food industry (management of production, quality control, research development and process design) including communication skills, critical thinking, problem solving and life-long learning skills. Graduates are to be well-qualified candidates for higher education and ultimately research and/or academic careers

As to the two Master programs under review, the Department aims to educate graduates in Food Science and Technology who demonstrate systematic and in-depth knowledge in food technology, emphasizing on food processing and engineering, food chemistry and analysis, food microbiology and safety, quality assurance and standards. Graduates are able to develop their higher professional skills for novel knowledge initiation and conduct advanced research work in the field of food science and technology, which is essential for contribution to the development of the country. It is important to note (see below), that the learning outcomes for the national and international Master program are practically identical. The International Master program has been designed for Thai and non-Thai residents to be able to gain their high skill and deep knowledge in food processing, food research and development, food quality control and safety. Its graduates are to be employed in both Thai and international food industries as well as government organizations that deal with international trading or law for food industry.

The experts are optimistic, that the learning outcomes for the three programs under review as formulated by the Department (and thus the attainment of the EQAS food label Learning Outcomes) can be achieved. In the expert´s opinion, the formulation of the learning outcomes for all programs should however be further specified and fine-tuned in order to describe in more detail which job profiles the graduates will eventually qualify for.

3) Educational Process

3.1 Overview and delivery of the curriculum

The **structure of the Bachelor curriculum** according to the information provided comprises four major groups of modules, accounting for a total credit of 214,5 ECTS or 143 CU credits.

Firstly, there are general education modules, worth 45 ECTS, with courses in social sciences, humanities, general sciences and mathematics, foreign language as well as computer science and business courses. Whereas all of the above mentioned modules are in an order of 4,5 ECTS, the English language educational offerings are worth 18 ECTS module and the computer Science and Business course 9 credits.

Secondly, there are specific major modules in fundamental sciences and mathematics (included in the specific major modules in food technology), calculated with 52.5 ECTS. Thirdly, there are required majors modules in food technology, worth 100.5 Credits, specifically in the area of food processing and engineering, food chemistry and analyses, food microbiology and safety, food quality assurance and sanitation as well as research techniques and other general competences. Also in this group belong elective major modules in food technology, with 7.5 ECTS. The fourth group comprise free elective modules, which account for 9 ETCS.

During the 7th semester, students must register in an Industrial Plant Training (module 2314492) in which the students will participate in a training session at food or food-related industrial settings for a period of 2 months or longer. In the 8th semester students are executing their undergraduate research senior projects, which is seen as an equivalence to doing a B.Sc Thesis.

The peers note that especially in the first and second semester students are familiarized primarily with a lot of basic science courses in mathematics, general chemistry, biology and physics with associated laboratories. In the third semester, students enroll in classes such as physical chemistry, analytical as well as organic chemistry with laboratories, computer and programming, another general science mathematics and one interdisciplinary module.

In the opinion of the experts, the overall structure of the **Bachelor curriculum** is suitable to reach the defined learning outcomes, however with a number of reservations. Coming out of a Department of Chemical Technology in the past, the Bachelor curriculum in their view puts too much emphasis on basic science courses. They see instead value in introducing courses in food science at an earlier stage in order to acquaint students at an early stage with a flavor of what the study program will contain for them in their specialty.

They understand that there is a Department policy of teaching these general science classes to students of all study programs in the science department. They nevertheless maintain that the content of these basic science courses could be considerably improved by adapting and relating it more specifically to the area of food technology.

Furthermore, the current **structure** of the Bachelor program leaves room for improvement. The experts point to the fact, that the modules "Nutrition for Food Technology" and the courses in "Food Analysis" as well as the laboratory "Chemical and Physical Measurements of Food" e.g. are coming before "Food Chemistry I" and "Food Chemistry II" in the course structure in spite of the fact, that the latter must be seen as a prerequisite for the former in many ways.

The experts also observe that there are few electives being offered only in the 4th year, and among them only two can be chosen in the field of food technology, while the other two free electives should be chosen from the area of social science and humanities. In their opinion, there is value in allowing for more individual student choice. They recommend opening the chance for individual profiling already in the 5th semester. It is also noteworthy, that the Learning Outcomes in these electives are exactly the same for Bachelor and Master students (food safety and quality management system, food shelf life assessment e.g.).

As regards the **exposure to industry**, the Bachelor curriculum foresees an Industrial Plant Training in the 7th semester of some 300 hours of students work (2-3 months duration). There are also Industrial Plant Studies in the final phase of study, in the framework of which excursions to 10 food factories of 3 hours per week take place.

While the experts think these components to be of vital importance to expose future graduates to the exigencies of the Thai labor market, they observe that no credits points are attached. As both modules are compulsory and students invest time for completing them, this must be corrected.

The peers commend the Department for providing special English communication courses worth 18 credits in the first year. During the review visit, most students in the interviews demonstrated good communication skills in English. The experts nevertheless recommend using English to a greater degree throughout the remained of the studies in food technology courses.

Concerning **the two-year national Master degree in food technology**, the curriculum structure of the **national M.Sc. program in Food Technology** comprises two categories, accounting for a total credit of 54 ECTS. Half of the credits are obtained by doing course work with 12 credits of required courses and 15 credits of elective courses. The other **27** ECTS credits are attached to the completion of the Master thesis. In the first semester, Master students are required to take courses in "Experimental Design for Technologists" as well as "Food Research Techniques and Instrumentation", furthermore adding two elective courses. The second semester is devoted to the so-called "seminar 1" plus one elective course; it also witnesses the start of the thesis. The second year is devoted entirely to writing the thesis as well as taking the so-called seminar II. For Elective Food Technology Modules, students can choose among a comprehensive list of altogether 32 elective courses in different specialties. All courses offered are taught entirely in Thai language.

As regards the **International Master degree**, students are introduced to systematic and in-depth knowledge in food science and technology, emphasizing on product and processing development, food properties and food processing and engineering. The program of a duration of 4 semesters is taught exclusively in English. The curriculum structure of M.Sc. program in Food Science and Technology comprises three major groups of modules, accounting for a total credit of 58.5 ECTS. First, there are required modules accounting for 13.5 ECTS credits in "Statistical Methods for Food Research", "Instrumentation Techniques in Food Research", the two seminars I and II and "Individual Study I". In a second category of electives, worth 18 ECTS, international students can choose among four elective groups, namely "food safety and microbiology", "food chemistry and analysis", "food processing and engineering", and "generic competences". Finally, the thesis is credited with **27** ECTS. Given the structure of the two Master programs the individual advisors are challenged to guide Master student in choosing the right set of electives, thereby also making sure that the EQAS learning outcomes are reached by all graduates. The experts note the absence of courses in international law, which is an essential component for graduates working in an international environment.

The experts note, that the two Master programs for national Thai students and international students are organized and executed completely separate from each other. International Students are thus effectively banned from enrolling in the national Master program/taking any compulsory or elective course as the language of instruction is exclusively Thai. This consequently also means, that a considerable number of separate educational offerings must be provided to very small number of international students in English. The necessity to offer two separate degree programs in the same filed in the experts view constitutes a waste of scare resources and should not be continued. In addition, international students complain about the fact that there is practically no interaction with Thai students and that they suffer from isolation, which is also counterproductive in the experts eyes.

Regarding the National Master Course, the peers learn that the standard period of study is regularly exceeded by 2 semester and before that background ask the program coordinators to institutionalize adequate instruments to avoid this delay. In the International Master program the standard period of study seems to be more in line with expectations, as these students usually study on a two-year scholarship.

3.2. Learning and Assessment

According to the Department representatives, instructors in all three programs under review must clearly address behavioral objectives, learning outcomes and assessment methods in the description and execution of the course syllabus. All modules are as a standard routine evaluated by both students and instructors upon completion of the online evaluation system via CU-CAS. For each module, assessments of learning outcomes using the total score collected from class participation, group activity, module assignment, student's performance

during practical work, laboratory activity report, oral presentation, written examination and comment from thesis or internship advisors will be considered for grading of students according to the criteria stated in Chulalongkorn University's regulations on (undergraduate) studies. The midterm and final examinations are held every semester. Each student is assigned a single letter grade at the end of each course according to the international A-F grading system, which is standardized for all departments, faculties and schools of the University.

The Department in recent years has started to revise its teaching methods and course assessment. In its last action plan, the following reforms are reportedly under way: "an evaluation of outcomes-based learning according to Thai Qualifications Framework system to improve teaching". Moreover, the department aspires to encourage "innovative learning, such as e-learning, active learning, smart classroom concepts to apply in several courses".

The review team takes note of the fact that currently no general policy of the University, concerning course assessment methods, is in place. The employed assessment methods based on student centered learning are chosen by each lecturer individually and are announced to students during the 1st courses at the beginning of each semester. Chulalongkorn University claims that it encourages outcome-based assessment on all levels. As exemplified by the module handbook, there is indeed a range of assessment tools including written and oral examinations, group projects, case studies as well as field trips.

The experts after the discussions with stakeholders conclude that there are good examples for an outcome based assessment system in place though not consistently in all courses. They recommend thinking about a more homogeneous approach across the entire Department. In addition, they see room for improvement as regards the use of outcome based rubrics in the examination system and furthermore recommend looking into the potential benefits of using external evaluators for the MSc thesis. Finally, in their discussions with stakeholders, the need to enhance "critical thinking skills" among students in the Department on all levels is very clearly voiced.

3.3 Alignment matrix for EQAS

The Department of Food Science and Technology has presented an extensive mapping of the required learning outcomes defined by the International Food Association as prerequisite for obtaining the EQAS Food quality seal for all three programs under view (while taking into account that the learning outcomes for the national and international version of the Master program are identical).

While seeing potential for reformulating the overall program learning outcomes (see above), the experts acknowledge that the course handbook is well written and that the modules dispose of well-written learning outcomes, using Blooms taxonomy as an instrument. Most of the essential information is contained. The peers before this background have only few suggestions for improving/correcting the document. On a purely technical basis, the

enumeration of courses/modules should follow a numerical order from the 1st to the 8th semester instead of mentioning the spring and fall semester for each year – this would increase the readability of the document. The course handbook should also include those modules, which as part of the electives are offered outside the Department (e.g. the business module in the first semester). There is a discrepancy as regards the calculation of ECTS for individual electives in the Bachelor program (3 ECTS are mentioned in the curriculum overview (page 8), but 4.5 ECTS in the list of the electives (pages 8-9)).

As to the issue of attaching ECTS credits, the experts ask to recalculate the distribution of credits in line with the requirements of the European ECTS system. In this system, one credit point is attached to 25-30 hours of student work.)

In final consequence, the experts attest alignment of learning outcomes for the Bachelor program as well as for the two Master programs under review, recommending that the above-mentioned changes to the curriculum are effectuated.

4) Resources and Partnerships

4.1 Academic and Support staff

According to the Self-Assessment Report, there are altogether 22 academic staff in the Department of Food Technology. All of them are holding a Ph.D. degree as academic qualification. It was not possible to accurately calculate the current student-staff ratio, as the exact total number of students was not provided to the experts – they asked that this information is provided. Most of the lecturers are engaged in a considerable number of research and professional activities, though publications in more prominent international journals is warranted. Students during the interviews voiced satisfaction with the quality of their teaching staff. Supporting evidence to that regard can be found in the evaluation surveys where the quality of staff is consistently rated high.

When interviewed, the teaching staff reported good working conditions in spite of the fact that they would like to have a better balance between teaching, research and administrative obligations, the latter consuming too much of their time.

New Faculty orientation aims to provide knowledge and understanding about the policies of Chulalongkorn University and the Faculties. New lecturers are trained to acknowledge and understand the curriculum, research policy, administration and other relevant academic and social activities at Chulalongkorn University. The knowledge and skill development program for lecturers includes workshops on academic behaviors, innovative teaching and learning methodology, novel active learning media, information technology, systems for curriculum evaluation, revision and development, university research funding, networking and collaboration, national trends and special issues in Thailand´s Higher Education System, corporate social responsibility, educational ethics, etc..

As to the support staff, there are currently six technicians, three administrative staff and four service staff being employed by the department. The Head of Laboratory and several technicians, teaching assistants and supporting staffs, manage all laboratories. Manager and Academic advisors direct the Center of Excellence in Food Processing Pilot Plant.

The review team after intensive discussion with all stakeholders reaches the conclusion that the academic resources available for the delivery of the three programs under review are suitable for the attainment of the intended learning outcomes and of good quality.

4.2 Facilities

The department of Food Technology at CU disposes of multiple facilities to guarantee the execution of the three study programs under review. First, there are three lecture rooms with a capacity of 75, 35 and 12 students, respectively, with an additional 20 lecture rooms provided by the Faculty of Science. Classroom facilities are generally well equipped. As to the Internet facilities, CU provides internet and Wi-Fi for students and staff. In addition, the Faculty of Science operates computer centers for all Science students.

CU has also established a so-called Center for Academic Resources, which comprises six units: The Central Library, the National Documentary Center, the Audio-visual Center, the International Information Resources Service as well as the Art Gallery and the Distance Learning Network. All six units provide services extending over every form of information resource: books, periodicals, printed matter, databases, audiovisual materials, and electronic materials. The on-line Food Science relevant databases include BioMed Central, PubMed, Scopus, SpringerLink, Taylor & Francis Journals, Web of Science, Wiley Online Library, World Scientific, etc.,

As to lab facilities, there are overall 4 teaching and research laboratories, namely the Food Processing and Unit Operations Laboratory, the Food Chemistry Laboratory, the Food Product Development and Quality Assurance Laboratory as well as the Food Microbiology and Biotechnology Laboratory. CU operates a Pilot Plant in Saraburi Province to which students can commute using bus services provided by the University. These laboratories support students' academic works and practical experience to work in agro-food industries. All facilities are set up to provide students education for conducting their practical works and thesis research as well as to support technical workshops occasionally organized for private sectors. There is enough capacity to do experiments as students of each academic year at the outset are divided in groups of around 5 students.

The experts rate the laboratories (strong food engineering and processing laboratories) as of adequate quality to reach the program learning outcomes.

Chemical handling and chemical waste treatment management as well as safety equipment are handled according to the "Safety Guideline for Laboratory" launched by "Enhancement of

Safety practice of Research Laboratory in Thailand (ESPReL) program" under National Research Council of Thailand. Foods and Chemicals are stored separately. Hazard chemicals are kept in the cabinet with locks controlled by technician. Chemical waste is collected by organization named by University twice a month. The experts view these safety features as being comprehensive and adequate.

Chulalongkorn University has built a number of facilities and established a range of services to meet the needs of faculty members, personnel, and students. These include dormitories, healthcare facilities, book centers, sports centers, a cooperative stores, consultancies and transportation

Staff as well as students during the interviews overall voice satisfaction with the quantity and quality of the infrastructure and equipment. Members of the teaching staff report that requests for equipment and supply are quickly honored and that the material base for teaching and research is sufficient.

4.3 Partnership

Partnership with industry

The Department of Food Technology has been working in collaborations with food industries as well as outside organizations for a long time. Internship is a compulsory component of the program. There are two entire floors dedicated to (startup) companies, one being paid by industry, the other one by the University. The experts commend the Department for trying to establish close links with Thai industry but recommend strengthening it further by establishing more permanent communication channels. This could be done by the formal creation of a Faculty-Industry Advisory Board.

All Food Technology students are required to work as trainees at least 300 hours (about 2.5-3 months) in the framework of a compulsory food industry internship during the summer of the 3rd year. The students are subsequently evaluated by the supervisors at the factory and have to submit a written report. The students may be put to work in production, quality assurance or in some instances may be assigned a project in research and development at the factory. Students, when interviewed, were enthusiastic about the potential of upgrading internship opportunities in the future.

Fourth year senior project will be the integration course of their knowledge in various fields of food science and technology. The students will work about 1 year individually or in pair on research under the supervision of academic staff. Here the connection with industry could also be strengthened as research topics emanating out of industry needs could form the basis for future senior projects on a more regular basis.

The Department representatives during the interviews point to close links with the Food Technology alumni who held positions in various food industries through CU Food Technology Alumni Club. The latter was created in 2010 to provide a linkage between the Department of Food Technology, Chulalongkorn University (FTCU), current students and fellow alumni through academic networking events, volunteering and fund-raising activities and social events. Many of the FTCU alumni are key players in Thai and international food and related industries. According to the interviewed stakeholder, there is however a lot of potential in modernizing the operations of the Alumni Club and to reinforce its ties with the Department.

International partnership

The Department of Food Technology has various activities and academic collaboration with international universities and institutes to support and improve the competence of its undergraduate students through research and educational opportunities. Active collaborations with the universities in America, Europe, Asia and Oceania are listed in the SAR as manifold: For the **USA** Cornell University, University of California Davis, Kansas State University, University of Illinois Urbana-Champaign, and Michigan State University; in **Europe:** Institut Polytechnique LaSalle Beauvais (FR), Institut National de Recherche en Sciences et Technologies pour l"Environnement et l"Agriculture: IRSTEA (FR), Ecole Nationale Supérieure des Industries Agricoles et Alimentaires: ENSIA (FR), AgroParisTech (FR), Université de La Réunion (FR), the University of Leeds (UK), Wageningen University (NL), University of Teramo (IT), University of Natural Resources and Life Sciences: BOKU (AT), Hochschule Geisenheim University (DE), Technical University of Munich (DE) and the University of Hohenheim (DE). Finally in A**sia:** Tokyo University of Marine Science and Technology: TUMSAT (JP), Toyo College (JP), Kagawa University (JP), Institute for Innovation, Ajinomoto, Co.,Inc. (JP), Malaysian Agricultural Research and Development Institute (MY), University of Malaysia, Terengganu (MY). National Pingtung University of Science and Technology (TW). In O**ceania:** University of New South Wales (AU), Massey University (NZ).

While this list of international partnerships is impressive, the experts however also note, that very few students of the national Bachelor and Master programs under review possess any international study experience (less than 10% according to the figures provided), thereby profiting directly from these international partnerships. The experts before this background encourage the Department to intensify its effort for internationalization of the programs under review (while noting that on the Bachelor level a double degree program with the University of Teramo, Italy is in preparation; on the Master level a 1-2 months exchange with a Japanese HEI is reported). They also point to the fact that in order for this to materialize, support measures such as intensified English language training not restricted to communication courses but also in regular class sessions, formalized bilateral agreements and the alignment of learning outcomes and credit point systems are needed.

As regards the transition from study to working life, the peers see room for improvement in the quest to better familiarize graduates with the exigencies of the labor market. They acknowledge the existence of instruments such as an industrial job fair, taking place in the premises of the University, and a short seminar before graduation but at the same time recommend more intensive tutoring by the career service center to assist student in the transition process.

5) Management System

In the Department of Food Technology organizational structure, the Head of Department is the highest authority. He is supported by six deputy heads with different areas of responsibility/portfolios, one each for the realm of administrative, academic, research, planning and student affairs as well as one for academic service and special activities (responsible for the organization of professional development and training for industrial sector).

Chulalongkorn University is operating under a university wide quality assurance system (CU-CAS). CU-CAS is a curriculum administrative system institutionalized to assure the quality of curricula, instruction and graduates. It consists of four interlinked parts related to the structure of the modules, the quality of teaching members and their contribution on specific topic(s), the realm of teaching media, methods and learning assessment and finally module evaluations and proposition for improvement. According to the Self-Assessment Report CU-CAS is serving as a model for the design and development of quality assurance management systems for other universities in Thailand as well.

There are various systems of quality assurance that the Department needs to follow and implement. CU for this purpose provides handouts on guidelines for implementing quality factors to Department. Every curriculum needs to revise its content in every 5 years and at the 4th year of that period, the Department has to conduct an evaluation its curriculum. The results of CU-CAS assessment need to be included in the documents that are sent to the University for approving of the revised curriculum.

Students In the department are required to do the class evaluation once a semester. Whereas in the past the response rate with regard to these student surveys was not satisfactory, this has changed since the Department has made internet access for students dependent on responding to these surveys.

During the interviews with the experts, students voiced the following concerns and requests: a need for modernization of the curriculum, to have more electives, to intensify English language education, to provide better internship opportunities and to combine the national and international version of the Master programs under review. As regards student feedback,

the peers suggest to use more the instrument of student focus groups in addition to regular questionnaires as a suitable means to learn what students need.

As to the interviewed **staff**, they argued in favor of more flexibility instead of having uniform preconceived brackets of teaching, research and administration. They also pointed to the fact that administrative tasks and quality assurance procedures are time consuming and could be better organized.

As to the **Alumni**, they stressed the importance of foreign language and professional skills during the interviews. **Employers** are invited to share their opinion and give feedbacks concerning the quality and performance of the degree graduates annually. Their responses are compiled and analyzed by faculty members responsible for curriculum management. The results are discussed among faculty members for further improvement of curricula, course content, skill sets required, and proposed activities in order to reflect employers' requirement. Additionally, employers of Master degree graduates are interviewed to give feedbacks of the graduate employees in the context of 5 major learning outcomes according to Thai Qualifications Framework for Higher Education

The experts commend the Department for its quality assurance arrangements. At the same time, they encourage the Faculty to close the feedback channels. Good practice requires that feedback is always reported back to various stakeholder groups to which extent their comments were taken into account. This thus far is not happening in the Department. They furthermore recommend establishing a formal Department-Industry advisory group to have more consistent communication patters with representatives of the job market.

6) Supporting Information about the Study Programs

As mentioned before, Bachelor Programs in Food Technology has been offered ever since 1963, the Master program in Food Science was established in 1973 and the International Master program as of 2001.

The admission process at CU to the program for all three programs are highly selective: Prospective students for the Bachelor program must have completed high school or be currently in their final year of high school. Students must enter the Central Admission System and participate in the National O-NET, GAT, PAT1 and PAT2 tests. O-NET includes 8 subjects: Thai Language, Social Science/Religion/Culture, English Language, Mathematics, Science, Health Science/Physical Education, Arts, Career and Technology. PATs are the Professional and Academic Aptitude Test in which PAT1 is the Mathematics test and PAT2 is the Science tests including Physics, Chemistry and Biology. Students who pass all the tests and wish to enter the Central Admission will be evaluated by interviewing by the Admission Interviewing Committee appointed by the Faculty of Science.

Prospective students for the Master programs must have completed bachelor degree in Food Science and Technology or related field or be currently in their final year of undergraduate program with English score as follows; CU-TEP (Chulalongkorn University Test of English Proficiency) at least 30 score or TOEFL 400 score or IELTS 3.0. Prospective students must fill out the application form online in www.grad.chula.ac.th. After completion online application, prospective student must print out their application documents and submit to Graduate School, Chulalongkorn University. Written examination is required for all prospective students except prospective student who graduated in the field of Food Science and Technology with GPA at least 3.00. After prospective student pass the written examination, all candidate must prepare one-page proposal related to the research they are planning to study after admission and submit to the program committee for interview process. Students who pass all the tests and wish to enter the Master degree program in Food Technology, Faculty of Science, Chulalongkorn University are required to register and attend orientation organized by the Department of Food Technology, Faculty of Science, Chulalongkorn University.

As to the International Master program in Science and Technology, applicants must hold a Bachelor of Science in Food Technology or related fields. For other related degree holders, an approval from the Academic Program Subcommittee is required. Students completing their eligible degrees in the last semester can also apply. Candidates whose first language is not English must have an appropriate level in an approved test of English. A TOEFL score of 530 (paper-based) or 197 (computer-based) or 71 (internet-based) or higher or an IELTS score of 6.0 or higher is required. For those who do not have TOEFL or IELTS score, CU Test of English Proficiency (CU-TEP) score equivalent to a TOEFL score of 530 is required. The applicants who are from other areas not Food Technology or Food Science or Food Science and Technology must enroll in the basic food technology subjects that the department graduate program administration committee will consider for a particular student. The Department graduate program administration committee considers that the applicants are qualified for this program.

As to current enrollment figures: for the Bachelor program, around 50-70 students are enrolled per year, around 250 per batch. Bachelor students have to pay around 800 EUR tuition fee per semester. For the (national Thai) Master program, the enrollment figures are at an order of around 15 per semester, paying an average of 2100 EUR for their studies, whereas the corresponding figures for the international Master program amounts to 3550 EUR for the semester with enrollment figures in low one-digit numbers.

6.1 Changes to program

As regards the development of the Bachelor program, the last reviews have taken place back in 2014 and then again at the beginning of this year. Not many changes have been reported on this occasion. Whereas the study programs in the first and second year of the Bachelor program has remained practically unchanged, the most essential has been the introduction of a new course in food safety management in the third year, prior to the execution of the

internship in industry. This change was done due to the feedback of the employer side, who requested this addition.

6.2. Performance

The department possesses a number of tools to assess achieved program outcomes.

Post-graduation surveys are distributed during the rehearsal of the graduation convocation ceremony each year. In addition, hard copies of the questionnaire regarding the career plan are distributed to the graduates. Questions include career plan (working or pursuing graduate studies), reason of unemployment, difficulty in job hunting (and its cause) for employed and unemployed graduates, categories of occupation, causes of unsatisfactory during working. At the time of the audit, no precise analysis was presented to the peers by the representatives of the Department. It is communicated that roughly about 70% of the graduates go to food industry, few continue to the Master program. The results reveal that all students, who do not want to continue their education, get a full time employment within one year after graduation. Only around 15 percent continue their education. The department however lacks more precise information about individual career paths, the quality of the employment, salary levels etc. The experts recommend, based on this background, devising more suitable survey instruments to analyze with more precision the degree to which graduates succeed in the job market. They see room for improvement in more consistently analyzing theses data and making necessary changes to the curricula accordingly.

Feedback from the employers

One of the University's policies is to obtain employer feedback by using online surveys, which are more convenient compared to paper-based questionnaire. Questionnaires will be e-mailed to employers by different approaches. After the contacted employers complete the survey questionnaire, the survey system will deliver all information to the Evaluation Department. This survey system is able to calculate a number of employer's feedback according to graduates affiliation. While the process is clear, again there is not much information available how consistent feedback of the employers is collected and influences the development of the programs under review (see below).

Research performance

According to the modules Project Proposal and Senior Project), the 4th year students are assigned to conduct research related to food science and technology based on their interest with selected project advisor. Each year, the 3rd year students are divided into about 20 groups (2-3 students per group), and then they will select the project advisor based on fields or topics of interest. After that, each group will develop proposal together with their advisor to get some funding from the Research Affairs, Faculty of Science, to conduct the research. Each group will receive about 10,000 THB (*ca.* 260 EUR) on the project. Not only funding from Faculty of Science, but the students and/or advisor may also get some funding from outside

sources (both government and industry) including Thailand Research Fund (Industrial and research projects for undergraduate students) and National Science and Technology Development Agency. In the 4th year, the students spend their whole academic year on their senior project along with coursework. Students are required to present their works by both oral presentation and writing a final report. The booklets of final report will be presented in the library of the Faculty of Science. Some projects will be further processed for presentation in many ways, including poster presentation, oral presentation, and proceedings in scientific conferences (both national and international). Some works could be processed to publish in scientific journal (both national and international). Also, the useful information in some projects will be selected by related industries and adapted for suitable application.

Competitions

Students are informed that the best senior project from the Department of Food Technology will be selected each year and sent to compete with other Department´s projects in Hitachi Trophy award competition, which is held every year. Also there is the Science Forum in Faculty of Science, Chulalongkorn University. In the Forum, the students have a chance to communicate their works by oral and poster presentation. In 2018, a team of students from the Food Technology Department received the second runner-up award from this competition for the project entitled “The color stability of Roselle extracted with gelling agents and development of jelly drink products”.

National undergraduate competition on Food Science and Technology

The Food Science and Technology Association of Thailand (FoSTAT), in collaboration with Nestlé (Thai) Ltd., annually organized the FoSTAT-Nestlé Quiz Bowl, a nationwide annual quiz on food science, technology and nutrition, to promote personnel’s abilities development on food science and technology in Thailand and rise to international level. This competition provides an opportunity for food science and technology students nationwide to unleash their potential in the academic quiz and apply their knowledge about food science, technology and human nutrition to advance Thailand's food industries to ensure future success. In 2018, a team of students from the Food Technology Department, Chulalongkorn University won the FoSTAT-Nestlé Quiz Bowl. They received a trophy on behalf of Dr. Ampol Senanarong, a former privy councilor during the reign of King Bhumibol Adulyadej (King Rama 9). The students on the winning team will go on an educational trip to visit the Nestlé Research & Development Center in Singapore, where they will be inspired by experiencing a professional work environment.